Predictable Errors in Monetary Policy Communications and Decisions*

Yaniv Konchitchki, Don A. Moore†, Biwen Zhang

University of California, Berkeley

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Abstract

Accurate economic forecasting is more difficult in periods of uncertainty, resulting in spiked forecast errors during such periods. Nevertheless, amid the post-pandemic economic uncertainty, the Fed Chair confidently yet incorrectly portrayed inflation as transitory, short-lived, defying this systematic pattern. Our analysis suggests that policy communications and decisions made by the Fed Chair overlooked this predictable fluctuation in inflation forecast errors. These material predictable errors proved detrimental to price stability, corporations, households, and capital markets. Our findings recommend tempered confidence from monetary policymakers during uncertain times, contributing to the literature on economics, psychology, and capital markets.

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†Corresponding Author: Don A. Moore, University of California at Berkeley, Haas School of Business, 545 Student Services Building #1900, Berkeley, CA 94720. Email: dm@berkeley.edu, Phone: (510) 642-1059. Contact information of the other coauthors: Yaniv Konchitchki, Email: yaniv@berkeley.edu; Biwen Zhang, Email: biwen.zhang@haas.berkeley.edu.

1 Introduction

Human beings fall short of perfect rationality. Research shows evidence consistent with errors due to limited attention on the part of managers and investors.[1] Other research shows errors due to overconfidence that affect economic behavior and capital markets.[2] In macroeconomics, previous studies suggest human errors may be due to inattention to macroeconomic information.[3] In behavioral economics, previous studies advocate, examine, and seek to incorporate behavioral explanations into various economic modeling, such as savings behavior and other decision making.[4]

Is the Chair of the Federal Reserve vulnerable to these errors? On the one hand, the Fed Chair is human. On the other hand, the consequences of such errors can be consequential enough that one might hope that the Fed would have systems, people, or processes in place that could mitigate errors. However, to date there has been little analysis of such errors. In this paper, we examine the possibility of predictable errors in public communications and associated monetary policy decisions made by the Fed Chair, Jerome Powell.[5]

Even minor errors by the Chair of the Federal Reserve Board can have major economic impacts. For example, a failure to stabilize inflation pressures can lead to inflation acceleration and, thus, to costly interest rate hikes. Our examination addresses a phenomenon that took place during 2020-2022, with costly consequences for economic growth, corporate profitability, household finances, retirement savings, and stock and real estate valuations. In addition to households losing

[1] For example, Hirshleifer et al. (2009) identify limited attention as a cause of investors' underreaction to new information. Attentional biases may help account for market anomalies, such as the new issue and repurchase puzzles (e.g., Loughran and Ritter, 1995), abnormal returns following events such as stock splits (e.g., Desai and Jain, 1997), return momentum (e.g., Jegadeesh and Titman, 1993), and post-earnings announcement drift (e.g., Bernard and Thomas, 1990). See also Peng and Xiong (2006) and Hirshleifer et al. (2011).

[2] For overconfidence on the part of managers, see, e.g., Malmendier and Tate (2008), Malmendier and Tate (2005), and Hirshleifer et al. (2012). For overconfidence on the part of investors, see, for example, the speculative bubbles in Scheinkman and Xiong (2003). For the consequences of other managers' biases in efficient markets, see, for example, Barberis and Thaler (2003) and Camerer and Malmendier (2007). See also Cheng et al. (2021).

[3] This literature suggests that agents face frictions and limitations in the acquisition and processing of information. Theoretical work has been done on two rational expectations models of information friction: the sticky information model (e.g., Mankiw and Reis, 2002; Woodford, 2003); the noisy information, or rational inattention model (e.g., Sims, 2003; Mackowiak and Wiederholt, 2009). Empirically, see works on inattention to macro figures (such as inflation) on part of managers (e.g., Coibion et al., 2018, 2020; Konchitchki and Xie, 2023) and investors (e.g., Konchitchki, 2011).

[4] See, for example, Akerlof (1991), Thaler (1994), Madrian and Shea (2001), Heffetz (2011), Heffetz (2012), Heffetz and Frank (2011), Benjamin et al. (2012) and Heffetz and Rabin (2013); also, see Benjamin (2019) for a review on errors in reasoning and judgment biases.

[5] Throughout, we refer to comments made by Powell, but it is possible that there are objecting views in deliberations within the Fed's Board. Our focus is on the public comments made by Powell, as these reflect the final outcome of the Board's deliberations.

trillions of dollars in retirement holdings in 2022 as a result of the tightening of monetary policy, the Fed's actions have increased the risk of an economic downturn in the United States (Coy, 2022).

Our overarching goal is to assess whether public communications about inflation and the associated monetary policy decisions made by the Fed Chair suffer from predictable errors. We also propose a mechanism that characterizes such errors and test our conjecture using regression and textual analyses. We ask: can the Fed Chair's communications and policy decisions suffer from material errors? If so, are such errors predictable? What is the mechanism that explains these predictable errors?

Our assessment of the Fed Chair's behavior is based on three observations. First, because forecasting is more difficult during uncertain economic periods, forecast errors of inflation may be higher in such periods. This difficulty even pertains to forecasts made by highly reputable forecasters. Second, the COVID-19 pandemic created a turbulent period of high economic uncertainty worldwide. These two observations imply that forecasting inflation during the economic uncertainty of 2020-2021 ran an elevated risk of error. Third, various consequences of the pandemic (e.g., historic spikes in the money supply, low interest rates, pandemic relief packages, and other expansionary monetary and fiscal policies) led to increases in inflation pressures (e.g., in April 2020, actual inflation was double the Fed's inflation target). Nevertheless, in public statements and monetary policy during the pandemic turbulence of 2020-2021, the Fed Chair repeatedly stated, with high confidence, that inflation was transitory, without fully incorporating the systematic inability to accurately forecast in uncertain periods as demonstrated by decades of data.

Building on these observations, our hypothesis is that the Fed Chair's confidence in predicting inflation was unwarranted, given the challenging nature of precise prediction-making during uncertain periods. To test our hypothesis, we conduct two empirical analyses. First, we analyze the time series properties of inflation forecasts, with an emphasis on how forecast errors vary with the level of economic uncertainty. To do this, we classify periods according to their level of economic uncertainty following the approach pioneered by Jurado et al. (2015). These time-varying measures (which capture a wider array of economic uncertainties than mere recession/expansion classification) aggregate macroeconomic uncertainty derived from many sources (such as real retail, compensation and labor costs, manufacturing and trade sales, consumer spending, housing starts, inventories) into one summary statistic. Then, to track the forecast information available to the

Fed Chair before his public comments and monetary policy decisions, we employ forecasts provided by the Federal Reserve Board of Governors in their Greenbooks. Greenbooks are produced by the research staff of the Fed's Board before each meeting of the Federal Open Market Committee (FOMC), and they provide critical input to monetary policy discussions and decisions at the FOMC meetings. After each FOMC meeting, the Fed Chair holds a press briefing to discuss the FOMC's policy decisions and to provide context for those decisions including the economic forecasts underlying the U.S. monetary policy.

We next use natural language processing to examine Powell's public statements about monetary policy in the uncertain period of 2020-2022 following the pandemic shock. ProQuest TDM Studio provides digital archives of leading newspapers (e.g., *New York Times*; *Wall Street Journal*), including media coverage of public communications on inflation prospects made by Powell since the beginning of his tenure (February 2018). We identify 7,269 unique newspaper articles that contain both Powell and inflation-related terms (i.e., "inflation," "CPI," or "price"), and we extract 19,474 sentences containing quotes from Powell. We employ a textual analysis algorithm that builds on recent advances in machine learning (e.g., Le and Mikolov, 2014) to identify sentences with a similar meaning to eliminate duplicate quotes. This procedure leads to 337 unique sentences that contain Powell's comments on inflation prospects. We then rate Powell's confidence that inflation would remain low. That is, we code his confidence that any substantial surge in inflation is transitory, where higher values indicate higher confidence that inflation would be temporary.

Our analysis of Powell's statements reveals three important results. First, both of our economic uncertainty variables (total and economic macro uncertainties) peaked around June 2020, coincident with COVID-19's economic shock wave. Both measures peaked above the uncertainty level registered during the 2007-2009 financial crisis.

We next compare the time series of Fed Chair's communications with contemporaneous measures of economic uncertainty. The results point to systematic errors on the part of the Fed Chair. The results suggest that Powell's public statements and monetary policies imply excessive confidence that inflation pressures in 2020 and 2021 would be transitory. Indeed, our textual analysis shows that, only around October 2021—more than a year after the initial peak of economic uncertainty—did Powell's confidence start to soften. Only on November 29, 2021, did he first acknowledge that his confidence that inflation was transitory was unfounded, leading to an abrupt

elimination of the word "transitory" in his public comments and recognition of the need to tighten monetary policy.[6]

We examine the extent to which Powell's public comments incorporate the elevated economic uncertainty of 2020 and 2021. The correlations between his confidence and contemporaneous economic uncertainty measures are not significantly different from zero, indicating that his confidence that inflation would be transitory did not respond to large changes in economic uncertainty. Powell's high confidence during periods of heightened economic uncertainty neglected the historical time series properties of inflation forecast errors—that forecasts' reliability decline with macroeconomic uncertainty. This overconfidence may have delayed the Fed's tightening of monetary policy (i.e., from the March 2020 uncertainty shock until March 2022 when the Fed started to increase the federal funds rate). This delayed response damaged the U.S. economy.

Together, our message is that when the economy is uncertain, monetary policy makers should moderate their confidence. By identifying predictable errors by the Fed Chair, this paper contributes to prior research on human errors in management, economics, psychology, and finance, as well as to the practice of monetary policy and investing. In particular, this paper is the first to document predictable behavioral errors in the decision making of perhaps the world's highest economic authority—the Chair of the Federal Reserve Board, which results in significant economic consequences. We show that communications and associated monetary policy decisions by the Fed Chair do not fully incorporate the time series properties of inflation forecast errors that we show spike during periods of economic uncertainty.

Our study is more than simple hindsight. On November 19, 2021, we preregistered this study in the Open Science Framework, with a time-stamp for our detailed plan that included hypotheses, predictions, and research design (https://osf.io/dg5pz/?view_only=538637193aeb49ce8be124bdba5181ba). Table A1 in the Online Appendix reports the results of all our preregistered analyses. At that time, we not only hypothesized that the Fed Chair was making material predictable errors, but we also provided the mechanism that forms the basis of our analysis. We conjectured that the predictable errors stem from the Fed Chair's high confidence in classifying inflation as transitory during a highly uncertain period, when accurate inflation fore-

[6] November 29, 2021 reflects a change in Powell's stance on inflation. On this date Powell told Congress "We tend to use [the word transitory] to mean that it won't leave a permanent mark in the form of higher inflation. I think it's probably a good time to retire that word."

casting is difficult. By acting certain during this uncertain period, the Fed Chair did not fully incorporate the historical time series properties of inflation forecast errors (which we show are high during uncertain economic periods) into his prediction, making potentially detrimental monetary policy decisions during a critical period to counter growing inflation pressures. The registration of our research plan sheds light on the ability to anticipate inflation risks during the uncertain post-pandemic recovery. Our findings contradict the claims of Fed officials that it was not possible to anticipate these risks (e.g., see https://youtu.be/9ztcpWpdPq0?t=1261), and provide guidance for better forecasting.

Finally, we note that our empirical tests are made possible by the availability of a sufficiently long time series of forecast data from the Fed that enable an exogenous assessment of economic uncertainty. While it may be possible that other Fed Chairs have made the predictable errors that we identify in this paper, our analyses focus on Powell during his tenure at the Fed.[7] Together, the focus of our paper makes our predictions, analyses, and messages robust—Powell had the time series data that we have (because our projections data are directly from the research staff of the Fed's Board), yet he systematically failed to fully incorporate it into his monetary policy communications and decisions. It is not possible to conduct our analyses on other historical Fed Chairs (for the reasons above, e.g., a look-ahead bias as historical time series data of forecast errors was not available to previous Fed Chairs during historical periods of high inflation and high economic uncertainty). While we do not claim that Powell's errors are made by all other Fed Chairs, we highlight the perils of the Fed underreacting to changing times. Our work serves as a warning against unwavering certainty in periods of high economic uncertainty, offering valuable insights not only to future Fed Chairs but also to other makers of monetary policy.

[7]Indeed, analyzing the time series properties of inflation forecast errors and how they vary with uncertainty require at least one decade of observations across certain and uncertain periods with varying inflation rates (e.g., in the 1970s-1980s, the forecast error series was too short to examine Fed Chairs' actions at that time). This fact, together with the facts that (a) inflation episodes are not frequent (where the last inflation episode before the current episode was in the 1980s), (b) economically uncertain periods are not frequent, (c) textual analyses techniques and promptly-disseminated digital communications data are relatively new, and (d) the different circumstances and characteristics involving each inflation episode and Fed's Chair (e.g., Clarida et al., 2000), require us to focus on the current Fed Chair to robustly examine predictable errors at the level of the highest economic authority. Our focus on the current Fed Chair incorporates insights and overcomes concerns in prior research that raises issues with comparing policy makers' decisions over time. For example, as Clarida et al. (2000) concludes: "What all this suggests is that in understanding historical economic behavior, it is important to take into account the state of policy-maker's knowledge of the economy and how it may have evolved over time." Sargent (2001) also suggests that policy makers' beliefs change over time, such as about the natural rate hypothesis.

2 Data and Descriptive Statistics

Our data come from several sources. First, we extract the Fed Chair's public communications on inflation from ProQuest TDM Studio, which provides digital archives of leading newspapers, from February 2018—when Powell first took office as Chair of the Fed's Board. We searched the digital archives of *The New York Times*, *Boston Globe*, *Chicago Tribune*, *The Washington Post*, *Los Angeles Times*, *Wall Street Journal*, and *San Francisco Chronicle* to identify articles that contain at least one word from the following two lists: (1) inflation list: "inflation," "CPI," or "price"; (2) Powell list: "Powell" or "Fed." In other words, we identify articles that contain terms in two categories pertaining to inflation and Jerome Powell. This yields 7,269 unique articles. Next, from these articles we extract potential quotes by Jerome Powell, extracting sentences that contain both double quotation marks and the word "Powell." This procedure yields 19,474 sentences. Lastly, we use a textual analysis algorithm to eliminate duplicate quotes, as it is common for different news outlets to report the same quotes from Powell. We use machine learning technologies (e.g., Le and Mikolov, 2014) to identify sentences with a similar meaning to eliminate these duplicates. This procedure leads to 337 unique sentences containing Powell's comments on inflation.

For each week from February 2018 to January 2022, we manually code Powell's comments on U.S. inflation prospects by rating his confidence regarding whether U.S. inflation will remain low—i.e., his confidence that any substantial surge in inflation is transitory, temporary, or beneficial. We rate Powell's confidence on a three-point scale, with one being the least confident and three being the most confident. Powell does not publicly comment on inflation prospects every week; accordingly, for weeks without such comments, we use his most recent comments before that week to fill in the value, assuming that his stance on inflation prospects has not changed. The Online Appendix, Table A2, includes examples of Powell's comments on inflation prospects and our confidence value.

To validate our manual coding, we recruited a research assistant, blind to our hypotheses, to independently code Powell's comments on the inflation prospects in the U.S. This coder underwent a training process and then read and coded Powell's comments. There is a high correlation (a correlation of 0.79, with p-value < 0.01) between our coding and that of the independent coder, demonstrating the validity of our coding methodology.

Second, we obtain macro and economic uncertainty indices from Jurado et al. (2015).[8] Jurado et al. (2015) develop these indices that capture time-varying economic uncertainty and macroeconomic fluctuations. These measures, which are different from recession/expansion classification as they capture a wide array of information about economic uncertainties, have been widely used in the literature (e.g., Bali et al., 2017; Atilgan et al., 2020; Guo et al., 2022). As the authors explain, these measures are comprehensive and relatively free from both the restrictions of theoretical models and dependencies on a handful of economic indicators (and they can be used in a variety of settings). These measures aggregate macroeconomic uncertainty derived from many sources into one summary statistic.[9]

Third, we use Greenbook forecasts because these are the projections to which the Fed Chair is directly exposed and on which the FOMC statements and decisions are based. We obtain quarterly data on forecasts made by the research staff of the Federal Reserve Board, available from the Philadelphia Fed's Tealbook (formerly Greenbook) Data Sets website. We use the quarter-over-quarter headline inflation forecasts in annualized percentage points (the variable is $gPCPI$).[10] Fourth, we also employ other forecasts—median consensus CPI forecasts from the Fed's Survey of Professional Forecasters (SPF) obtained from the Philadelphia Fed's website.[11] The inflation variable is termed by the Fed as "$CPI2$," which is the quarter-over-quarter SPF forecast of headline inflation for the current quarter in annualized terms, consistent with the time horizon and specifications of the Greenbook forecasts.[12] To calculate CPI forecast error, we subtract forecasted CPI from realized CPI. CPI realizations are from the Fed's SPF website. To ensure that the realization figure is as close as possible to its true value, we use the most recent vintage of the realization data

[8] We thank Sydney Ludvigson for sharing indices data via her website: https://www.sydneyludvigson.com/macro-and-financial-uncertainty-indexes.

[9] The uncertainty measures are estimated from two datasets: (a) a monthly macro dataset that uses information in hundreds of macro and financial indicators; (b) a quarterly firm-level dataset of firm-level observations on profit growth normalized by sales. These data series include macro series such as employment and hours, real retail, manufacturing and trade sales, consumer spending, real output and income, housing starts, inventories, compensation and labor costs, bond and stock market indexes, and foreign exchange measures. The data series also include financial time series such as the dividend-price and earnings-price ratios, growth rates of aggregate dividends and prices, default and term spreads, corporate bond yields, Treasuries' yields and spreads, and a broad cross-section of industry, size, book-market, and momentum portfolio equity returns.

[10] See "Philadelphia Fed's Tealbook/Greenbook Data Set: Row Format".

[11] We use the file titled "Median Responses".

[12] This variable refers to the SPF forecast for the current quarter (i.e., nowcast) following the Fed's "Documentation" file, (page 21). This file demonstrates the horizon terminology in forecasted variables using the nominal GDP variable. Also, per this Documentation and as defined in the Greenbook dataset, the inflation variables are quarter-over-quarter and stated in annual terms.

available from the Fed's realization dataset.[13] Lastly, we obtain monthly CPI data and market yields on U.S. Treasury securities from the Federal Reserve Bank of St. Louis.[14]

We calculate the correlation for CPI forecasts made by two groups of forecasters: the research staff of the Federal Reserve Board (i.e., Greenbook forecasts) and the median consensus among the Fed's professional macro forecasters (i.e., SPF forecasts). We find that this correlation is 0.9435 (p-value <0.001), suggesting a high correspondence between the forecasts. This finding suggests that even though the Greenbook forecasts undergo an embargo by the Fed's Board, the SPF forecasts can be used as a real-time proxy for the Fed's Board forecasts. Also, this high correlation together with and our additional analyses below employing SPF forecasts and showing similar inferences to using Greenbook forecasts serve as an additional external validity on our tests.

Table 1 reports descriptive statistics and correlations for select variables. The unit of observation is at the quarterly level, and the sample runs from the fourth quarter of 1979 to the fourth quarter of 2015. The sample period is due to the data availability of the Fed's CPI forecasts and realized CPI. More recent Greenbook forecast data are still under embargo. Variable definitions are in the notes to this table.

3 CPI Forecast Errors and Macro Uncertainties

We examine the linkages between CPI forecast errors and macroeconomic uncertainty by first estimating the following regression model:

$$CPI\_FError_q = \alpha + \beta_1 \cdot Total\_Macro\_Unct_q(Econ\_Macro\_Unct_q) + \beta_2 \cdot Controls_q + \epsilon_q, \quad (1)$$

where CPI_FError_q denotes the CPI forecast errors in quarter q, constructed as the absolute value of the difference between CPI forecast of the research staff of the Federal Reserve Board and the realized CPI. The main independent variables are $Total\_Macro\_Unct$ and $Econ\_Macro\_Unct$, which capture time-varying macroeconomic uncertainty, obtained from Jurado et al. (2015). $Total\_Macro\_Unct$ captures estimates of uncertainty from all sources; $Econ\_Macro\_Unct$ is an estimate of uncertainty due to (non-health related) economic fundamentals.[15] We also include con-

[13] See "Data for error statistics (projections and realizations)".
[14] Available at: https://fred.stlouisfed.org.
[15] See more details at: https://www.sydneyludvigson.com/macro-and-financial-uncertainty-indexes.

trol variables that might be associated with the time series variations of CPI forecast errors: trailing CPI level ($Prior\_CPI$); trailing CPI volatility (CPI_Vol); and trailing term structure of interest yields ($Yield\_Diff\_10y3m$). $Prior\_CPI$ is the CPI level in the U.S. in quarter $q-1$; CPI_Vol is the standard deviation of the trailing 12 months of CPI; $Yield\_Diff\_10y3m$ is the difference between the market yields on 10-year and three-month U.S. Treasury securities in quarter $q-1$.

Table 2 reports the results. Across all specifications, both $Total\_Macro\_Unct$ and $Econ\_Macro\_Unct$ are significantly positively related to CPI_FError, all significant at the 1% level. Column (1) shows that CPI forecast errors increase with $Total\_Macro\_Unct$ (t-statistics = 8.06), and $Total\_Macro\_Unct$ alone explains 31% of the variation in the forecast errors. Column (2) yields a similar inference, and shows that, after controlling for other variables, a one standard deviation increase in $Total\_Macro\_Unct$ (about 0.1) is associated with a 0.49% increase in the CPI forecast errors, roughly 57% of its standard deviation. Columns (3) and (4) show similar results for the interplay between CPI forecast errors and economic macro uncertainty. The results in Column (3) show that $Econ\_Macro\_Unct$ alone explains 30% of the variations of CPI_FError, as reflected by the adjusted R-squared. Lastly, the results in Column (4) indicate that, after controlling for other predictors of CPI forecast errors, a one standard deviation increase in $Econ\_Macro\_Unct$ (about 0.1) is roughly associated with an increase of 0.49% in CPI_FError (roughly 57% of its standard deviation). Overall, across all specifications, CPI forecast errors are all positively correlated with total/economic macro uncertainty, revealing that it is in general more difficult to accurately predict the CPI level during periods of high macro uncertainty.

Then, Figure 1 plots the time series evolution of both CPI forecast errors (dashed green line) and total/economic macro uncertainty (solid red line) over time. The figures show that CPI forecast errors usually co-move with the total and economic macro uncertainty measures. For example, during the 2007-2009 financial crisis, total/economic macro uncertainties peaked at 1.1, while CPI forecast errors also peaked at 5%. In sum, Figure 1 yields the same inference as Table 2 in that predicting inflation during uncertain periods is prone to substantial forecast errors.

4 Fed Chair's Confidence and Macro Uncertainties

We next investigate the interplay between the Fed Chair's confidence regarding U.S. inflation and contemporaneous macro uncertainty. We use textual analysis to extract the assessment of the severity of inflation by Powell in all his public statements. We especially focus on how Powell incorporates the varying macro conditions in his inflation projections. Our key pre-registered analysis correlates macroeconomic uncertainty with Powell's public expressions of confidence that inflation is temporary.

Figure 2 report the results. Panel A shows the time series evolution of Powell's certainty regarding the inflation in the U.S. economy being transitory (dashed green line) and contemporaneous total macro uncertainties (solid red line).[16] It shows that the total macro uncertainties peaked around June 2020 and then gradually declined. To put things into perspective, from March 2020 to June 2020 (the onset of the COVID-19 pandemic), the macro uncertainties peaked at 1.3, a level above the macro uncertainties (1.1) of the 2007-2009 financial crisis. Yet, during almost the entire period from February 2018 to January 2022, Powell remained confident that inflation would stay low, and only started to soften his stance around September 2021—18 months after and into an economic uncertain period. In fact, it was not until November 29, 2021 that Powell recognized that his confidence that inflation was transitory was unfounded, leading to officially omitting the word "transitory" in his public communications and recognizing the need to tighten monetary policy.

The correlations between Powell's confidence and contemporaneous total macro uncertainties are below 0.05, and statistically insignificant. The implication of the correlation matrices (Panel B of Figure 2) is that Powell's confidence is not related to the contemporaneous total macroeconomic uncertainties.

5 Additional Analyses

We briefly discuss additional analyses reported in the Online Appendix. First, we show that the interplay between Fed Chair's confidence and macro uncertainty is robust to the use of economic macro uncertainty indices (see Figure A1). Second, we use box plots to compare the average

[16] The results are robust to the use of economic macro uncertainties, reported in Figure A1 in the Online Appendix.

accuracy of the Fed's Greenbook CPI projections in economically certain and uncertain periods. The results show that the CPI projections during certain periods are significantly more precise than those during uncertain periods (see Figure A2). Third, as a robustness check and to shed light on whether the difficulty in predicting CPI during uncertain periods is generalized for predicting economic activity, we conduct similar box plot and regression analyses using Gross Domestic Product (GDP) growth, and we find similar inferences regarding the difficulty of predicting GDP growth during uncertain periods (see Figure A3 and Table A3). Fourth, using bootstrapping analyses, we consistently find that forecast accuracy is significantly higher in economically certain periods when comparing the forecast accuracy of both CPI and GDP growth during certain and uncertain periods (see Table A4). Lastly, as a robustness check, we estimate the relation between forecast errors of professional macro forecasters and economic uncertainty, and the inferences remain the same (see Table A5).

6 Conclusion

We hypothesize and find evidence consistent with predictable behavioral errors in the decision making of perhaps the world's highest economic authority—the Chair of the Federal Reserve Board—resulting in significant economic consequences. We first show that inflation forecast errors significantly and predictably vary with economic uncertainty, spiking during uncertain economic periods. We then show that monetary policy communications and decisions made by the Fed Chair during the uncertain periods beginning with the shock of the pandemic do not fully incorporate the time series properties of inflation forecast errors that vary with economic uncertainty. This leads to material errors made by the Fed Chair, who repeatedly claimed confidence during uncertain economic periods.

One possible explanation for our results is overconfidence by the Fed Chair (e.g., Daniel et al., 1998; Odean, 1998; Hayward et al., 2006; Moore and Healy, 2008; Ben-David et al., 2013; Adebambo and Yan, 2018; Moore et al., 2015, 2017). An additional explanation centers on Powell's career concerns and/or political pressures. In particular, as mentioned above, on November 29, 2021, Powell abruptly changed his narrative that inflation was only transitory by omitting the word "transitory" in his public communications and recognized the need to tighten monetary policy.

This shift came only two days after President Biden's re-nomination of Powell on November 27, 2021.[17] This may be a coincidence. However, there are other instances in which Powell appeared sensitive to career concerns and/or political pressures. For instance, he abruptly changed his push for hikes in the fed funds rate in late 2018 after President Trump threatened to fire him if he continued to increase the rates.[18] In fact, our conjectured explanation is consistent with recent evidence that Powell's actual monetary policy was significantly impacted by President Trump's tweets criticizing his decisions (Bianchi et al., 2023). Powell also remained conspicuously silent on major fiscal actions that risked exacerbating inflation, such as President Biden's student loan forgiveness program. Our evidence is compatible with the notion that even the Fed Chair may not be immune to career concerns and political pressures.

One may also argue that Powell strategically dismissed the risk of inflation to avoid sparking it. That is, because inflation is, in part, driven by public expectations of inflation, Powell might have manipulated the Fed's inflation narrative by avoiding communicating that inflation was a serious problem. In other words, an alternative explanation for our results is that Powell sought to manipulate public expectations to avoid contributing to inflation pressure. However, three realities militate against this possibility. First, simply manipulating expectations is insufficient for the Fed to control inflation. Second, prior studies and practices establish that monetary policy should be preemptive and forward-looking: that is, the Fed needs to act well before inflationary or deflationary pressures take hold (e.g., Mishkin, 2007). Accordingly, when inflation picked up in early 2022, it was already too late for Powell to talk down inflation fears. Third, there are enormous costs for the Fed trying to "fake it" by pretending that the risk of inflation is lower than it actually is. Faking it precludes timely action in the face of gathering inflation pressures. Being exposed as faking it also damages the Fed's reputation, thereby impairing its credibility and thus harming the Fed's ability to achieve its future objectives. The Fed's mission is to promote optimal macroeconomic performance by fostering stability, integrity, and efficiency of the nation's monetary and financial systems. The Fed's predictable errors led to its delayed monetary policy response to spiking inflation. This in turn forced it to aggressively increase its federal funds rate after inflationary pressures took hold, dampening economic growth and sabotaging the Fed's mission. Research estimates that when a

[17] See, e.g., https://www.whitehouse.gov/briefing-room/statements-releases/2021/11/22/president-biden-nominates-jerome-powell-to-serve-as-chair-of-the-federal-reserve-dr-lael-brainard-to-serve-as-vice-chair.

[18] See, e.g., https://www.cnbc.com/2018/12/22/trump-reportedly-wants-to-fire-fed-chair-powell.html.

central bank moves to reduce inflation, such actions result in a loss equal to between 2% and 3% of GDP for each percentage point reduction in inflation (e.g., Ball, 1994; Feldstein, 1997; Romer and Romer, 1997). These realities suggest Powell's actions may have been biased in ways that proved costly to the macroeconomy.

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Table 1
Descriptive Statistics

Panel A: Descriptive Statistics

	N	Mean	25 Pct.	50 Pct.	75 Pct.	SD
$CPI\_FError(\%)$	145	0.788	0.300	0.600	1.000	0.857
$Total\_Macro\_Unct$	145	0.647	0.580	0.622	0.673	0.100
$Econ\_Marco\_Unct$	145	0.652	0.584	0.630	0.678	0.099
$Prior\_CPI(\%)$	145	3.445	2.100	3.100	4.100	2.871
CPI_Vol	145	0.006	0.003	0.005	0.009	0.005
$Yield\_Diff\_10y3m$	136	1.864	0.977	2.035	2.727	1.097

Panel B: Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)
(1) *CPI_FError(%)*	1	0.442***	0.446***	0.161*	0.315***	0.053
(2) *Total_Macro_Unct*	0.567***	1	0.999***	0.427***	0.537***	-0.227***
(3) *Econ_Marco_Unct*	0.564***	1.000***	1	0.420***	0.546***	-0.217**
(4) *Prior_CPI*	0.426***	0.553***	0.548***	1	0.285***	-0.207**
(5) *CPI_Vol*	0.240***	0.570***	0.582***	0.306***	1	0.146*
(6) *Yield_Diff_10y3m*	0.016	-0.090	-0.082	-0.236***	0.217**	1

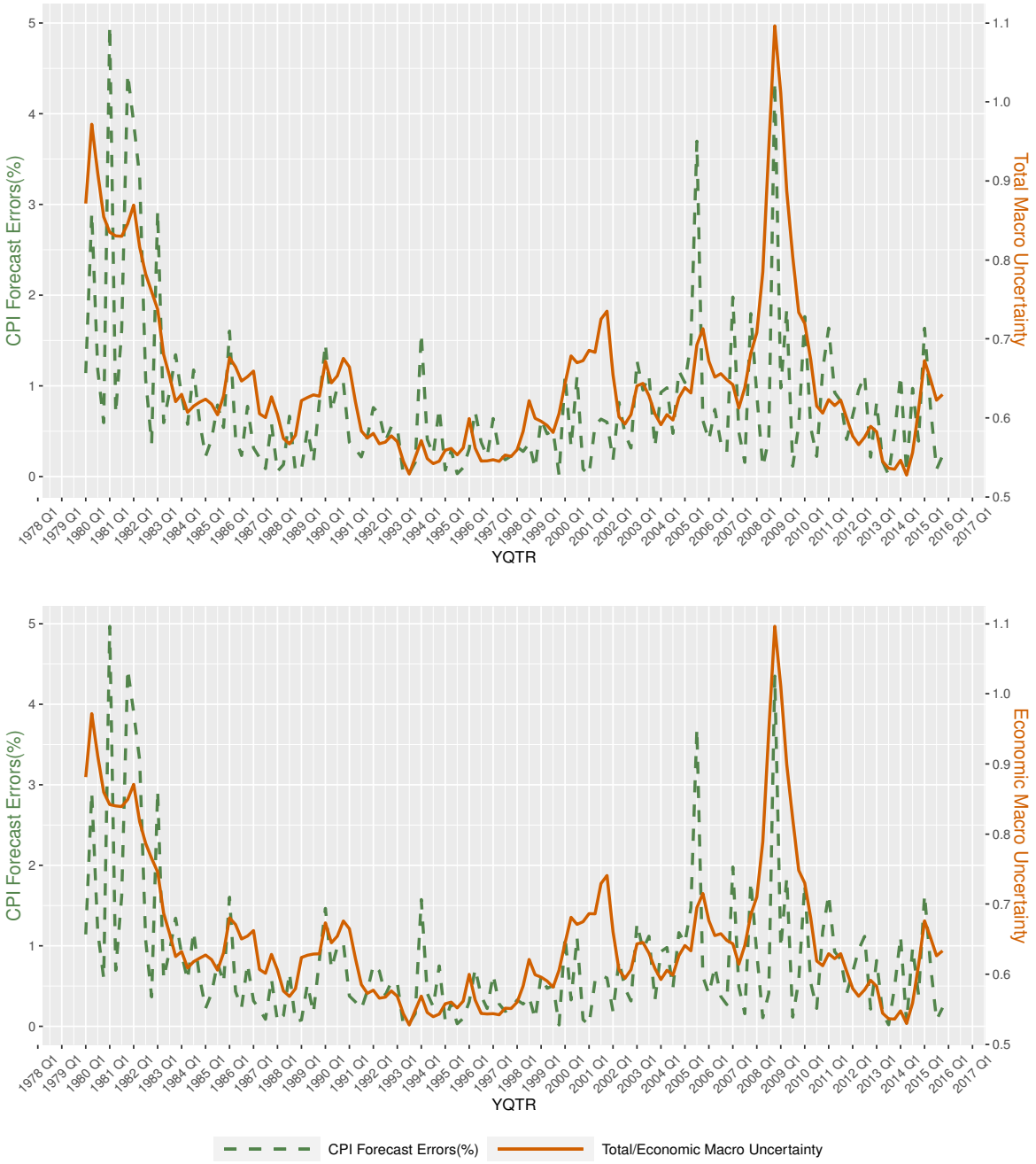
Notes. This table presents summary statistics (Panel A) and the correlation matrix (Panel B) of select variables. In Panel B, the lower (upper) triangle reports the Pearson (Spearman) coefficients. All the variables are measured at the quarterly level, and the sample period spans from the fourth quarter of 1979 to the fourth quarter of 2015. CPI_FError is the forecast errors of the CPI, constructed as the absolute value of the difference between CPI forecasts of the research staff of the Federal Reserve Board and realized CPI. $Total\_Macro\_Unct$ and $Econ\_Macro\_Unct$ capture time-varying macro uncertainty, obtained from Jurado et al. (2015). In particular, $Total\_Macro\_Unct$ captures an estimate of uncertainty from all sources; $Econ\_Macro\_Unct$ is an estimate of uncertainty due to (non-health related) economic fundamentals. $Prior\_CPI$ is the CPI level in the prior quarter. CPI_Vol is the standard deviation of the trailing 12 months of CPI. $Yield\_Diff\_10y3m$ is the difference between the market yields on 10-year and three-month U.S. Treasury securities in the previous quarter. Total macro and economic macro uncertainty indices are from Jurado et al. (2015). Realized quarter-over-quarter CPI and CPI forecast data are from the Survey of Professional Forecasters and Philadelphia Fed's Tealbook (formerly Greenbook) data sets, respectively. Monthly CPI data and market yields on U.S. Treasury securities are from the Federal Reserve Bank of St. Louis.

Table 2
CPI Forecast Errors and Macro Uncertainties

	Dep. Var = *CPI_FError*			
Total_Macro_Unct	4.809***	4.870***		
	(0.597)	(0.820)		
Econ_Marco_Unct			4.792***	4.898***
			(0.600)	(0.827)
Prior_CPI		7.990**		8.276**
		(3.766)		(3.755)
CPI_Vol		-22.419		-23.800
		(15.557)		(15.725)
Yield_Diff_10y3m		0.092*		0.091*
		(0.053)		(0.053)
Adj. R^2	0.307	0.289	0.304	0.288
N	145	136	145	136

Notes. This table reports the OLS regression results of whether forecast errors of CPI are a function of the contemporaneous total/economic macro uncertainties. All the variables are at the quarterly level. The sample period spans from the fourth quarter of 1979 to the fourth quarter of 2015. The dependent variable is CPI_FError, namely CPI forecast errors, constructed as the absolute value of the difference between the CPI forecast of the research staff of the Federal Reserve Board and the realized CPI. The main independent variables are $Total\_Macro\_Unct$ and $Econ\_Macro\_Unct$, both of which capture time-varying macro uncertainty, obtained from Jurado et al. (2015). $Total\_Macro\_Unct$ captures an estimate of uncertainty from all sources; $Econ\_Macro\_Unct$ is an estimate of uncertainty due to (non-health related) economic fundamentals. Standard errors are reported in parentheses. ***, **, and * denote 1%, 5%, and 10% levels of significance, respectively. Variable definitions are in the table notes of Table 1.

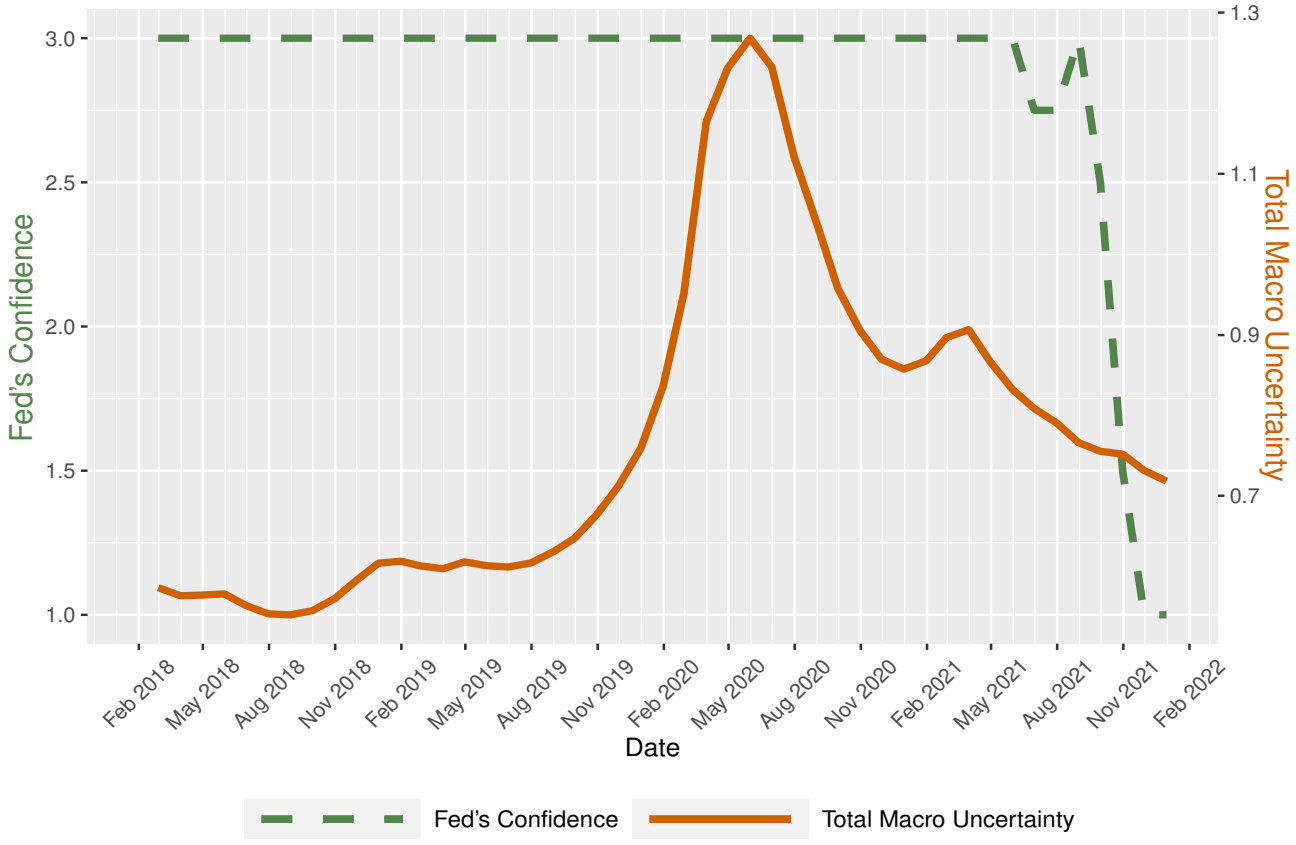
Figure 1
CPI Forecast Errors and Macro Uncertainties



Notes. This figure presents the time series evolution of CPI forecast errors (dashed green line) and total/economic macro uncertainty (solid red line). The top (bottom) panel plots the time series of CPI forecast errors and total (economic) macro uncertainty from the fourth quarter of 1979 to the fourth quarter of 2015. All variables are measured at the quarterly level. Total Macro Uncertainty and Economic Macro Uncertainty are available at the monthly level, and are aggregated into the quarterly level by taking the average value for each quarter. CPI forecast errors are constructed as the absolute value of the difference between CPI forecast of the research staff of the Federal Reserve Board and the realized CPI. Realized quarter-over-quarter CPI and CPI forecast data are from the Survey of Professional Forecasters and Philadelphia Fed's Tealbook (formerly Greenbook) data sets, respectively. Total Macro Uncertainty and Economic Macro Uncertainty are from Jurado et al. (2015).

Figure 2
Fed's Confidence and Total Macro Uncertainty

Panel A: Fed's Confidence and Total Macro Uncertainty



Panel B: Correlation between Fed's Confidence and Total Macro Uncertainty (Pearson correlations reported by the lower triangle and Spearman by the upper triangle)

	(1)	(2)
(1) *Fed_Conf*	1	-0.016
	(0.000)	(0.820)
(2) *Total_Macro_Unct*	0.047	1
	(0.508)	(0.000)

Notes. This table presents the relation of Fed's confidence that inflation in the U.S. will remain at a low level with Total Macro Uncertainty. The sample period spans from February 2018 to January 2022. Panel A shows the time series of the Fed's confidence and Total Macro Uncertainty. The dashed green (solid red) line denotes the time series of the Fed's Confidence (Total Macro Uncertainty). Panel B reports the correlation between the Fed's Confidence and Total Macro Uncertainty. *P*-values are in parentheses. The lower (upper) triangle reports the Pearson (Spearman) correlation coefficients.

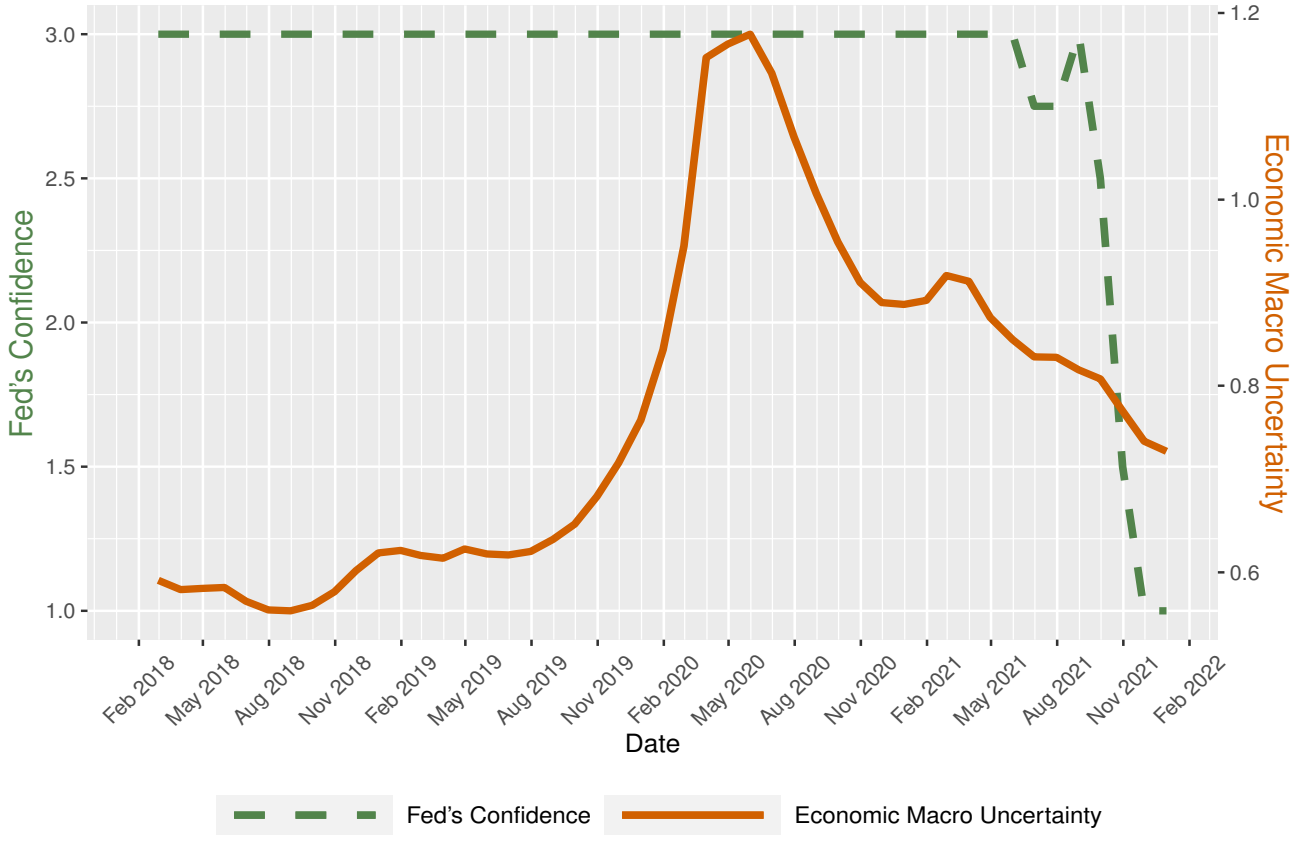
Online Appendix for "Predictable Errors in Monetary Policy Communications and Decisions"

Yaniv Konchitchki, Don A. Moore, Biwen Zhang

This Online Appendix provides supplementary material to the manuscript titled "Predictable Errors in Monetary Policy Communications and Decisions," coauthored by Yaniv Konchitchki, Don A. Moore, and Biwen Zhang.

Figure A1
Fed's Confidence and Economic Macro Uncertainty

Panel A: Fed's Confidence and Economic Macro Uncertainty



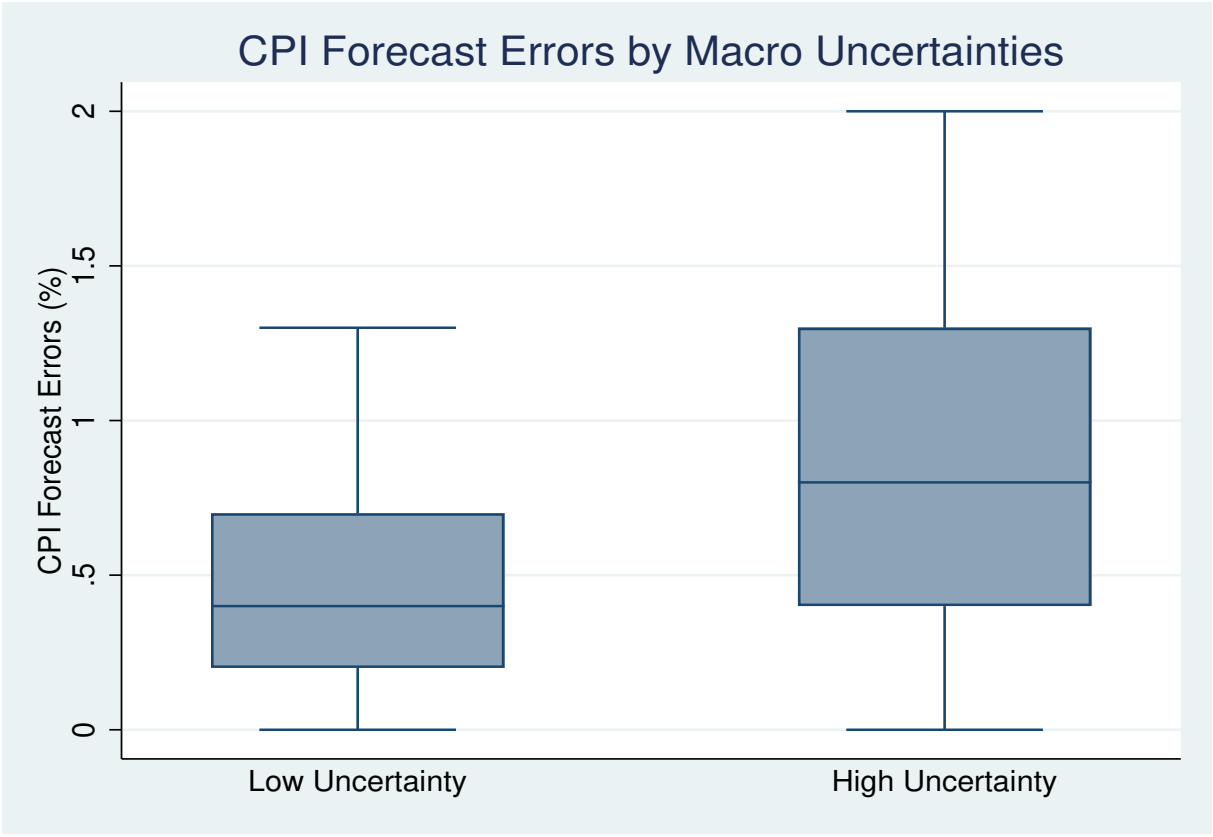
Panel B: Correlation between Fed's Confidence and Economic Macro Uncertainty (Pearson correlations reported by the lower triangle and Spearman by the upper triangle)

	(1)	(2)
(1) *Fed_Conf*	1	-0.025
	(0.000)	(0.725)
(2) *Econ_Macro_Unct*	0.027	1
	(0.697)	(0.000)

Notes. This table presents the relation of the Fed's confidence that inflation in the United States will remain at a low level with Economic Macro Uncertainty. The sample period spans from February 2018 to January 2022. Panel A shows the time series of the Fed's confidence and Economic Macro Uncertainty. Panel B reports the correlation between the Fed's Confidence and Economic Macro Uncertainty. *P*-values are in parentheses. The lower (upper) triangle reports the Pearson (Spearman) correlation coefficients.

Figure A2
CPI Forecast Errors by Levels of Total Macro Uncertainties

Panel A: Box Plots of CPI Forecast Errors by Levels of Total Macro Uncertainties



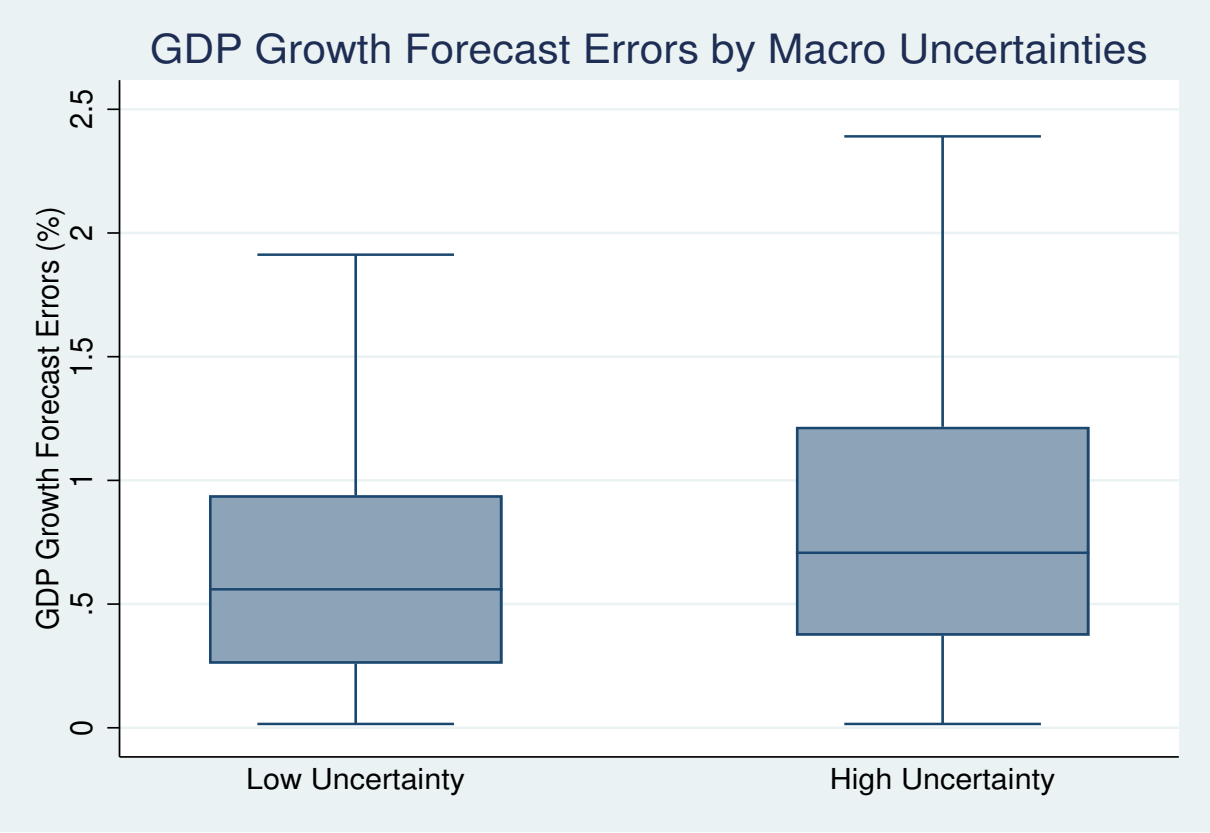
Panel B: Summary Statistics of CPI Forecast Errors by Levels of Total Macro Uncertainities

	Mean	SD
Low Uncertainty	0.476	0.382
High Uncertainty	1.121	1.076
	Value	*t-statistics*
High - Low	0.645***	4.876

Notes. This figure presents the distribution of CPI forecast errors by the level of contemporaneous total macro uncertainties. For each quarter from the fourth quarter of 1979 to the fourth quarter of 2015, we classify sample quarters into Low and High Uncertainty based on the level of total macro uncertainties. Specifically, periods of Low (High) Uncertainty are characterized by a level of total macro uncertainty that falls below (above) the median level of the sample period. Panel A (B) presents the box plots (summary statistics) of CPI forecast errors by levels of total macro uncertainties. ***, **, and * denote 1%, 5%, and 10% levels of significance, respectively.

Figure A3
GDP Growth Forecast Errors by Levels of Total Macro Uncertainties

Panel A: Box Plots of GDP Growth Forecast Errors by Levels of Total Macro Uncertainties

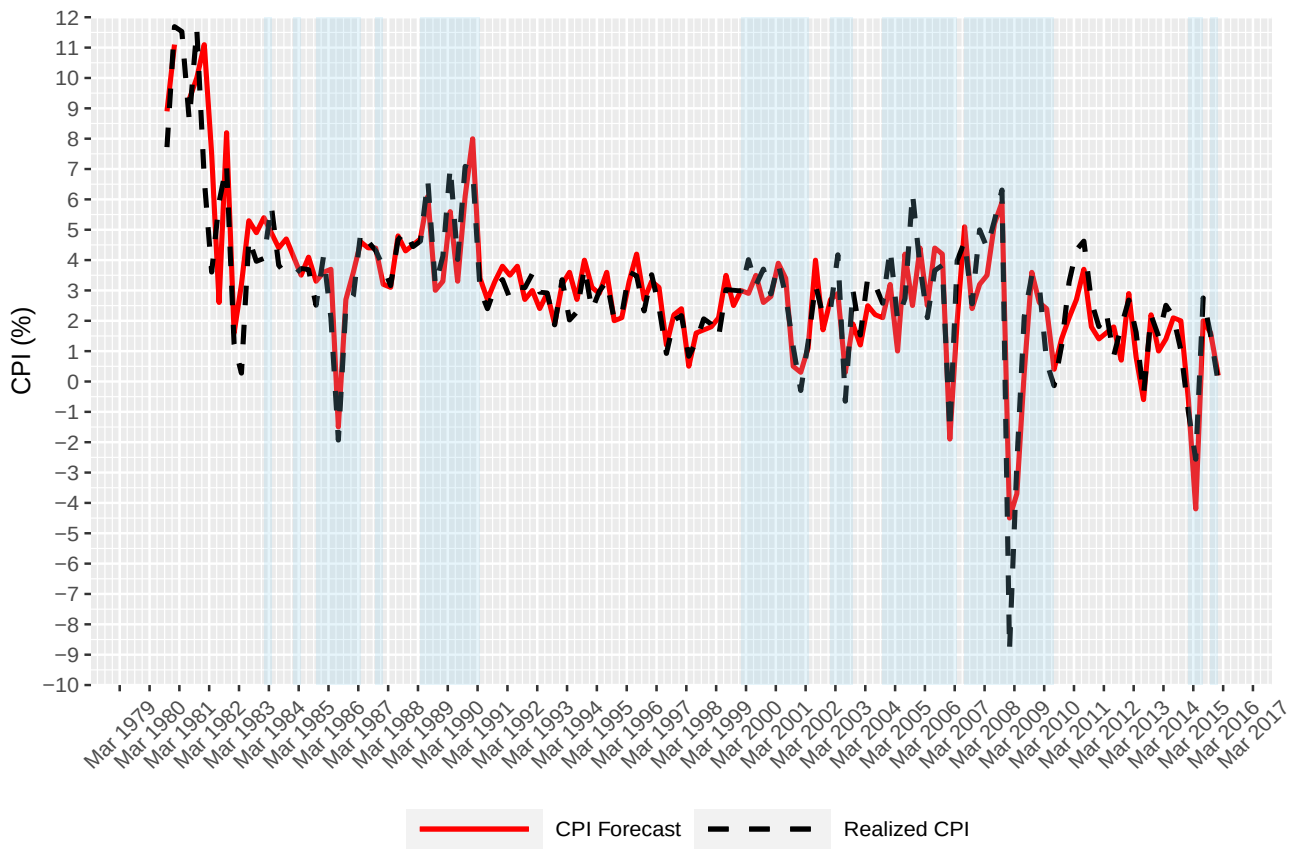


Panel B: Summary Statistics of GDP Growth Forecast Errors by Levels of Total Macro Uncertainities

	Mean	SD
Low Uncertainty	0.668	0.513
High Uncertainty	0.953	0.842
	Value	*t-statistics*
High - Low	0.285***	2.798

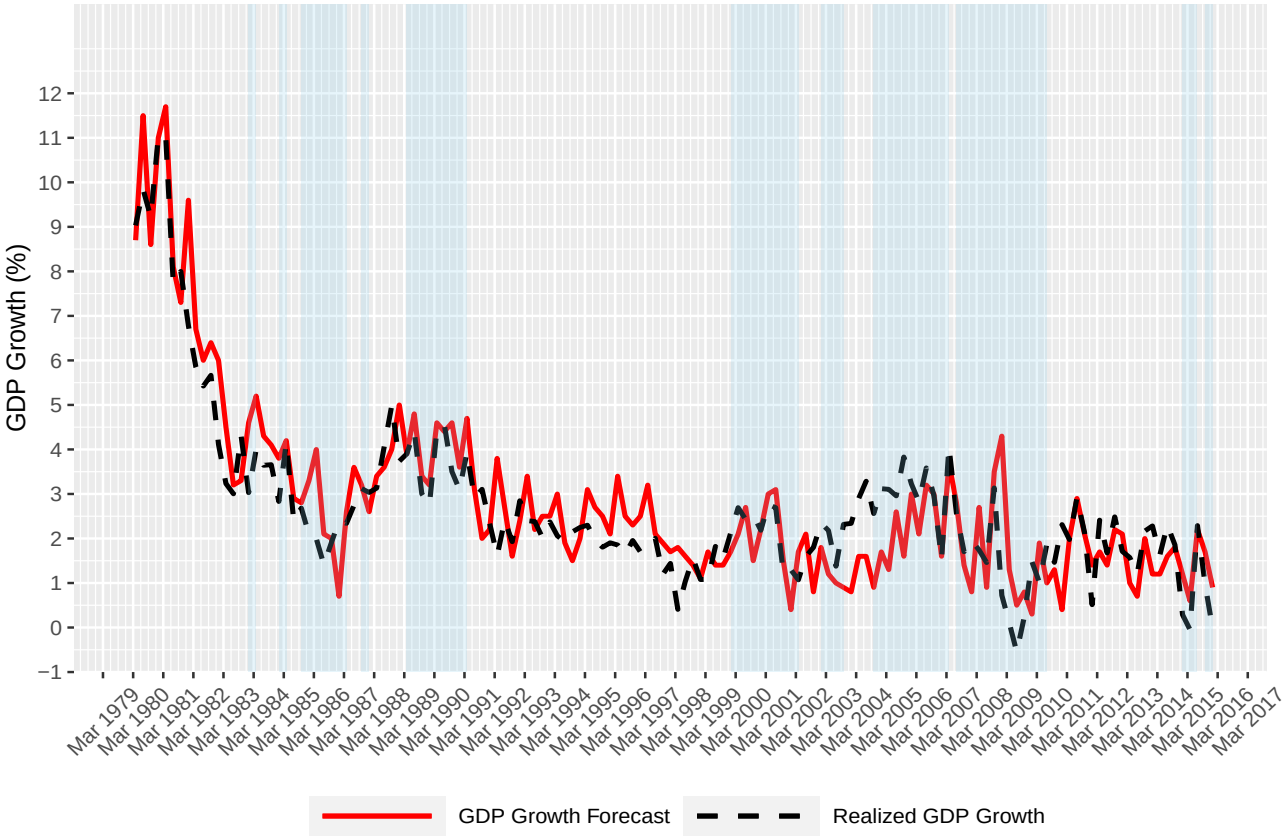
Notes. This figure presents the distribution of GDP growth forecast errors by the level of contemporaneous total macro uncertainties. For each quarter from the fourth quarter of 1979 to the fourth quarter of 2015, we classify sample quarters into Low and High Uncertainty. Specifically, periods of Low (High) Uncertainty are characterized by a level of total macro uncertainty that falls below (above) the median level of the sample period. Panel A (B) presents the box plots (summary statistics) of GDP growth forecast errors by levels of total macro uncertainties. ***, **, and * denote 1%, 5%, and 10% levels of significance, respectively.

Figure A4
CPI Forecasts and Realized CPI



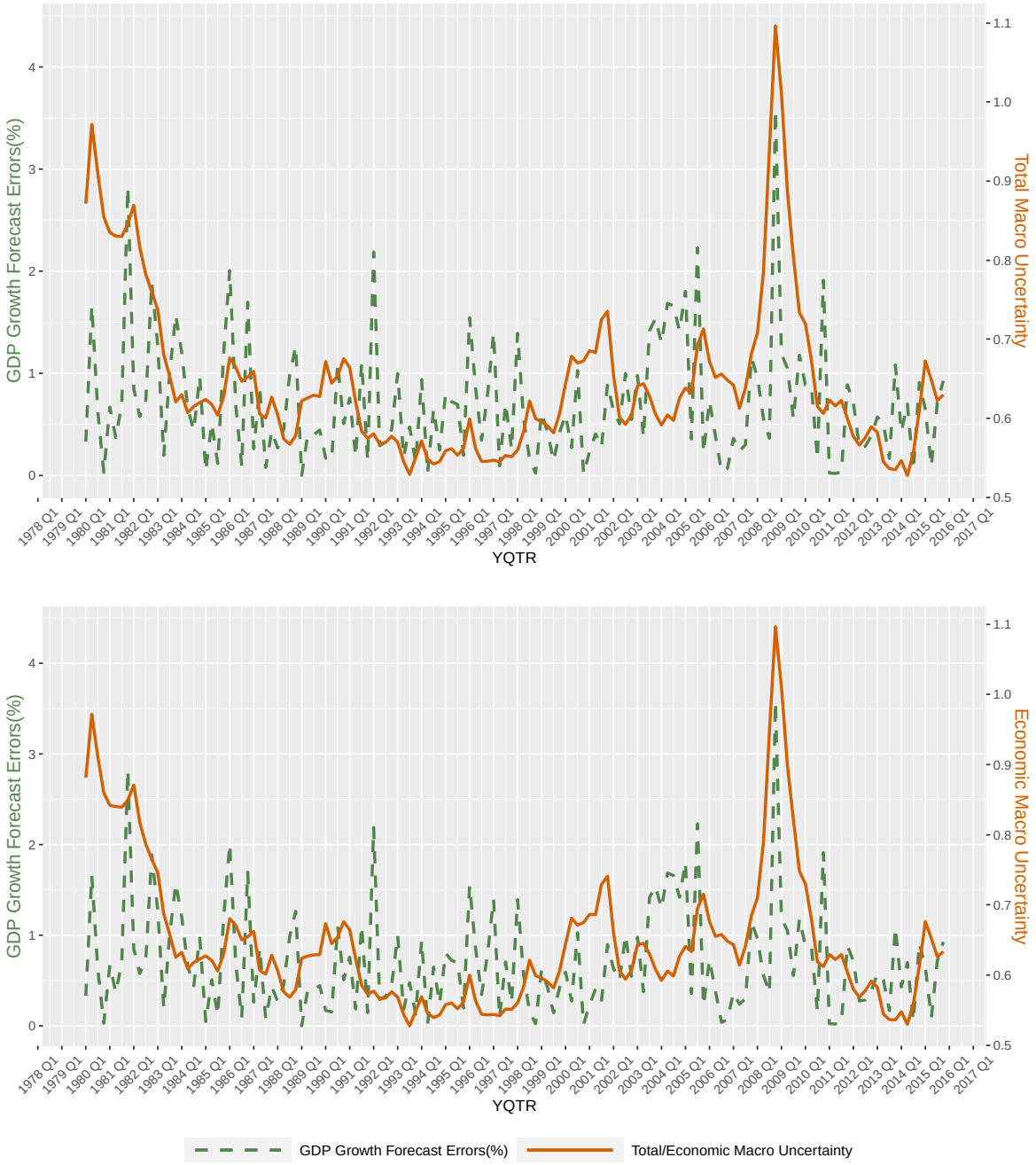
Notes. This figure presents the time-series evolution of the CPI forecasts (solid red line) and the realized CPI (dashed black line) from the fourth quarter of 1979 to the fourth quarter of 2015. Periods of high macroeconomic uncertainty are represented by blue shading. A quarter is deemed to have high macroeconomic uncertainty if its level of total macro uncertainty exceeds the median level of the sample period. All variables are measured at the quarterly level. Realized quarter-over-quarter CPI and CPI forecast data are from the Survey of Professional Forecasters and Philadelphia Fed's Tealbook (formerly Greenbook) data sets, respectively.

Figure A5
GDP Growth Forecasts and Realized GDP Growth



Notes. This figure presents the time-series evolution of the GDP growth forecasts (solid red line) and the realized GDP growth (dashed black line) from the fourth quarter of 1979 to the fourth quarter of 2015. Periods of high macroeconomic uncertainty are represented by blue shading. A quarter is deemed to have high macroeconomic uncertainty if its level of total macro uncertainty exceeds the median level of the sample period. All variables are measured at the quarterly level. Realized quarter-over-quarter GDP growth and GDP growth forecast data are from the Survey of Professional Forecasters and Philadelphia Fed's Tealbook (formerly Greenbook) data sets, respectively.

Figure A6
GDP Growth Forecast Errors and Macro Uncertainties



Notes. This figure presents the time-series evolution of GDP growth forecast errors (dashed green line) and total/economic macro uncertainty (solid red line). The top (bottom) panel plots the time-series of GDP Growth forecast errors and total (economic) macro uncertainty from the fourth quarter of 1979 to the fourth quarter of 2015. All variables are measured at the quarterly level. Total Macro Uncertainty and Economic Macro Uncertainty are available at the monthly level, and are aggregated into the quarterly level by taking the average value for each quarter. The GDP growth forecast errors are constructed as the absolute value of the difference between the GDP growth forecast of the research staff of the Federal Reserve Board and the realized GDP growth. Realized quarter-over-quarter GDP growth and GDP growth forecast data are from the Survey of Professional Forecasters and Philadelphia Fed's Tealbook (formerly Greenbook) data sets, respectively. Total Macro Uncertainty and Economic Macro Uncertainty are from Jurado et al. (2015).

Table A1
Registered Analyses and Corresponding Tables and Figures

Registered Analysis	Tables & Figures
1. Unconditional Forecast Accuracy Analyses (2 analyses)	
i. Focus on inflation projections and benchmark against the actual reported.	Figure A4
ii. As a gauge regarding other predictive tasks, we will also look at GDP growth projections and benchmark them against the actual reported figures. Do GDP forecasts differ from actuals?	Figure A5
2. Conditional Forecast Accuracy Analyses (10 analyses)	
a. A baseline analysis: Is forecast accuracy for projections made by the Research Staff of the Federal Reserve Board similar for economically certain vs. uncertain periods (by assigning each period a rank of uncertainty based on the economic uncertainty measure)? (8 analyses, 4 each for inflation and GDP growth)	
i. We test the accuracy of the Fed's projections in economically certain versus uncertain periods, using the objective measure of economic uncertainty per above to classify periods into economically certain and uncertain. In particular, we first classify the sample into two types of periods based on the economic uncertainty measure. Then we aggregate the forecast errors for the two periods using accuracy metrics that are accepted in the literature. For example, we calculate the mean of forecast errors over economically certain and uncertain periods. Then we use statistical tests to examine the significance of the difference between the means of forecast errors for the certain and uncertain periods.	Figure A2
ii. As robustness tests, we repeat the analyses using different cutoffs to classify high and low economic uncertainty.	The results are robust when classifying high (low) economic uncertainty as periods whose total macro uncertainty fall within the top (bottom) tercile, quartile, and quintile of the sample period. For brevity, these results are not reported and are available upon request.
iii. Using histogram analysis, we tabulate the forecast errors as a function of economic uncertainty. We focus on portfolios of periods with the highest and lowest economic uncertainty.	Figure A2
iv. Using regression analyses, we regress the magnitude of the forecast errors on the measure of economic uncertainty per above. We predict that if indeed it is harder to project inflation during uncertain times, the regression analysis will result in a statistically positive coefficient from such a regression above.	Table 2
v. We repeat the above for both inflation and GDP growth. We note that, even though GDP growth is not the focus of our project, we calculate it to gauge the accuracy of the forecasting task during certain vs. uncertain economic regimes.	Figure A3, Table A3, and Figure A6
b. A randomized analysis: Bootstrapping forecast errors for economically certain vs. uncertain periods. (2 analyses)	
i. In particular, the analysis will (a) randomly select periods from the entire sample, (b) calculate forecast error metrics and compare them across the randomized regimes, and (c) repeat the analysis 1,000 times. Then, the analysis will investigate the statistical significance between the randomized samples of certain vs. uncertain periods using all tests as in the baseline analyses.	Table A4: analyses for CPI (GDP growth) in Panel A (B).

Continued on next page

Table A1 (cont.)
Registered Analyses and Corresponding Tables and Figures

Registered Analysis	Tables & Figures
3. Textual Analysis of Fed Chair Communications (2 analyses)	
a. Using the same measure of economic uncertainty used to classify periods into economically certain vs. uncertain, we classify the entire tenure period of the current Fed Chair, including the recent period of the coronavirus pandemic. (1 analysis)	Figure 2 and Figure A1
b. We collect public communications made by the Fed Chair in news articles during the Chair's tenure. We then conduct textual analysis to extract the level of certainty reflected from the tone of each of these communications. We assign CERTAINTY SCORE to each of these public communications by the Fed Chair. We will compute this score using the same methodology used in decades of research developing various measures based on ranking orders (e.g., Fama-French small-minus-big and market-to-book value factors; i.e., by sorting all communications into buckets). (1 analysis)	See Section 2 for detailed procedures.
4. Final Step: Evaluation of Public Communications made by the Fed Chair – Overall and Most Recent Period (1 analysis)	
a. For each period of a Fed Chair communication:	
i. Calculate CERTAINTY SCORE; Economic uncertainty level; Historical Greenbook forecast errors for this level of economic uncertainty.	Figure A2
ii. Then, using correlation and/or regression analysis, we estimate the link between CERTAINTY SCORE and economic uncertainty level. We also estimate the link between the periodic CERTAINTY SCORE and the historical forecast errors associated with the level of economic uncertainty for that period. We discuss inferences based on this link. For example, are Fed Chair public communications (a) predictably wrong, (b) appear rational, (c) unrelated to fundamentals or is the sample too short/noisy? An important implication for 2021 is as follows: Given the level of economic certainty/uncertainty nowadays, should capital markets, households, corporations take the current communications of Fed Chair communications at face value? Include a discussion of possible consequences.	Panel B of Figure 2 and Figure A1

This table enumerates the pre-specified analyses outlined in the study registration, along with the corresponding tables, figures, or sections where the focal analyses are presented.

Table A2
Examples of Powell's Comments on Inflation Prospects

Week	Comments	Confidence Value
02/22/2021	"I really do not expect that we'll be in a situation where inflation rises to troubling levels," Mr. Powell said.	3
03/08/2021	"There's a difference between a one-time surge in prices and ongoing inflation," Mr. Powell said this month, making it clear that he expected the coming increase to be transitory. The Fed earned an inflation-fighting reputation in the 1970s and 1980s, when it eventually contained runaway prices with double-digit interest rates that caused a recession.	3
03/29/2021	"We could also see upward pressure on prices if spending rebounds quickly as the economy continues to reopen, particularly if supply bottlenecks limit how quickly production can respond in the near term," Mr. Powell said. Federal Reserve Chair Jerome H. Powell spoke before the House Financial Services Committee and stated that he expects inflation to rise this year, but he played down inflation's effects by saying they would be "neither particularly large nor persistent" Federal Reserve chair Jerome Powell said he didn't expect prices to increase to the point "where they would move inflation expectations materially above 2%."	3
04/05/2021	"There's a difference between essentially a one-time increase in prices and persistent inflation," Mr. Powell said on Thursday.	3
08/23/2021	"My view is that the 'substantial further progress' test has been met for inflation," Powell said in the remarks. "While the underlying global disinflationary factors are likely to evolve over time, there is little reason to think that they have suddenly reversed or abated," Mr. Powell said.	3
09/20/2021	Federal Reserve Chair Jerome H. Powell said this week that widespread supply problems, particularly in the auto industry, which lacks enough imported semiconductors, have been "larger and longer lasting than anticipated," forcing the Fed to raise its estimate of future price gains. "Inflation expectations are terribly important, we spend a lot of time watching them, and if we did see them moving up in a troubling way" then "we would certainly react to that," Mr. Powell said. "We are seeing upward pressure on prices particularly because supply bottlenecks in some sectors have limited how quickly production can respond in the near term," Powell told reporters.	2
12/13/2021	"The inflation we got was not at all the inflation we were talking about last year," Mr. Powell said. "There's a lot of uncertainty with the new variant, and it's not clear how big the effects would be on either inflation or growth or hiring," Jerome H. Powell, the Fed chair, said on Wednesday. "There's a real risk now, we believe - I believe - that inflation may be more persistent," Fed Chair Jerome H. Powell said at a news conference Wednesday. "We've been calling out the fact [prices] are becoming larger and more persistent," Powell said. For example, when Federal Reserve Chair Jerome H. Powell was recently asked at a congressional hearing whether he stood by earlier testimony that price increases are not particularly large or persistent, Powell responded, "No, that is no longer my view."	1

This table provides examples of Jerome Powell's comments on inflation prospects in the U.S. and the corresponding assigned confidence value. The confidence value refers to Jerome Powell's confidence/certainty that inflation in the U.S. will remain at a low level. The first column reports the start date of the week, during which the quotes are extracted. The second column presents extracted quotes of Jerome Powell's comments on inflation prospects, obtained via Pro Quest TDM Studio. The third column reports the assigned confidence value, with one being the least confident and three being the most confident.

Table A3
GDP Growth Forecast Errors and Macro Uncertainties

	Dep. Var = *GDPG_FError*			
Total_Macro_Unct	2.365***	2.225***		
	(0.523)	(0.610)		
Econ_Marco_Unct			2.351***	2.208***
			(0.525)	(0.614)
Prior_GDPG		0.041		0.042
		(0.040)		(0.040)
GDPG_Vol		-0.157		-0.160
		(0.162)		(0.163)
Yield_Diff_10y3m		0.139***		0.138***
		(0.043)		(0.043)
Adj. R^2	0.094	0.126	0.092	0.124
N	189	136	189	136

Notes. This table reports the OLS regression results of whether forecast errors of GDP growth are a function of the contemporaneous total/economic macro uncertainties. All the variables are at the quarterly level, and the sample period spans from the fourth quarter of 1979 to the fourth quarter of 2015. The dependent variable is $GDPG\_FError$, namely GDP Growth forecast errors, constructed as the absolute value of the difference between the GDP growth forecast of the research staff of the Federal Reserve Board and the realized GDP Growth. The main independent variables are $Total\_Macro\_Unct$ and $Econ\_Macro\_Unct$, both of which capture time-varying macro uncertainty, obtained from Jurado et al. (2015). $Total\_Macro\_Unct$ captures an estimate of uncertainty from all sources; $Econ\_Macro\_Unct$ is an estimate of uncertainty due to (non-health related) economic fundamentals. Standard errors are reported in parentheses. ***, **, and * denote 1%, 5%, and 10% levels of significance, respectively.

Table A4

Comparing CPI and GDP Forecast Errors during High and Low Macroeconomic Uncertainty Periods using Bootstrapping Analyses

Panel A: CPI Forecast Errors	
Mean forecast errors during periods of high macro uncertainty	1.131
Mean forecast errors during periods of low macro uncertainty	0.451
Percentage of instances where mean forecast errors are higher during periods of high macroeconomic uncertainty compared to periods of low uncertainty	100.00%
Panel B: GDP Forecast Errors	
Mean forecast errors during periods of high macro uncertainty	0.957
Mean forecast errors during periods of low macro uncertainty	0.675
Percentage of instances where mean forecast errors are higher during periods of high macroeconomic uncertainty compared to periods of low uncertainty	94.50%

Notes. This table provides the mean forecast errors of both CPI (Panel A) and GDP growth (Panel B) during periods of high and low macroeconomic uncertainty using the bootstrap method. Specifically, periods of Low (High) Uncertainty are characterized by a level of total macro uncertainty that falls below (above) the median level of the sample period. The bootstrapping analysis involves the following steps: (1) randomly drawing a bootstrap sample of forecast errors for 15 periods with replacement from periods of high and low total macro uncertainty, respectively (2) recording the mean forecast errors for both high and low uncertainty periods and determining if the mean of forecast errors of high uncertainty periods is greater than those of the low uncertainty periods, (3) repeating these steps 1,000 times, and (4) reporting the mean forecast errors of high and low total macro uncertainty for the 1,000 bootstrapped samples, as well as the percentage of instances where the mean forecast errors are higher during periods of high total macro uncertainty than low uncertainty.

Table A5

CPI Forecast Errors of Professional Macro Forecasters and Macro Uncertainties

	Dep. Var = *CPI_FError_SPF*			
Total_Macro_Unct	3.992***	3.999***		
	(0.573)	(0.679)		
Econ_Marco_Unct			4.068***	4.147***
			(0.581)	(0.700)
Prior_CPI		5.989		6.102
		(3.987)		(3.981)
CPI_Vol		-5.734		-9.302
		(16.842)		(17.099)
Yield_Diff_10y3m		0.109*		0.111*
		(0.060)		(0.060)
Adj. R^2	0.228	0.214	0.230	0.216
N	162	160	162	160

Notes. This table reports the OLS regression results of whether CPI forecast errors of professional macro forecasters are a function of the contemporaneous total/economic macro uncertainties. All the variables are at the quarterly level, and the sample period spans from the third quarter of 1981 to the third quarter of 2022. The dependent variable is CPI_FError_SPF, constructed as the absolute value of the difference between the median of CPI forecasts by professional macro forecasters and the realized CPI. The main independent variables are $Total\_Macro\_Unct$ and $Econ\_Macro\_Unct$, both of which capture time-varying macro uncertainty, obtained from Jurado et al. (2015). In particular, $Total\_Macro\_Unct$ captures an estimate of uncertainty from all sources; $Econ\_Macro\_Unct$ is an estimate of uncertainty due to (non-health related) economic fundamentals. Standard errors are reported in parentheses. ***, **, and * denote 1%, 5%, and 10% levels of significance, respectively. The variable definitions are in the table notes of Table 1.