

Speeches by the Fed Chair Are More Important Than FOMC Announcements: An Improved High-Frequency Measure of U.S. Monetary Policy Shocks

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Abstract

We extend the high-frequency monetary policy shock measures of Kuttner (2001) and Gürkaynak, Sack, and Swanson (2005a) to other major types of Fed communication beyond FOMC announcements, including post-FOMC-meeting press conferences, speeches and Congressional testimony by the Fed Chair and Vice Chair, and FOMC meeting minutes releases, all from 1988 to 2019. We find that speeches by the Fed Chair are more important than FOMC announcements for Treasury yields, stock prices, and all but the very shortest-maturity interest rate futures. Thus, previous studies' focus on FOMC announcements has generally missed the most important source of variation in U.S. monetary policy. Post-FOMC press conferences have become more important over time and now also rival FOMC announcements in importance. FOMC minutes releases and Vice Chair speeches are not as important, but are still nonnegligible. We identify federal funds rate, forward guidance, and LSAP components for each of these announcement types and show that their effects are consistent across types.

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1. Introduction

Many recent studies have used high-frequency changes in asset prices around Federal Reserve Federal Open Market Committee (FOMC) announcements to measure the effects of monetary policy on financial markets (e.g., Kuttner, 2001; Gürkaynak, Sack, and Swanson, 2005a; Bernanke and Kuttner, 2005; Swanson, 2021) or as an “external instrument” to estimate the effects of monetary policy on macroeconomic variables such as output, unemployment, and inflation (e.g., Cochrane and Piazzesi, 2002; Faust et al., 2003; Faust, Swanson, and Wright, 2004; Stock and Watson, 2012; Gertler and Karadi, 2015; Ramey, 2016; Bauer and Swanson, 2023b). A significant challenge facing these applications, however, is that there are only eight scheduled FOMC announcements per year, with a mean absolute change in short-term interest rates of just 3 basis points (bp) per announcement. It is very difficult to obtain statistically significant, robust estimates of the effects of monetary policy on monthly or quarterly macroeconomic variables with just eight 3bp changes in monetary policy per year. Indeed, Ramey (2016) argues that this is why standard high-frequency external instruments estimates of monetary policy’s effects on macroeconomic variables are fragile with respect to changes in sample period and specification.¹

In this paper, we address this challenge by expanding the set of U.S. monetary policy announcements to include much more than just the eight scheduled FOMC announcements per year. In particular, we collect the dates, times, and high-frequency, intradaily financial market responses from January 1988 to December 2019 for: i) all unscheduled and scheduled FOMC announcements, ii) all post-FOMC-meeting press conferences, iii) all speeches and Congressional testimony by the Federal Reserve Chair, iv) all speeches and Congressional testimony by the Federal Reserve Board Vice Chair, and v) all minutes releases a few weeks after each FOMC meeting. This greatly expands the set of monetary policy announcements: for example, there were 847 speeches and Congressional testimony by the Fed Chair from 1988 to 2019, compared to 256 scheduled FOMC announcements.

We find that speeches and Congressional testimony by the Fed Chair, in particular, have large effects on financial markets and are even more important than FOMC announcements for stocks, bonds, and all but the very shortest-maturity interest rate futures. Intuitively, FOMC

¹ Bauer and Swanson (2023b) draw on the data from the present paper to address Ramey’s critique. Note also that this critique does not apply to estimates of the effects of monetary policy on financial market variables, since in that case both the left- and right-hand side variables in the regression can be sampled at high frequency around the FOMC announcement, removing the confounding effects of other news each month (Bernanke and Kuttner 2005, Gürkaynak et al. 2005a, Swanson 2021, Bauer and Swanson 2023b).

decisions are typically communicated to financial markets ahead of time through speeches by the Fed Chair and other FOMC members. As a result, FOMC announcements themselves are rarely a surprise, while significant changes in monetary policy are frequently communicated to the markets beforehand via speeches. The end result is that, for all but the very shortest-maturity assets, Fed Chair speeches are more important than FOMC announcements.

A main reason previous studies have focused on FOMC announcements is that the Fed only changes its conventional monetary policy tool—the federal funds rate—along with one of those announcements (where the term “announcement” here includes post-FOMC-meeting open market operations, which were important before the Fed began explicitly announcing federal funds rate changes in 1994). However, as U.S. monetary policy has become more transparent over time, changes in the federal funds rate have become more predictable (Swanson, 2006), so that increasingly the most important news about monetary policy in an FOMC announcement is the FOMC’s forward guidance about the likely future path of the federal funds rate rather than the current federal funds rate decision itself (Gürkaynak, Sack, and Swanson, 2005a). This trend increased after 2008, when the FOMC lowered the federal funds rate to essentially zero and began focusing its announcements entirely on forward guidance and long-term bond purchases (Swanson, 2021). Thus, empirical studies of FOMC announcement effects since 2008 have used changes in interest rates with a longer maturity than the overnight federal funds rate to capture some of the effects of forward guidance as well as the federal funds rate. For example, Gertler and Karadi (2015) use the one-year Treasury yield and the three-month-ahead federal funds futures rate as their measures of monetary policy, while Gürkaynak, Sack, and Swanson (2005a) and Nakamura and Steinsson (2018) extract principal components from federal funds futures and Eurodollar futures rates with maturities of up to one year. One of the main findings of the present paper is that restricting attention to FOMC announcements alone misses the most important source of variation in those interest rates: speeches by the Fed Chair.

We also show that post-FOMC-meeting press conferences by the Fed Chair have become increasingly important over time and now rival FOMC announcements themselves as a source of news about U.S. monetary policy. Speeches and testimony by the Fed Vice Chair and FOMC meeting minutes releases are only modestly important as a source of news about monetary policy, but are still nonnegligible.

Finally, we follow Swanson (2021) and identify federal funds rate, forward guidance, and large-scale asset purchase (LSAP) components for each of our five monetary policy announcement

types (FOMC announcements, Fed Chair speeches, press conferences, Vice Chair speeches, and minutes releases). The federal funds rate only changes with an FOMC announcement, but there are forward guidance and LSAP components for all five announcement types, and we show that the effects of those components are consistent across announcement types. That is, we do not reject the hypothesis that forward guidance has identical effects no matter what the source of that forward guidance was (and similarly for news about LSAPs). This suggests that a unified measure of forward guidance (LSAPs) across these different announcement types can help researchers improve their estimates of the effects of forward guidance (LSAPs) in the data.

All together, our expanded set of U.S. monetary policy announcements explains several times as much interest rate variation each month as FOMC announcements alone. As a result, we have a much more powerful instrument for studying the effects of monetary policy on financial markets and macroeconomic variables. For example, Bauer and Swanson (2023b) and Swanson (2023b) revisit the high-frequency external instruments estimates in Gertler and Karadi (2015), Ramey (2016), and Miranda-Agrippino and Ricco (2023) and are able to get substantially more precise and robust estimates by making use of the data we construct in this paper.

After a brief literature review, the remainder of the paper proceeds as follows. In Section 2, we describe how we construct our extended set of monetary policy announcements, including the dates, times, and intradaily financial market responses to all of those announcements. In Section 3, we compare the importance of these different monetary policy announcement types for different financial market assets. In Section 4, we show how the importance of these different monetary policy announcement types has varied over time. In Section 5, we decompose each of these monetary policy announcement types into federal funds rate, forward guidance, and LSAP components and compare those effects across announcement types. Section 6 concludes.

Related Literature

Many previous papers have used high-frequency changes in interest rates around FOMC announcements to measure changes in U.S. monetary policy. Kuttner (2001) uses the one-day change in the current- or next-month federal funds futures contract around FOMC announcements to measure the unexpected component of the FOMC’s federal funds rate decisions and the effects of those decisions on financial markets. His sample runs from June 1989 to February 2000 but includes only the 42 FOMC announcements in that period at which the FOMC changed the federal funds rate. Gürkaynak et al. (2005a, henceforth GSS) extend Kuttner’s (2001) analysis in several

ways: first, they consider every FOMC announcement, whether the federal funds rate target was changed or not, thus including cases where the FOMC did not change the target but surprised markets with its inaction.² Second, GSS use intra-daily interest rate data to distinguish the effects of FOMC announcements from the effects of other macroeconomic news that day.³ And third, GSS show that the effects of FOMC announcements are not one-dimensional, but instead require two factors to adequately capture their effects on financial markets, and that these two factors can be interpreted as the surprise change in the federal funds rate and the surprise change in forward guidance.⁴ See also Cochrane and Piazzesi (2002), Faust et al. (2003), Faust, Swanson, and Wright (2004), Gürkaynak, Sack, and Swanson (2005b), Bernanke and Kutner (2005), Stock and Watson (2012), Gertler and Karadi (2015), Ramey (2016), Nakamura and Steinsson (2018), Miranda-Agrippino and Ricco (2021, 2023), and Bauer and Swanson (2023b) for applications that use high-frequency interest rate changes around FOMC announcements as measures of changes in monetary policy. In contrast to these studies, we use high-frequency interest rate changes around other major monetary policy announcements, such as post-FOMC press conferences and Fed Chair speeches, as well as FOMC announcements, to measure changes in U.S. monetary policy.

A number of other papers have built on the GSS insight that monetary policy has multiple dimensions. Brand, Buncic, and Turunen (2010) apply GSS’s methods to the ECB’s monetary policy announcements and post-meeting press conferences, as well as the separation in time between those two announcement types, to identify the effects of each on financial markets. Swanson (2021) extends the GSS analysis to include the U.S. zero lower bound (ZLB) and post-ZLB periods from 2009–15 and 2015–19 and finds that these periods require a third factor to explain asset price responses to FOMC announcements, which he shows can be interpreted as the surprise change in the Fed’s large-scale asset purchases (LSAPs). Altavilla et al. (2019) apply Swanson’s (2021) methods to data from the euro area. In the present paper, we use many of the same methods as the papers above, but apply those methods to a much wider set of monetary policy

²This happens on several occasions; for example, on Dec. 20, 1994, the FOMC left the federal funds rate unchanged at 5.5 percent even though markets had widely expected them to tighten; as a result, the Kuttner-type monetary policy surprise on that date is -22.5bp , a large easing surprise relative to market expectations, which is not in Kuttner’s (2001) sample.

³This is important because several FOMC announcements took place on the same day as a weak Employment Report.

⁴Nakamura and Steinsson (2018) use the same data as GSS but extract only the first principal component, for simplicity. Their one-dimensional monetary policy surprise measure is thus a weighted average of the GSS “target” and forward guidance “path” factors.

announcements, including post-FOMC press conferences, speeches by the Fed Chair, etc.

Finally, there are several papers that go beyond FOMC announcements to include other types of monetary policy announcements in their analysis. Gagnon et al. (2011) analyze FOMC announcements from Jan. 2009 to Feb. 2010 and one speech by Fed Chair Bernanke. Wright (2012) considers FOMC announcements from Nov. 2008 to Sept. 2011 and four speeches by Fed Chair Bernanke. Cieslak and Schrimpf (2019) include FOMC announcements, post-FOMC press conferences, and FOMC meeting minutes releases from Oct. 1997 to Dec. 2017, but no speeches by the Fed Chair or Vice Chair. Kim, Laubach, and Wei (2020) include FOMC announcements and post-FOMC press conferences from July 1991 to Dec. 2015, but just “a few” Fed Chair speeches. In contrast to these papers, we include all speeches and Congressional testimony by the Fed Chair and Federal Reserve Board Vice Chair, as well as all FOMC announcements, press conferences, and minutes releases from 1988 to 2019. An additional distinguishing feature of our paper is that we construct a much longer history of monetary policy announcements than previous studies, extending from January 1988 to December 2019. The early years of our sample are a particularly useful contribution, since interest rates varied more substantially during this period. For example, Ramey (2016) suggests that data from years prior to the mid-1990s could be particularly helpful for estimating the effects of monetary policy on macroeconomic variables due to the greater interest rate variation during that period.

2. Construction of Monetary Policy Announcement Data

In this section, we describe each of the monetary policy announcement types we consider below, how we determined the dates and times of each of those announcements, and the high-frequency data used to construct the financial market responses to those announcements.

2.1 Types of Monetary Policy Announcements Considered

The Federal Reserve’s primary instrument of monetary policy is the overnight federal funds rate, an interbank market interest rate that the Fed historically targeted by varying the aggregate supply of federal funds reserves in that market.⁵ The FOMC has eight scheduled meetings per year at which it decides what the federal funds rate target will be, and the outcome of those decisions

⁵ See Swanson (2023a) for a survey of the federal funds market before and after 2008.

is announced following the end of the FOMC meeting.⁶ In addition, the FOMC sometimes changes its target for the federal funds in between scheduled meetings—typically when economic conditions deteriorate rapidly and the FOMC does not want to wait several weeks for the next scheduled FOMC meeting—and announces its decision shortly afterward.⁷ These are referred to as “unscheduled” or “intermeeting” FOMC announcements. Unless otherwise specified, the term “FOMC announcement” includes both types: scheduled and unscheduled. Since 1994, these announcements have typically been accompanied by an FOMC statement that explains the rationale for the decision; these statements have gradually grown in length over time and currently span about six paragraphs.

Beginning in April 2011, the Federal Reserve Chair held a press conference in the afternoon after approximately every other FOMC meeting (and after every FOMC meeting beginning in 2019) to answer questions from the press about the FOMC’s decision, the FOMC statement, the rationale for its decision, and monetary policy and the economy more generally.

A few weeks after each FOMC meeting, the FOMC approves the minutes of the meeting and those minutes are released to the public. The minutes summarize all of the discussion that took place at the meeting, including issues related to the U.S. and global macroeconomy, U.S. and global financial market conditions, and the rationale for the FOMC’s monetary policy decision, including any debates or disagreement about that decision. The minutes are much more detailed and much longer than the original FOMC statement, spanning about 10–20 pages of text.

In addition to official FOMC communication, individual FOMC members frequently give speeches to the public or testimony to Congress in which they discuss their views of the economy and U.S. monetary policy and answer questions from the audience. (For brevity, the term “speeches” will be taken to include both speeches and Congressional testimony throughout the remainder of the paper, unless otherwise specified.) Financial market participants read and watch these speeches very carefully to look for hints about future U.S. monetary policy, and these

⁶The FOMC has explicitly announced its decisions for the federal funds rate target after each FOMC meeting since the beginning of 1994. Prior to 1994, the FOMC effectively announced its decisions for the federal funds rate target through the size and type of open market operation conducted in the federal funds market the morning following the FOMC meeting. See below for additional details.

⁷For example, on January 22, 2008, the FOMC made an unscheduled announcement that it was cutting the federal funds rate by 75 bp “in view of a weakening of the economic outlook and increasing downside risks to growth” (FOMC statement, Jan. 22, 2008). Although the next scheduled FOMC meeting was only nine days away, Chairman Bernanke argued that “seven trading days is a long time in financial markets” and “I think we have to take a meaningful action” (FOMC transcript of January 21, 2008). Prior to 1994, the FOMC’s unscheduled decisions were typically made in the morning and effectively announced to financial markets through the size and type of open market operation conducted later that morning. See below for additional details.

speeches often cause significant financial market movements. Ideally, we would like to include every speech by every FOMC member over our sample, but there are 19 members who participate in FOMC meetings, each of whom gives 20–40 speeches per year, which would result in over ten thousand observations over our 32-year sample.⁸ To keep the set of speeches down to a more manageable number, we focus on two of the most influential members of the FOMC: the Federal Reserve Board Chair and Vice Chair.

The Federal Reserve Board Chair is also the Chair of the FOMC and is by far the most influential member of the Committee. The Chair sets the agenda for each FOMC meeting, determines the order in which the Committee members present their views, presents their own views at the end, and has never been on the losing side of an FOMC vote. While financial market participants closely watch speeches by all FOMC members, those by the Fed Chair are given extra attention and consideration due to the Chair’s outsized influence on the Committee.

The Federal Reserve Board Vice Chair is less influential than the Chair, but is more influential than the other Federal Reserve Board Governors and Bank Presidents, with the possible exception of the Federal Reserve Bank of New York President. For example, the Board Vice Chair, like the Chair, frequently testifies before Congress, which other Governors and Bank Presidents rarely do. The Board Vice Chair is also located in the same building as the Chair, is typically in frequent communication with the Chair, and has never voted against the Chair’s position at an FOMC meeting. Thus, in addition to all speeches by the Fed Chair, we also consider all speeches by the Board Vice Chair over our sample.⁹

2.2 Dates and Times of Monetary Policy Announcements

To measure the high-frequency, intra-daily financial market responses to each of the monetary policy announcements above, we first determined the date and time of each announcement, as follows.

2.2.1 FOMC Announcements

In 1994, the FOMC began issuing a press release shortly after every regularly-scheduled FOMC

⁸The FOMC consists of the 7 Federal Reserve Board Governors and the 12 regional Federal Reserve Bank Presidents. Only 12 members of the FOMC have a vote at any one time, but all 19 members attend each FOMC meeting and present their views on the economy and the appropriate course for monetary policy. The 19 FOMC members vote on a rotating basis from year to year.

⁹After 2010, the Dodd-Frank Act established the additional position of Federal Reserve Board Vice Chair for Supervision. We do not include speeches by the Vice Chair for Supervision in our analysis. Also note that the Board Vice Chair is not the same as the Vice Chair of the FOMC—that latter position is always held by the President of the Federal Reserve Bank of New York.

meeting and every unscheduled FOMC interest rate change which explicitly communicated to the markets the Fed's target for the federal funds rate.¹⁰ Gürkaynak et al. (2005a) obtained the dates and times of each of these press releases from the Office of the Secretary of the Federal Reserve Board for the period from 1994 to May 2004, and we use their dates and times. After 2004, we again obtained the dates and times of FOMC announcements from the Office of the Secretary of the Federal Reserve Board, which are also available on the Federal Reserve Board's public website from 2016 onward.

Prior to 1994, the FOMC did not explicitly announce its target for the federal funds rate, but implemented changes in its target via open market operations that altered the aggregate quantity of reserves in the federal funds market. Thus, financial market participants could typically infer changes in Fed policy from the size and type of open market operation conducted following any such policy change. These open market operations were conducted at 11:30am every business day over this period, so the outcome of a regularly-scheduled FOMC meeting could typically be inferred at 11:30am the following morning, while unscheduled interest rate changes by the FOMC could typically be inferred at the time of the next open market operation (often later that same morning). Thus, the date and time of each pre-1994 FOMC announcement is usually the date and time of the first open market operation after that FOMC decision.

There are a few exceptions to this pre-1994 timing, however. First, in a few cases, the FOMC changed the discount rate (the interest rate that the Fed charges banks to borrow directly from the Fed's discount window) as well as the federal funds rate target, and announced the change in the discount rate immediately via a press release. Financial market participants typically inferred from this press release that the FOMC had also changed its target for the federal funds rate. In those cases, the date and time of the FOMC decision is the date and time of the discount rate change press release.

Second, the Fed's ability to signal its intentions in the federal funds market was sometimes diminished by natural variation in the supply of reserves (such as changes in the float due to large payments by the U.S. Treasury or a delay in the transportation of checks across the country due to bad weather) that required the Fed to conduct offsetting open market operations. In those cases, there was often some debate in financial markets about whether the FOMC had actually changed

¹⁰ At first, from 1994 to March 1999, the FOMC did not issue a press release if there was no change in the federal fund rate target, and the markets correctly interpreted the absence of a press release as signalling no change in policy. Beginning in May 1999, the FOMC began releasing a statement after every FOMC meeting, whether or not there was a change in the federal fund rate target (Swanson, 2006).

policy or not, and this uncertainty might take one or more *additional* open market operations over the next several days to be resolved. This was never a problem from 1991 onward, but from 1988–90 there are several instances where the FOMC’s decision was not immediately clear to market participants and it took several days for the market to gradually arrive at a consensus regarding the Fed’s policy decision. In those cases, we read the “Credit Markets” column of *The New York Times* every day to determine how many open market operations it took for the financial markets to achieve a reasonable degree of consensus, and we consider *each* of these open market operations to be a monetary policy announcement (albeit typically a small one). For example, the FOMC made an unscheduled change to the federal funds rate target on the morning of May 9, 1988, but it took the markets two days—May 9 and 10, 1988—to determine that a change had taken place, so there are effectively FOMC monetary policy announcements at 11:30am on *both* May 9 and 10, 1988.¹¹

Finally, from 1988–91, when the FOMC changed the *discount* rate, it immediately announced that change to the public via a press release, as discussed above, but there was sometimes some uncertainty in financial markets whether the discount rate change would also be accompanied by a change in the federal funds rate target or not. (By 1992, it was clear to financial markets that a change in the discount rate was always accompanied by a change in the federal funds rate target.) Thus, on those dates, there are actually *two* FOMC announcements: one at the time of the discount rate change press release (typically before 10am in the morning) and one at the time of the next open market operation at 11:30am.¹²

Over our sample from 1988 to 2019, there are 256 scheduled FOMC announcements—eight per year—plus an additional 68 intermeeting FOMC announcements of the types described above, for a total of 324 FOMC announcements. However, one of those announcements—the FOMC’s intermeeting announcement on September 17, 2001—occurred before financial markets

¹¹In 1988 and 1989, the FOMC frequently adjusted the federal funds rate by small amounts, often in between regularly-scheduled meetings, so there are effectively many FOMC announcements in those two years (27 in 1988 and 23 in 1989). In fact, in these years it’s not unreasonable to think of there being a small FOMC announcement *every* business day at 11:30am, when the Fed’s open market operation is announced. We do not take that approach in this paper, and instead concentrate attention only on those open market operations that generated a significant amount of attention in financial markets due to their proximity to a scheduled FOMC meeting or a change in Fed policy. This reduces the size of our set of FOMC announcements and concentrates attention on those open market operations that were the most significant to financial markets.

¹²Note that Gürkaynak et al. (2005a) missed these announcements because they assumed that markets always understood that a discount rate change would be accompanied by a change in the federal funds rate target, even though our readings of *The New York Times* “Credit Markets” column made clear that that was not the case prior to 1992. Thus, the GSS listing of FOMC announcement dates and times in their Appendix A1 does not include these post-discount-rate-change open market operation announcements.

opened that day and after they had been closed for several days following the September 11 terrorist attacks, which makes it impossible to get high-frequency measures of the financial market responses to that announcement that exclude the effects of the terrorist attack itself. We thus exclude that announcement from our analysis, as is standard in the literature, leaving us with 323 FOMC announcements total.

2.2.2 Post-FOMC Meeting Press Conferences

We obtained the dates and times of the post-FOMC-meeting press conferences from the Federal Reserve Board’s public website. When the press conferences were first introduced in 2011, they were held at 2:15pm on the last day of essentially every other FOMC meeting.¹³ Since March 2013, the press conferences have been held at 2:30pm. The duration of the press conferences is typically about one hour, but ranges in length from about 45 minutes to 1 hour and 15 minutes. Overall, there are 40 post-FOMC-meeting press conferences in our sample—four each year from 2011 to 2018, and eight in 2019.

2.2.3 FOMC Meeting Minutes Releases

We obtained a listing of FOMC meeting minutes release dates and times from the Office of the Secretary of the Federal Reserve Board. The dates of the minutes releases from 1993 onwards are also available on the Federal Reserve Board’s public website.

Prior to 2005, the minutes for each FOMC meeting were approved by a vote at the next FOMC meeting and then released to the public about three days after approval. From 1988 to 1996, that public release was made on Friday afternoons at 4:30pm Eastern Time, after financial markets had closed for the week. From 1997 to 2004, the minutes were released at 2:00pm on Thursday afternoons, with two exceptions (July 2, 1998, and August 20, 1998, on which dates the minutes were released at 12:00 noon). Beginning in 2005, this release schedule was accelerated in the interest of transparency, so the minutes of each FOMC meeting were approved by a vote of the FOMC and released to the public approximately three weeks after the meeting, typically on Tuesdays at 2:00pm Eastern Time. Overall, there are 256 FOMC meeting minutes releases in

¹³In 2011, post-FOMC press conferences were held after the April, June, and November FOMC meetings; the April and June meetings were consecutive and there was no press conference after either the August or September FOMC meeting. In 2012, press conferences were held after the January, April, June, September, and December FOMC meetings, and the April and June meetings were consecutive. From 2013 to 2018, press conferences were held after the March, June, September and December meetings. From 2019 onward, there is a post-FOMC meeting press conference after every FOMC meeting.

our sample—one after each of the eight regularly-scheduled FOMC meetings each year from 1988 to 2019.

However, in our analysis below, we found that FOMC minutes releases before 1997 essentially never had a significant effect on financial markets, at least not as reported in contemporaneous accounts in the “Credit Markets” column of *The New York Times*. This is probably partly because they were released after the market close on Friday afternoons, which prevented markets from responding directly to the minutes and may have made it difficult for market participants to attribute any moves in asset prices on Monday morning to the minutes release from the previous Friday. Thus, we drop the pre-1997 minutes releases from the rest of our analysis, since we are trying to focus on market responses that can be attributed to potential information about U.S. monetary policy. This leaves us with 184 minutes releases—eight per year from 1997 to 2019.

2.2.4 Speeches by the Federal Reserve Board Chair and Vice Chair

We obtained the dates and times of speeches (including Congressional testimony) by the Federal Reserve Board Chair and Vice Chair from multiple sources. First, we obtained the dates of the speeches from 1996 onwards from the Federal Reserve Board’s public website.¹⁴ Dates prior to 1996 were obtained from the FRASER digital library of the Federal Reserve Bank of St. Louis. For speeches from 2010 onwards, with the exception of a few, the Federal Reserve Board’s public website has a digital copy of the speech which lists the time that document was released to the public. For speeches prior to 2010, FRASER has a digital copy of the speech or testimony, which lists the time that document was released to public in the majority of cases. For those dates where the time of the speech is not available from either the Board’s website or FRASER, we conducted a Factiva search of the financial press and newswires. If the speech appears in any of the daily or weekly calendars of economic events in the financial press, then we used the time listed on that calendar as the start of the speech. If the speech is not listed on a daily or weekly calendar of events, we picked the time that news about the speech first appeared on the newswires or in an article on Factiva. Note that speeches by the Federal Reserve Board Chair and Vice Chair are often given in locations around the U.S. or in other countries; thus, the time of the speeches must be converted to U.S. Eastern Time in each case. Over our sample from 1988 to 2019, the Fed Chair gave 847 speeches, not counting the 40 post-FOMC press conferences described above.

¹⁴In our readings of the market responses to the Chair’s speeches, below, we discovered that the Board’s website did not report two of the Chair’s semiannual Monetary Policy Reports to Congress: Feb. 21, 1996, and July 17, 2002. Our sample includes these two important testimonies.

The Federal Reserve Board Vice Chair gave 310 speeches.

However, in our analysis below, we wish to focus on announcements that potentially had implications for U.S. monetary policy. The Fed Chair and Federal Reserve Board Vice Chair often give speeches that are either ceremonial (e.g., commencement or dedication speeches) or on topics other than monetary policy, such as bank regulation, securities market regulation, fiscal policy, Social Security, the stock market, the exchange rate, check clearing, and other economic and financial issues of national importance. To identify those speeches that did contain information about monetary policy, we read the market commentary in *The Wall Street Journal* or *The New York Times* following each speech. This resulted in 364 Fed Chair speeches and 102 Vice Chair speeches that contained enough information about monetary policy to be mentioned as having possible implications for interest rates in the market commentary.

2.3 Intradaily Financial Market Changes

To measure the effects of the monetary policy announcements described above, we purchased historical intradaily financial market data from Tick Data, LLC, covering the history of Eurodollar futures contracts (December 1981 to the present), S&P 500 futures (April 1982–present), 30-year U.S. Treasury bond futures (October 1982–present), 10-year U.S. Treasury note futures (January 1983–present), 5-year U.S. Treasury note futures (July 1988–present), 2-year U.S. Treasury note futures (January 1991–present), S&P 500 e-mini futures (September 1997–present), and federal funds futures (January 2010–present). The short history of federal funds futures is not a serious constraint for our analysis below because Eurodollar futures are a close substitute (Gürkaynak, Sack, and Swanson, 2007).

Eurodollar futures settle based on the spot 90-day Eurodollar deposit rate at expiration, and we consider contracts that expire near the end of the current quarter and one, two, and three quarters ahead.¹⁵ Gürkaynak et al. (2007) show that these contracts are the best financial market predictors of the future federal funds rate at horizons of six months or more, and are virtually as good as federal funds futures at horizons less than six months.

Federal funds futures settle based on the average federal funds rate for the contract month, as reported by the Federal Reserve Bank of New York. We consider contracts that expire at the end of the current month and the next month. We convert these futures price changes into the

¹⁵ Eurodollar futures expire on the International Monetary Market (IMM) dates: the third Wednesday of March, June, September, and December.

surprise change in the federal funds rate target using the same scale factor as described in Kuttner (2001) and GSS (2005a). Although Tick Data does not have intradaily federal funds futures data for years prior to 2010, we have data on the high-frequency, intradaily change in federal funds futures contracts around FOMC announcements going back to 1990 from an updated version of the GSS (2005a) dataset maintained by staff at the Federal Reserve Board. For monetary policy announcements that are not FOMC announcements, we assume that the surprise change in the federal funds rate target is zero, since every federal funds rate target change is accompanied by an FOMC announcement, as discussed above.

Treasury futures settle every quarter based on the spot price of a notional Treasury security at expiration. We consider only the current-quarter contract for these securities, and we convert the price change around monetary policy announcements into a yield change using the duration of the notional security underlying the contract, downloaded from a Bloomberg terminal.

S&P 500 and S&P 500 e-mini futures settle every quarter based on the level of the S&P 500 stock index at expiration. We consider only the current-quarter contract for these securities, and we use the change in the natural log of the price around monetary policy announcements to compute the percent change in the S&P 500 around those announcements. The S&P 500 e-mini futures contract was introduced in September 1997, has a smaller contract size, and is generally more liquid and has longer trading hours over most of our sample than the S&P 500 futures contract, so we use the change in the log S&P 500 e-mini futures price as our measure of the stock price change from September 1997 onward; from 1988 to August 1997, we use the change in the log S&P 500 futures price.

To facilitate working with the data, we convert the individual trades into minute-by-minute data for each security, recording the high and low trade price for each minute. (If there is only one trade in a particular minute, or all trades take place at the same price, then the high and low prices for that minute coincide.)

For FOMC announcements, we follow Gürkaynak et al. (2005a) and measure the change in financial markets using an intradaily window beginning 10 minutes before the announcement and ending 20 minutes after the announcement. If there are multiple trades in the minute exactly 10 minutes before the announcement, we take the midpoint between the high and low price of the trades that took place that minute; if there are no trades exactly 10 minutes before the announcement, we search backward for the most recent minute in which there was a trade and use the midpoint of the high and low prices from that minute. Similarly, if there are multiple

trades in the minute exactly 20 minutes after the announcement, we take the midpoint of the high and low prices that minute, and if there are no trades exactly 20 minutes after the announcement, we search forward for the next minute in which there was a trade and use the midpoint of the high and low prices from that minute.¹⁶

We follow an exactly analogous procedure for each of the other monetary policy announcement types described above, albeit with different window lengths. Post-FOMC meeting press conferences typically last for about one hour, so we begin the intradaily window 10 minutes before the start of the press conference and end it 80 minutes after the start of the press conference, for a total window length of 90 minutes. The FOMC meeting minutes are much longer than an FOMC statement, amounting to about 10–20 pages of text, so we use a longer intradaily window for those announcements than we do for FOMC announcements, beginning 10 minutes before the minutes release and ending 50 minutes after, for a total window length of 60 minutes.

Speeches by the Fed Chair and Board Vice Chair are typically 30–60 minutes long and can be followed by as much as 30 more minutes of answering questions from the audience. For these speeches, we use an intradaily window of 2 hours in length, beginning 15 minutes before the start of the speech and ending 1 hour and 45 minutes after. Congressional testimony by the Fed Chair or Vice Chair is typically even longer, often consisting of a 30- to 60-minute opening statement followed by two hours of answering questions from members of Congress. Thus, we use a 3.5-hour intradaily window for Congressional testimony, beginning 15 minutes before the start of the testimony and ending 3 hours and 15 minutes after.¹⁷

Some of these announcements, particularly speeches by the Fed Chair or Board Vice Chair, can take place near the end of market trading hours or while the markets are closed. (Tick Data contains almost around-the-clock electronic trading data beginning in July 2003, so this is a relatively rare occurrence after that point.) In this case, we compute the change in financial market prices using the same algorithm as described above, which often implies that the market close is the last minute of trading preceding the announcement window and the next day’s market open is the first minute of trading after the announcement window. Although this creates a relatively

¹⁶There is one announcement (December 18, 1990) that occurs at 3:30pm, which is after the Eurodollar and Treasury futures markets have closed for the day. For those contracts and that announcement, the last trades before the announcement take place at the market close at 3pm, and the first trades after the announcement occur at the market open the following morning at 8:20am.

¹⁷There are a few dates where the Chair (or Vice Chair) gives two speeches on the same date and our intradaily windows for those two speeches overlap. In that case, we combine the two speeches into one event (effectively one long speech) and use the union of the two intradaily windows as the intradaily window for the one long event.

long window of time around the announcement, the market open typically occurs at 8:20am, before any macroeconomic data is released at 8:30am, so the major source of economic news in our announcement windows is typically the monetary policy announcement itself.¹⁸

Finally, we check whether the intraday windows around any of the announcements overlap with a macroeconomic data release or other market-moving event such as a Treasury auction. When such an overlap occurs, we read the market commentary in *The Wall Street Journal* or *The New York Times* to determine whether the data release was a significant mover of financial markets that day. If the data release was not reported as having caused any market reaction or was completely dominated by the Fed announcement, then we just use the asset price changes around the monetary policy announcement as is. However, if the data release was a significant mover of financial markets, then we adjust the event window start or end time around the monetary policy announcement to avoid overlapping with the data release.¹⁹ Finally, there are two cases where the Chair and the Vice Chair gave a speech at exactly the same time, and both speeches had implications for monetary policy. In those cases, we attributed the market response to the Chair’s speech and dropped the Vice Chair’s speech from our sample.

2.4 Summary Statistics

Table 1 reports summary statistics for our five different types of U.S. monetary policy announcements: **FOMC announcements**, **speeches and testimony by the Federal Reserve Chair**, **post-FOMC-meeting press conferences**, FOMC meeting minutes releases, and speeches and testimony by the Federal Reserve Board Vice Chair. We report the number of each type of announcement during our sample, 1988–2019 (2011–19 for press conferences, 1997–2019 for minutes releases), and

¹⁸The 8:20am market open time is for Eurodollar and Treasury futures; prior to July 2003, the S&P 500 futures market opens at 9:30am Eastern Time, so some macroeconomic data releases could be included in our measure of stock price changes if our intraday window rolls over to the next day’s open. From September 1997 onward, we use the S&P 500 e-mini futures contract, for which Tick Data has electronic trading data that extends beyond normal market hours. Prior to September 1997, we check whether there are any major macroeconomic announcements on the morning in question and, if so, whether that announcement was a significant surprise relative to the Money Market Services expectation for the value of that release (see Gürkaynak et al., 2005b, or Swanson and Williams, 2014, for a discussion of these expectations data). If there was a macroeconomic data release that was a substantial surprise, then we treat the stock price change for that window as a missing observation, since we are unable to separate the effects of the monetary policy announcement from the macroeconomic data release.

¹⁹For example, Treasury auction results are released at 1pm, so we would use an end window time of a few minutes before 1pm to avoid overlapping with the auction results. There are several instances where the Fed Chair began testifying before Congress at 10am and a macro data release also occurred at 10am and moved markets. In those cases, we begin the event window for the Chair’s testimony at 10:10am, which misses the first 10 minutes of the Chair’s opening remarks, but still captures the majority of the opening remarks and all of the Q&A, while avoiding almost all of the effects of the macro data release. See Gürkaynak et al. (2005a) for evidence on the speed of the market reaction to important macroeconomic and monetary policy announcements.

TABLE 1: SUMMARY STATISTICS FOR U.S. MONETARY POLICY ANNOUNCEMENTS, 1988–2019

	FOMC announcemnts	Chair speeches	Press conferences	Minutes	Vice Chair speeches
Number	323	364	40	184	102
Standard deviation (bp)					
ED1	5.4	3.0	1.5	1.2	1.5
ED4	6.2	6.3	3.4	3.2	2.5
2-yr Treasury	5.2	4.7	3.1	2.6	2.1
10-yr Treasury	3.7	3.8	3.0	2.1	1.7
S&P 500	57.4	64.9	54.7	36.9	36.5
Minimum change (bp)					
ED1	−34.0	−20.0	−6.8	−3.5	−7.0
ED4	−27.5	−30.0	−7.5	−14.5	−11.0
2-yr Treasury	−21.8	−15.6	−4.9	−12.0	−9.5
10-yr Treasury	−30.2	−12.4	−5.2	−9.6	−5.7
S&P 500	−201.25	−301.7	−170.9	−133.9	−132.1
Maximum change (bp)					
ED1	18.3	12.0	3.5	4.5	6.0
ED4	24.3	27.5	11.3	13.3	10.3
2-yr Treasury	20.5	22.1	9.9	9.6	9.5
10-yr Treasury	16.4	14.3	9.2	8.8	6.2
S&P 500	439.1	229.0	101.5	118.5	116.4
Mean change (bp)					
ED1	−0.9	−0.2	−0.2	0.0	−0.1
ED4	−1.0	−0.2	−0.1	−0.1	0.0
2-yr Treasury	−0.8	0.0	0.1	−0.1	−0.1
10-yr Treasury	−0.2	−0.1	−0.1	−0.1	0.1
S&P 500	3.7	3.1	−3.0	0.3	0.0

Number of each type of monetary policy announcement and summary of high-frequency responses of current-quarter Eurodollar futures rate (ED1), 3-quarter-ahead Eurodollar futures rate (ED4), 2-year Treasury yield, 10-year Treasury yield, and S&P 500 index to each announcement type. Changes for ED1, ED4, and 2- and 10-yr Treasuries are in basis points; changes for S&P 500 are 10,000 times the change in the log of the index. Sample period for 2-yr Treasury is 1991–2019 due to data availability; sample period for press conferences is 2011–19; sample period for minutes is 1997–2019. See text for details.

the mean asset price response, standard deviation of each asset price response, minimum asset price response, and maximum asset price response for five representative assets: the current-quarter and three-quarter-ahead Eurodollar futures contracts (ED1 and ED4), the 2-year and 10-year Treasury yields, and the S&P 500 stock price index. (Results for the other Eurodollar futures rates and Treasury yields are similar and are not reported in the interest of space.) Inter-

est rate changes are reported in basis points (bp) and S&P 500 stock price changes in log basis points (10,000 times the change in the log of the S&P 500 index).

The first point to note in Table 1 is that there are more Fed Chair speeches than FOMC announcements—364 vs. 323. (Recall that this is after we have taken the original 847 Fed Chair speeches and eliminated those that were not reported as having possible implications for interest rates.) The large number of Fed Chair speeches is one of the reasons we find them to be so important. Post-FOMC press conferences are the least numerous announcement type, but that is because they do not begin until 2011 and even then occur only four times per year until 2019.

Second, the standard deviations and minimum and maximum changes for each announcement type also show that Fed Chair speeches are very important. The standard deviations, maxima, and minima for Fed Chair speeches are roughly equal to or even exceed those of FOMC announcements for all but the shortest-maturity Eurodollar future rate (ED1). The other three announcement types (press conferences, minutes releases, and Vice Chair speeches) are clearly less important than those two.

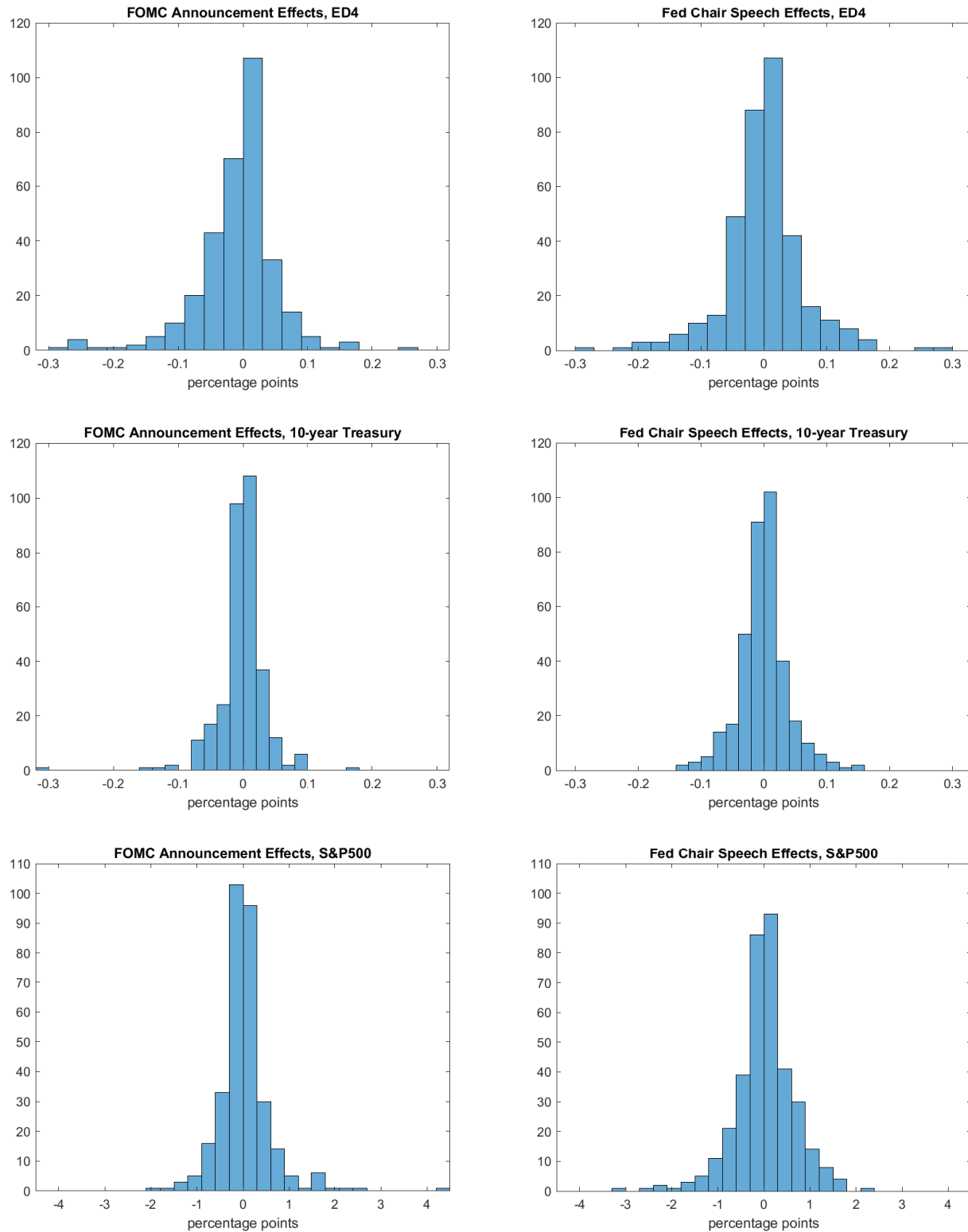
Third, the mean changes for all five announcement types in Table 1 are close to zero, as expected. FOMC announcements show a slight easing bias of about 1bp per announcement for short- and medium-term interest rates, but this is small relative to the standard deviations of those changes.

Figure 1 compares the histograms of the two most important monetary policy announcement types—FOMC announcements and Fed Chair speeches—for the three-quarter-ahead Eurodollar futures rate (ED4), the 10-year Treasury yield, and the S&P 500 stock price index (results for the other Eurodollar futures rates and Treasury yields are similar and are not reported in the interest of space). As can be seen in the figure, the effects of Fed Chair speeches generally look very similar to those of FOMC announcements, both in the shape of the distributions and in the magnitudes of the announcement effects, consistent with the general patterns observed in Table 1.

3. Importance of Different Monetary Policy Announcement Types

Table 2 reports three different measures of the importance of the five monetary policy announcement types described above: FOMC announcements, speeches and Congressional testimony by the Fed Chair, post-FOMC press conferences, FOMC meeting minutes releases, and speeches and Congressional testimony by the Federal Reserve Board Vice Chair. Each column considers a

FIGURE 1: HISTOGRAMS OF FOMC ANNOUNCEMENT AND FED CHAIR SPEECH EFFECTS ON ED4, 10-YEAR TREASURY YIELD, AND S&P 500, 1988–2019



Histograms of the set of high-frequency, intradaily effects of FOMC announcements and Fed Chair speeches on the 3-quarter-ahead Eurodollar futures rate (ED4), 10-year Treasury yield, and S&P 500 stock price index over our sample from 1988 to 2019. See text for details.

TABLE 2: IMPORTANCE OF DIFFERENT TYPES OF U.S. MONETARY POLICY ANNOUNCEMENTS

	Eurodollar Futures				Treasury Yields				S&P500
	ED1	ED2	ED3	ED4	2yr	5yr	10yr	30yr	
(A) Sum of Absolute Changes (in pp)									
FOMC Annmnts	9.60	11.19	12.07	12.80	8.91	9.63	7.37	6.20	113.7
Chair Speeches	6.42	10.46	13.43	15.05	10.65	12.17	9.87	9.48	162.6
Press Confs	0.33	0.55	0.75	0.91	0.91	1.14	0.91	0.76	17.2
Minutes	1.30	2.47	3.28	3.67	3.09	3.38	2.68	2.44	49.0
Vice Chair Spchs	0.78	1.31	1.43	1.56	1.26	1.38	1.17	1.23	25.6
(B) Mean Absolute Change per Announcement (in bp)									
FOMC Annmnts	2.97	3.46	3.74	3.96	2.76	2.98	2.28	1.92	35.2
Chair Speeches	1.77	2.87	3.69	4.13	2.93	3.34	2.71	2.60	44.7
Press Confs	0.83	1.38	1.87	2.28	2.29	2.84	2.27	1.91	43.0
Minutes	0.71	1.34	1.78	1.99	1.68	1.84	1.46	1.32	26.6
Vice Chair Spchs	0.77	1.28	1.40	1.52	1.24	1.35	1.14	1.20	25.1
(C) Explanatory R^2 for Monthly Interest Rate Changes and Stock Returns									
FOMC Annmnts	.123	.096	.066	.046	.016	.022	.022	.020	.039
Chair Speeches	.036	.071	.078	.080	.064	.065	.051	.051	.073
Press Confs	.002	.001	.000	.000	.001	.005	.003	.001	.009
Minutes	.006	.007	.005	.005	.002	−.001	−.002	.001	−.011
Vice Chair Spchs	.013	.008	.007	.004	.002	.006	.007	.008	−.006
All of the Above	.179	.183	.159	.142	.090	.099	.082	.082	.111

Notes: (A) cumulative sum, in percentage points, of the absolute value of the change in interest rates or stock returns around each type of monetary policy announcement; (B) mean absolute value per announcement, in basis points, of the change in interest rates or stock returns around each announcement type; (C) R^2 of monthly sum of interest rate changes or stock returns for the total interest rate change or stock return in each month (R^2 can be negative if the monthly sum for an announcement type frequently goes in the wrong direction). For each panel, boldface numbers denote the largest value in each column. Sample: Jan 1988–Dec 2019 (Sep 1988–Dec 2019 for 5-year Treasury and Jan 1991–Dec 2019 for 2-year Treasury). See Table 1 and text for details.

different financial asset response: the current-quarter and 1-, 2-, and 3-quarter-ahead Eurodollar futures rates (ED1–ED4), the 2-, 5-, 10-, and 30-year Treasury yields, and the S&P500 stock price index.

In panel (A) of Table 2, each entry reports the sum from 1988–2019 of the absolute values of all the asset price changes around the events in the corresponding row for the asset in the corresponding column. The units for Eurodollar futures and Treasuries are interest rate changes in percentage points and for the S&P500 they are 100 times the change in the log index. In each column, the largest value is highlighted in boldface. For almost every asset, the most important of the five announcement types is the Fed Chair’s speeches. For the S&P500 and 30-year Treasury

yield, Fed Chair speeches are roughly 50% more important than FOMC announcements, while for 2- and 3-quarter-ahead Eurodollar futures and 2-, 5-, and 10-year Treasuries, Fed Chair speeches are about 10–35% more important, with greater importance at the longer maturities. Only at the very shortest horizons—the current-quarter and 1-quarter-ahead Eurodollar futures—are FOMC announcements more important. Post-FOMC press conferences, minutes releases, and speeches by the Vice Chair are much less important, although part of this difference is due to the fact that there are fewer of those types of announcements. For example, there were no post-FOMC press conferences until 2011, and even then they occurred only four times per year until 2019.

Panel (B) of Table 2 thus reports the mean absolute effect per announcement for each announcement type. By this measure, post-FOMC press conferences, minutes releases, and Vice Chair speeches are more comparable to FOMC announcements and Fed Chair speeches. This is especially true for press conferences, which are now about equal in importance to FOMC announcements for longer-term Treasury yields and stock prices. The results in panel (B) show that the main reason why press conferences are less important than FOMC announcements and Fed Chair speeches overall (in panel A) is simply that there are so few of them. Going forward, now that there is a press conference after every scheduled FOMC meeting, we should expect press conferences to be much closer in importance to FOMC announcements themselves. Minutes releases and Vice Chair speeches are clearly not as important as the other announcement types, but are still not negligible.

Finally, panel (C) of Table 2 reports how important each announcement type is for the total change in interest rates (or stock returns) each month. For example, for Fed Chair speeches and the 10-year Treasury yield, we compute the monthly change in the 10-year yield that is due to Fed Chair speeches by adding up the effects of all of the Chair’s speeches on the 10-year yield that month. We then compare that sum to the total change in the 10-year yield each month and report the result as an R^2 statistic, which in this case is 5.1 percent.²⁰ We repeat this analysis for

²⁰ Let t index months, i index assets, y_t^i denote the end-of-month value of asset i , and $\Delta y_t^i \equiv y_t^i - y_{t-1}^i$, the total change in asset i over month t . For each asset i and $type \in \{\text{FOMC announcement, Chair speech, press conference, minutes, Vice Chair speech}\}$, let

$$\text{MPMTH}_t^{i,type} \equiv \sum_{\tau_{type} \in t} \text{MPHF}_{\tau_{type}}^{i,type}, \quad (1)$$

denote the monthly change in asset i due to that monetary policy announcement $type$, where τ_{type} indexes announcements of each type, $\text{MPHF}_{\tau_{type}}^{i,type}$ denotes the high-frequency, intradaily response of asset i to announcement τ_{type} , t indexes months, and the summation is taken over all announcements τ_{type} that occurred in month t . (If there are no announcements of a given $type$ in month t , then the summation on the right-hand side of (1) is empty and we define $\text{MPMTH}_t^{i,type} = 0$ for that month.)

For each asset i , let $\text{MPMTH}_t^{i,all\ types} \equiv \sum_{type} \text{MPMTH}_t^{i,type}$ denote the total change in asset i in month

each entry in panel (C). The advantage of this approach over panel (A) is that it penalizes asset price changes around announcements if they do not help to explain the total change in the asset price that month. The results in panel (C) confirm those in panel (A), with the results being even stronger for Fed Chair speeches—for example, by this measure, Fed Chair speeches are 2 to 4 times as important as FOMC announcements for stocks and Treasuries. This is because, in the early years of the sample, FOMC announcements were noisier and less consistent with the overall change in interest rates each month, which is penalized in panel (C) but not in panel (A).

In panel (C), the R^2 for minutes releases are low, and are even slightly negative in some cases, which can happen if the announcements frequently lead markets to move in the opposite direction to where they will ultimately go for the month. The R^2 values for Vice Chair speeches are slightly higher and have some predictive power for monthly changes, especially for near-term Eurodollar futures and long-term Treasury yields, but Vice Chair speeches are still clearly not as important as FOMC announcements or Fed Chair speeches.

Overall, there are three main points to take away from Table 2. First, Fed Chair speeches are more important than FOMC announcements for stocks, Treasuries, and all but the shortest-maturity interest rate futures. This observation is particularly important because studies of the effects of monetary policy have increasingly used longer-term futures and Treasury yields to measure the stance of monetary policy—see, e.g., Gürkaynak et al., (2005a), Swanson and Williams (2014), Gertler and Karadi (2015), Nakamura and Steinsson (2018), and Swanson (2021). For example, Gertler and Karadi (2015) use the one- and two-year Treasury yields and the three-month-ahead federal funds futures rate as their measures of monetary policy. As discussed by Swanson and Williams (2014), these longer-maturity interest rates measure not just the current level of the federal funds rate, but also where financial markets expect the federal funds rate to go over the next several quarters, which is a better overall indicator of the cost of funding for households and firms. Thus, previous studies of the effects of monetary policy on financial markets and the economy have ignored the most important type of U.S. monetary policy announcement.

Second, for very short-term interest rates, FOMC announcements are the most important.

t that is due to any of the five monetary policy announcement types in our data set.

The R^2 statistic is computed as $1 - USS^{i,type} / TSS^i$, where TSS^i denotes the sum of squared monthly changes $\sum_t (\Delta y_t^i)^2$, and $USS^{i,type}$ denotes the sum of squared residuals that remain after subtracting the effects of $MPMTH_t^{i,type}$ from the total Δy_t^i each month,

$$USS^{i,type} = \sum_t (\Delta y_t^i - MPMTH_t^{i,type})^2.$$

Note that this R^2 measure can be negative if $MPMTH_t^{i,type}$ happens to be negatively correlated with Δy_t^i .

This is not surprising—FOMC announcements are the only times at which the current federal funds rate target changes, so the very shortest end of the yield curve is essentially perfectly anchored except on the dates of FOMC announcements.

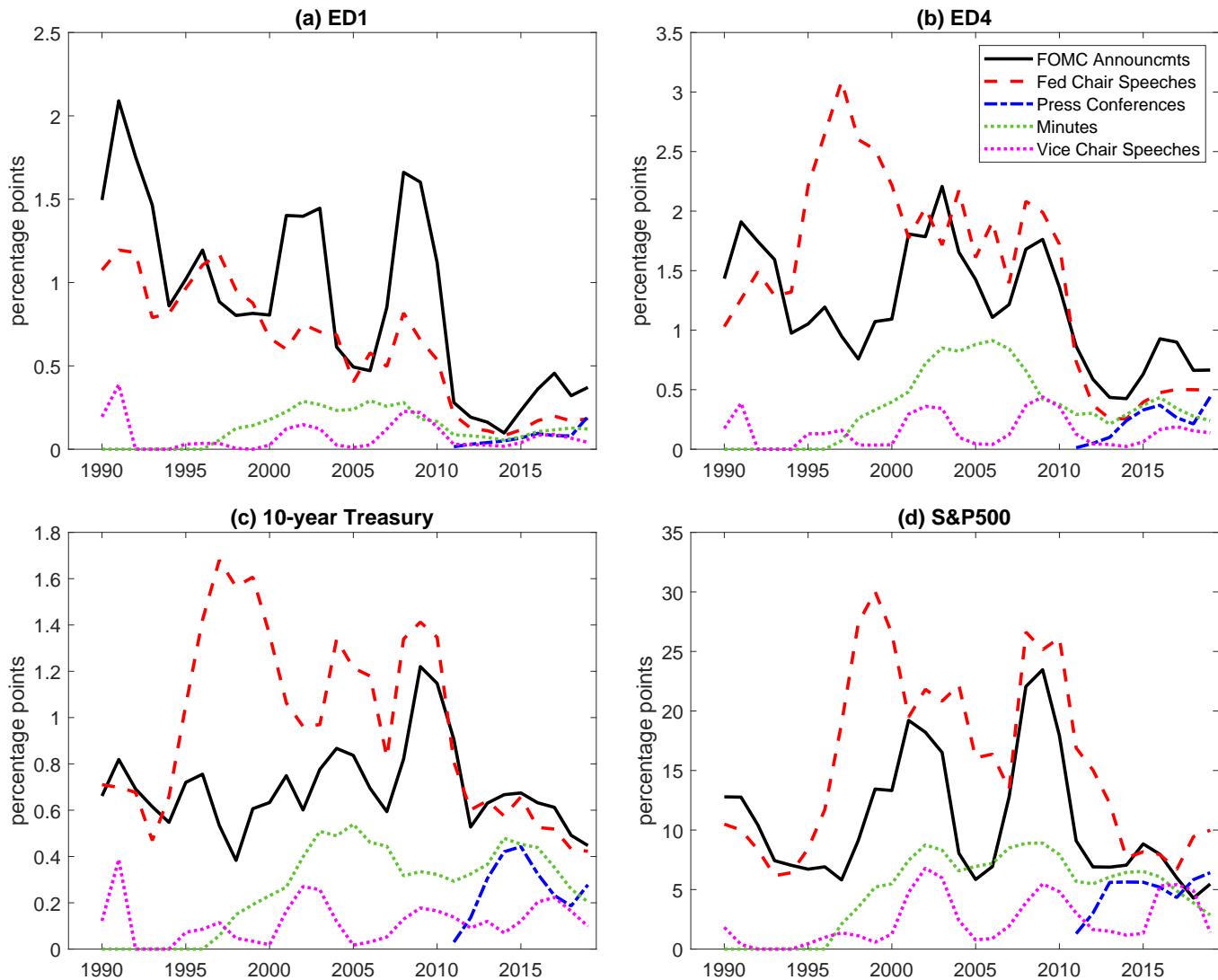
Third, the final row of Table 2, labeled “All of the Above”, sums up the high-frequency effects of all five monetary policy announcement types each month and computes the explanatory R^2 for monthly asset price changes, just as in the rest of panel (C). Even for the shortest maturity interest rate (ED1), the increase in R^2 from considering all of our announcement types is substantial—about 50% larger than considering FOMC announcements alone. For longer maturities, the increase is much greater, with R^2 typically rising by a factor of two to five: for example, the R^2 for the 2-year Treasury yield is more than 5.5 times larger using all of our announcements vs. FOMC announcements alone. Where Gertler and Karadi (2015) found first-stage F -statistics for the 2-year Treasury yield of 4 or 5 using high-frequency interest rate changes around FOMC announcements as an instrument, our more powerful high-frequency instrument produces first-stage F -statistics greater than 30 (Bauer and Swanson, 2023b; Swanson, 2023b).

4. Importance of Different Announcement Types over Time

We next analyze how the importance of the different U.S. monetary policy announcement types has evolved over time. This is a very relevant topic because some announcement types, like post-FOMC press conferences, did not exist in the early years of our sample, while other announcement types, like FOMC announcements and minutes releases, have evolved over time in how they are released and in the amount of material that is released. It’s also reasonable to think that the nature and amount of communication about monetary policy in the Fed Chair’s and Vice Chair’s speeches has evolved over time.

Figure 2 reports rolling-window estimates of the effects of our five different monetary policy announcement types on four representative assets: the current-quarter Eurodollar future rate (ED1), the 3-quarter-ahead Eurodollar future rate (ED4), the 10-year Treasury yield, and the S&P500. Each panel reports the cumulative sum of interest rate (or log S&P 500) changes around FOMC announcements (solid black line), Fed Chair speeches (dashed red line), post-FOMC press conferences (dash-dotted blue line), FOMC minutes releases (dotted green line), and Vice Chair speeches (dotted purple line), analogous to panel (A) of Table 2, except over three-year trailing rolling windows instead of over the entire sample.

FIGURE 2: IMPORTANCE OF DIFFERENT U.S. MONETARY POLICY ANNOUNCEMENT TYPES OVER TIME



Notes: cumulative sum over trailing 3-year rolling windows, in percentage points, of the absolute value of the change in interest rates or log stock prices around each monetary policy announcement type. Sample: Jan 1988–Dec 2019. See notes to panel (A) of Table 2 and text for details.

There are several important points to take away from Figure 2. First, there is a strong downward trend in panel (a) for both FOMC announcements and Fed Chair speeches. That is, both types of announcements have caused smaller moves in the current-quarter Eurodollar future rate over time. Part of this trend is due to the U.S. zero lower bound period from 2009–15 mechanically making ED1 changes small during that period, but the trend is clear prior to 2009 as well (see also Swanson, 2006). Intuitively, the Fed has become more transparent over time and has given financial markets increasingly more information about the near-term outlook for the federal funds rate. As a result, FOMC announcements and Fed Chair speeches have become less

surprising for very near-term values of the federal funds rate.

Second, for all the assets in Figure 1, there are clear upward spikes in the importance of FOMC announcements, Fed Chair speeches, and Vice Chair speeches around 1990–91, 2001–03, and 2008–09, which correspond to periods when monetary policy was very active due to the recessions around those years.

Third, the greater importance of Fed Chair speeches in panels (b), (c), and (d) has neither increased nor decreased over time, but rather has been present throughout the sample. It is true that Fed Chair speeches were particularly important in the late 1990s, but they were also more important than FOMC announcements throughout the 2000s. Similarly, in panel (a), FOMC announcements have been more important than Fed Chair speeches throughout the sample.

Fourth, post-FOMC press conferences and minutes releases have become more important over time. Post-FOMC press conferences begin in 2011 and trend steadily upward in importance. By the end of our sample in 2019, they are virtually as important as FOMC announcements and Fed Chair speeches. This implies that, going forward, researchers should be especially careful to include press conferences along with FOMC announcements and Fed Chair speeches in their analysis. The importance of FOMC minutes releases has increased less monotonically, rising from 1997 to about 2003 or 2004 and then reaching a plateau. By the end of the sample, minutes releases are still not as important as FOMC announcements, Fed Chair speeches, or press conferences, but they are also not negligible.

Fifth and finally, speeches by the Federal Reserve Board Vice Chair are the least important of the announcement types we consider, and have consistently been the least important over our sample. Their importance does increase modestly in 1990–91, 2001–03, and 2007–09, as mentioned above, but aside from those episodes, the Vice Chair’s speeches have not been very important.

Overall, the main conclusion from Figure 2 is that empirical researchers using high-frequency monetary policy announcement data have much to gain by extending their analysis beyond just FOMC announcements. Fed Chair speeches are clearly at least as important as FOMC announcements for all but the shortest-maturity interest rate futures, and post-FOMC press conferences have become increasingly important over time and now rival FOMC announcements as well. There are also gains from including FOMC minutes releases and Vice Chair speeches. A good example of the benefits of including these other announcements is provided by Swanson (2023b), who estimates the effects of changes in forward guidance on U.S. macroeconomic variables. Swanson shows that interest rate changes around FOMC announcements alone are a weak instrument

for forward guidance in a VAR, with a first-stage F -statistic of just 1.7, but that including all five announcement types above increases this first-stage F -statistic to 38.6, more than 20 times higher and far above the weak instruments cutoff suggested by Stock and Watson (2012).

5. Federal Funds Rate, Forward Guidance, and LSAPs

Gürkaynak, Sack, and Swanson (2005a) decompose interest rate changes around FOMC announcements into components due to the surprise change in the federal funds rate and the surprise change in forward guidance. Swanson (2021) extends this methodology to estimate the surprise change in the Federal Reserve’s large-scale asset purchases (LSAPs) as well. In this section, we apply these methods to decompose each of the five types of monetary policy announcements discussed above (FOMC announcements, post-FOMC press conferences, Fed Chair speeches, FOMC minutes releases, and Fed Vice Chair speeches) into federal funds rate, forward guidance, and LSAP components. We then compare these components across the five monetary policy announcement types.

5.1 Identification of Federal Funds Rate and Forward Guidance Components

We begin by identifying federal funds rate and forward guidance components for each of our announcement types, and then identify LSAPs below. Changes in the Fed’s target for the federal funds rate are always accompanied by an FOMC announcement, as discussed in Section 2, above, so none of the other monetary policy announcement types in our sample result in a change in the federal funds rate. We thus define the surprise change in the federal funds rate to be zero for all of those non-FOMC announcements.

For the forward guidance component of FOMC announcements, we follow GSS and let X^{FOMC} be the 323×5 matrix of short- and medium-term interest rate futures responses to FOMC announcements. Each row of X^{FOMC} corresponds to an FOMC announcement and each column to MP1, ED1, ED2, ED3, and ED4, respectively, where MP1 denotes the surprise change in the federal funds rate computed from fed funds futures, as in Kuttner (2001) and GSS, and ED1–4 are the changes in the current-quarter through three-quarter-ahead Eurodollar futures rates, as discussed in Section 2, above. The (i, j) th element of X^{FOMC} corresponds to the change in futures rate j in a narrow, 30-minute window of time around FOMC announcement i . We follow GSS and extract the first two principal components from X^{FOMC} and rotate those two

principal components so that the second one has no effect on the current federal funds rate (MP1). As discussed in GSS, the first of these two factors then corresponds to the surprise change in the federal funds rate and the second factor to the surprise change in forward guidance (because it causes interest rate futures to change for reasons other than changes in the current federal funds rate).

We use essentially the same methods to identify the forward guidance component of each of our other announcement types (press conferences, Fed Chair speeches, minutes, and Vice Chair speeches), except that there is no federal funds rate change for these other announcements. Thus, the matrix X^{type} for each of these other monetary policy announcement types has dimensions $T_{type} \times 4$, where T_{type} denotes the number of announcements of the given type and the four columns of X^{type} correspond to the futures rates ED1–ED4, with no MP1 because the surprise change in the federal funds rate is zero. We take the first principal component of the matrix X^{type} and define that to be the change in forward guidance around the announcement—this is analogous to the definition of forward guidance for FOMC announcements, above, because here there are no changes in the federal funds rate.

Finally, we normalize the scale of each factor (federal funds rate and forward guidance) for each type of monetary policy announcement to have a standard deviation of unity.²¹

5.2 Forward Guidance Effects for Different Announcement Types

For each type of monetary policy announcement (FOMC announcements, Fed Chair speeches, etc.), we run high-frequency event study regressions of the form

$$\Delta y_t = \alpha + \beta' F_t^{type} + \varepsilon_t, \quad (2)$$

where t indexes announcements of the given type, Δy_t denotes the change in a particular interest rate or stock return in a narrow window of time around announcement t , F_t^{type} contains the federal funds rate and forward guidance factors identified above for announcement t , α and β are parameters, and ε_t is a regression residual.

The results from these regressions are reported in Table 3. Each column corresponds to a different interest rate change or S&P 500 stock return in a narrow window of time around the

²¹In particular, we follow Swanson (2021) and normalize the federal funds rate factor (which is nonzero for FOMC announcements only) to have a unit standard deviation from 1988–2008, before the zero lower bound began to be a constraint. We normalize the forward guidance factor for each announcement type to have a unit standard deviation over the whole sample, 1988–2019.

TABLE 3: EFFECTS OF FEDERAL FUNDS RATE AND FORWARD GUIDANCE ON INTEREST RATES AND STOCK RETURNS FOR DIFFERENT TYPES OF MONETARY POLICY ANNOUNCEMENTS

	Eurodollar Futures				Treasury Yields				S&P500
	ED1	ED2	ED3	ED4	2yr	5yr	10yr	30yr	
(A) Effects of Federal Funds Rate Changes									
FOMC Announcemts	5.47 (0.18)	5.04 (0.11)	4.50 (0.12)	3.89 (0.13)	2.65 (0.27)	1.93 (0.23)	1.02 (0.19)	0.35 (0.18)	−36.8 (6.73)
(B) Effects of Forward Guidance Changes									
FOMC Announcemts	2.18 (0.14)	3.66 (0.10)	4.50 (0.06)	5.05 (0.11)	3.77 (0.16)	3.59 (0.20)	2.51 (0.15)	1.70 (0.15)	−11.5 (4.05)
Chair Speeches	2.77 (0.16)	4.52 (0.05)	5.66 (0.12)	6.08 (0.19)	4.37 (0.17)	3.87 (0.22)	2.89 (0.21)	2.34 (0.22)	−8.4 (3.91)
Press Conferences	1.38 (0.21)	2.24 (0.04)	2.89 (0.14)	3.26 (0.22)	2.76 (0.25)	2.63 (0.27)	1.71 (0.10)	0.88 (0.11)	−10.4 (6.92)
Minutes	1.04 (0.06)	2.14 (0.04)	2.73 (0.07)	3.00 (0.11)	2.34 (0.11)	2.10 (0.12)	1.50 (0.12)	1.08 (0.12)	−2.5 (3.53)
Vice Chair Speeches	1.31 (0.18)	2.16 (0.09)	2.24 (0.11)	2.37 (0.18)	1.99 (0.22)	1.62 (0.18)	1.24 (0.15)	0.97 (0.18)	−1.5 (5.40)
(C) Effects of Forward Guidance Changes, Estimated Jointly									
all announcemt types	2.12 (0.11)	3.69 (0.12)	4.62 (0.16)	5.03 (0.18)	3.80 (0.15)	3.51 (0.15)	2.59 (0.13)	1.96 (0.12)	−7.4 (2.41)
$\hat{\gamma}^{CS} = 1.22$	(0.04)								
$\hat{\gamma}^{PC} = 0.63$	(0.02)								
$\hat{\gamma}^{Min} = 0.59$	(0.02)								
$\hat{\gamma}^{VC} = 0.52$	(0.02)								

Notes: Panels (A)–(B) report estimated coefficients β from regressions $\Delta y_t = \alpha + \beta F_t^{type} + \varepsilon_t$, where t indexes announcements of the given type in each row, Δy_t denotes the interest rate change or S&P500 stock return in a narrow window around each announcement, and F_t^{type} denotes the federal funds rate and forward guidance factors for each announcement. Panel (C) reports estimated coefficients β^i and γ^{type} from regressions $\Delta y_t^{i,type} = \alpha^{i,type} + \gamma^{type} \beta^i F_t^{type} + \varepsilon_t^{i,type}$, estimated jointly for all 5 announcement types and 9 assets i , with γ^{FOMC} normalized to 1. Coefficients are in basis points per standard deviation change. Heteroskedasticity-consistent standard errors in parentheses. Sample: 1988–2019 (2011–2019 for press conferences, 1997–2019 for minutes releases, Sep. 1988–2019 for 5-year Treasury, 1991–2019 for 2-year Treasury). See text for details.

announcements in the corresponding row. The coefficients in the table are in units of basis points per standard deviation change in the factor for that announcement type. Heteroskedasticity-consistent standard errors are reported in parentheses below each coefficient estimate.

Panel (A) reports results for the effects of changes in the federal funds rate. The funds rate only changes when there is an FOMC announcement, so there is no federal funds rate component for any other announcement type. A one-standard-deviation change corresponds to a surprise

increase in the federal funds rate of 7.45bp (not shown in the table due to space limitations), which raises the current-quarter Eurodollar futures rate by 5.47bp and has effects on other interest rates that are highly statistically significant but diminish with maturity. These estimates are all very similar to those in Kuttner (2001), GSS, and Swanson (2021). The effects on the stock market are -0.37 percent for a one-standard-deviation tightening and are highly statistically significant, consistent with Bernanke and Kuttner (2005) and Swanson (2021).

Panel (B) of Table 3 reports results for the effects of forward guidance, estimated separately for each asset and each of our five announcement types. (Thus, each of the 45 estimated coefficients in panel B is from a separate regression). A one-standard-deviation increase in the forward guidance component of FOMC announcements raises the 2-year Treasury yield by 3.77bp, while a one-standard-deviation increase in the forward guidance component of Fed Chair speeches raises that yield by 4.37bp. The interest rate responses in panel (B) are all highly statistically significant, with t -statistics ranging from 6 up to about 25—there is no question that interest rates respond systematically to these announcements in the narrow intradaily windows we consider. Also note that for each announcement type, the effects on the yield curve have a very similar hump shape, with a peak effect at a horizon of about 1 year (the ED4 rate). This finding is very similar to GSS and Swanson (2021), and suggests that our identifying assumptions are working as intended.

The very similar hump shapes across the different rows in panel (B) suggest that forward guidance is essentially the same across these announcement types, as one might expect. We thus re-estimate the effects of forward guidance for all five announcement types and all nine assets in Table 3 jointly, using the restricted specification

$$\Delta y_t^{i,type} = \alpha^{i,type} + \gamma^{type} \beta^i F_t^{type} + \varepsilon_t^{i,type}, \quad (3)$$

where i indexes different assets (ED1, ED2, etc.), $type$ denotes different announcement types (FOMC announcements, Chair speeches, etc.), and t indexes the times at which any of the announcements were made. The coefficients β^i are allowed to vary across assets i —for example, by having a hump shape—but are restricted to be the same across announcement types; the scalar coefficients γ^{type} allow the different announcement types to differ in scale—so that minutes releases and Vice Chair speeches can have smaller effects on average. We normalize the γ^{FOMC} scale factor for FOMC announcements to be 1, and estimate the scale factors γ^{type} for the other announcement types.

We estimate the nonlinear specification (3) by GMM, and report the results in panel (C) of

Table 3. In contrast to panel (B), every estimated coefficient in panel (C) comes from a single, joint regression (3). A J -test of the over-identifying restrictions in equation (3) has a p -value of 0.81, so the restricted specification is very consistent with the data and confirms the similarity across rows we observed in panel (B). The estimates for β^i in panel (C) are very similar to those for FOMC announcements in panel (B), albeit with smaller standard errors due to the larger sample. Chair speeches on average have 22 percent larger effects than FOMC announcements ($\gamma^{CS} = 1.22$), while press conferences, minutes releases, and Vice Chair speeches have effects that are only 63, 59, and 52 percent as large as FOMC announcements, respectively. Thus, Fed Chair speeches were the most powerful source of forward guidance over our sample, followed by FOMC announcements, press conferences, minutes releases, and Vice Chair speeches.

The last column of Table 3 reports the response of the stock market to forward guidance. Consistent with GSS, Swanson (2021), and Bernanke and Kuttner (2005), higher interest rates cause the stock market to decline, although the standard errors for many announcement types in panel (B) are large and the results are only statistically significant for FOMC announcements, Fed Chair speeches, and the joint estimates in panel (C). A one-standard-deviation tightening of forward guidance causes the S&P 500 to fall about 0.1 percent.

Interestingly, changes in forward guidance have much smaller and less statistically significant effects on the stock market than do changes in the federal funds rate, again consistent with GSS and Swanson (2021). This is surprising, because stocks have very long duration and forward guidance has substantially larger effects on long-term interest rates than do changes in the federal funds rate. This finding also sheds light on a puzzle raised by Bauer and Swanson (2023b): namely, why does the stock market respond more strongly to FOMC announcements than to Fed Chair speeches? Our results in Table 3 show that this is primarily because changes in the federal funds rate have larger effects on the stock market than do changes in forward guidance, and speeches by the Fed Chair do not change the current federal funds rate. If we focus only on the forward guidance component of FOMC announcements and Fed Chair speeches, then the two have similarly-sized effects on the S&P 500 and the difference between them is not statistically significant.

Overall, the main takeaway from Table 3 is that the effects of forward guidance are consistent across all five monetary policy announcement types, suggesting that they can be combined into a single forward guidance series, as in panel (C). Indeed, Swanson (2023b) does exactly that to get a more powerful instrument for forward guidance in a VAR. By combining all five measures

of forward guidance into a single instrument, Swanson gets a first-stage F -statistic of over 40, compared to just 3.4 using forward guidance from FOMC announcements alone.

5.3 Identification of LSAP Components

We now turn to identifying the LSAP component of each of our announcement types. Swanson (2021) separately identifies the LSAP component of FOMC announcements by imposing that LSAPs are a latent factor that has minimum variance in the pre-2009 period, because the Fed generally did not conduct LSAPs before 2009. We cannot apply that approach in all cases here, however, because post-FOMC press conferences only begin in 2011 and Vice Chair speeches generate little variation prior to 2009 (see Figure 2).

We thus pursue a slightly different and somewhat simpler approach. For each monetary policy announcement type, we define the change in LSAPs to be the change in the long-term Treasury bond yield, orthogonalized with respect to changes in the federal funds rate and forward guidance.²² This identifying assumption is intuitive and is essentially the same as in Rogers, Scotti, and Wright (2018) and Gilchrist, Yue, and Zakrajsek (2019); it is also simpler than the one in Swanson (2021) and can be used for all of our announcement types. Finally, we normalize the LSAP factor to have a negative effect on the 10-year Treasury yield, so that an increase in LSAPs causes long-term Treasury yields to fall.

5.4 LSAP Effects for Different Announcement Types

Table 4 reports our estimates for the effects of LSAPs. Panel (A) reports the results for each monetary policy announcement type and each asset estimated separately, as in regression (2). The effects of LSAPs on Eurodollar futures are typically small and statistically insignificant, but the effects on longer-term Treasury yields are much larger, negative, and highly statistically significant. A one-standard-deviation increase in the LSAP component of an FOMC announcement lowers the 10-year Treasury yield by 4.37bp, while a one-standard-deviation increase in the LSAP component of a Fed Chair speech reduces the 10-year yield by 2.58bp. In contrast to forward guidance, the effects of LSAPs are largest at maturities of 5 to 30 years. These results are consistent with Swanson (2021), suggesting that our identifying assumptions for LSAPs are working

²²We compute the change in the long-term Treasury bond yield around each announcement as the average change in the 10-year and 30-year Treasury yields. We measure the predicted effects of the federal funds rate and forward guidance on these Treasury yields using the estimates in panels (A) and (C) of Table 3.

TABLE 4: EFFECTS OF LSAPs ON INTEREST RATES AND STOCK RETURNS
FOR DIFFERENT TYPES OF MONETARY POLICY ANNOUNCEMENTS

	Eurodollar Futures				Treasury Yields				S&P500
	ED1	ED2	ED3	ED4	2yr	5yr	10yr	30yr	
(A) Effects of LSAP Changes									
FOMC Announcemnts	-0.04 (0.20)	0.07 (0.24)	-0.01 (0.14)	-0.03 (0.11)	-0.43 (0.17)	-2.55 (0.45)	-4.37 (0.23)	-5.10 (0.17)	19.7 (5.98)
Chair Speeches	0.32 (0.08)	0.23 (0.06)	-0.19 (0.08)	-0.74 (0.21)	-0.94 (0.12)	-2.66 (0.15)	-2.58 (0.08)	-2.92 (0.08)	-14.9 (6.54)
Press Conferences	0.34 (0.13)	0.18 (0.06)	-0.22 (0.12)	-0.77 (0.16)	-1.10 (0.25)	-2.86 (0.35)	-2.71 (0.18)	-2.43 (0.17)	-2.2 (12.23)
Minutes	0.06 (0.06)	0.09 (0.03)	0.02 (0.05)	-0.27 (0.09)	-0.55 (0.11)	-1.86 (0.13)	-1.88 (0.07)	-2.01 (0.07)	-1.1 (5.06)
Vice Chair Speeches	0.11 (0.06)	0.12 (0.04)	-0.05 (0.04)	-0.25 (0.06)	-0.40 (0.08)	-1.15 (0.11)	-1.08 (0.06)	-1.07 (0.06)	-14.1 (6.65)
(B) Effects of LSAP Changes, Estimated Jointly									
all announcemt types	0.32 (0.14)	0.27 (0.22)	-0.15 (0.28)	-0.49 (0.30)	-0.95 (0.22)	-3.50 (0.43)	-3.75 (0.47)	-4.04 (0.49)	-13.3 (6.61)
$\hat{\gamma}^{CS} = 0.72$	(0.09)								
$\hat{\gamma}^{PC} = 0.67$	(0.10)								
$\hat{\gamma}^{Min} = 0.50$	(0.06)								
$\hat{\gamma}^{VC} = 0.28$	(0.04)								

Notes: Panel (A) reports estimated coefficients β on the LSAP factor from regressions $\Delta y_t = \alpha + \beta F_t^{type} + \varepsilon_t$, where t indexes announcements of the given type in each row, Δy_t denotes the interest rate change or S&P500 stock return in a narrow window of time around each announcement, and F_t^{type} denotes the federal funds rate, forward guidance, and LSAP factors for each announcement. Panel (B) reports estimated coefficients β^i and γ^{type} from regressions $\Delta y_t^{i,type} = \alpha^{i,type} + \gamma^{type} \beta^i F_t^{type} + \varepsilon_t^{i,type}$, estimated jointly for all 5 announcement types and 9 assets i , with γ^{FOMC} normalized to 1. Coefficients are in basis points per standard deviation change in LSAPs. Heteroskedasticity-consistent standard errors in parentheses. Sample: 1988–2019 (2011–2019 for press conferences, 1997–2019 for minutes releases, Sep. 1988–2019 for 5-year Treasury, 1991–2019 for 2-year Treasury). See Table 3 and text for additional details.

as intended.

As was the case for forward guidance in Table 3, the yield curve responses to LSAPs in Table 4 have similar shapes across the different announcement types. The effects on shorter-term Eurodollar futures are small and insignificant, while the effects on long-term Treasury yields are large, negative, and significant, with a peak effect at a maturity between 5 and 30 years. We thus likewise estimate the effects of LSAPs across announcement types and assets jointly using the single joint nonlinear regression specification (3), estimated via GMM. The results of this joint estimation are reported in panel (B) of Table 4. The J -test of the over-identifying restrictions in equation (3) has a p -value of 0.99, so the restricted specification is very consistent with the data

and confirms the similarity across rows observed in panel (A). The estimates for β^i in panel (B) are very similar to those for FOMC announcements in panel (A).

For LSAPs, FOMC announcements are the most powerful announcement type. Chair speeches are on average 72 percent as powerful, while press conferences, minutes releases, and Vice Chair speeches have effects that are only 67, 50, and 28 percent as large as FOMC announcements, respectively.

Finally, the last column of Table 4 reports the estimated effects of LSAPs on the stock market. The results for stock prices are mixed: the LSAP component of FOMC announcements has the expected sign, with a one-standard-deviation decrease in interest rates due to an LSAP causing stock prices to rise about 0.2 percent, and that effect is highly statistically significant. But the LSAP components of all the other monetary policy announcement types have puzzling, negative signs, and two of these are statistically significant (speeches by the Fed Chair and Vice Chair). Jointly, the estimated effects on the stock market are negative, so that a one-standard-deviation decrease in interest rates due to an LSAP causes the stock market to *fall* about 0.13 percent on average. This sharp contrast between the effects of LSAPs announced at FOMC meetings vs. LSAPs announced in speeches, press conferences, and minutes releases presents a significant puzzle for future research.

6. Conclusions

Previous studies of the effects of monetary policy using high-frequency interest rate changes have focused almost exclusively on FOMC announcements. However, there are only eight scheduled FOMC announcements per year, with a typical change in short-term interest rates around each FOMC announcement being just a few basis points. In this paper, we greatly expanded the set of monetary policy announcement surprises to include interest rate changes around all FOMC announcements, all post-FOMC press conferences, all speeches and Congressional testimony by the Fed Chair and Federal Reserve Board Vice Chair, and all FOMC meeting minutes releases from 1988 to 2019, a sample that is also several years longer than in previous studies.

Our expanded set of monetary policy announcements leads to several important conclusions. First, previous studies using high-frequency interest rate changes around FOMC announcements have missed the most important source of variation in U.S. monetary policy: speeches and Congressional testimony by the Fed Chair. We find that for interest rates with 2 years to maturity

or more, speeches by the Fed Chair have 2.5 to 4 times the explanatory power of FOMC announcements for interest rate changes each month. Only for the very shortest-maturity interest rate futures are FOMC announcements more important, but these very short-term interest rates have become less important over time as the Fed has increasingly turned to forward guidance and large-scale asset purchases to influence medium- and longer-term interest rates.

Second, we show that post-FOMC press conferences have become more important over time, and now rival FOMC announcements as a source of variation in U.S. monetary policy. FOMC minutes releases and speeches by the Fed Vice Chair were less important over our sample, but are still non-negligible, especially around recessions.

Third, we decompose each monetary policy announcement in our sample into federal funds rate, forward guidance, and LSAP components. The federal funds rate is only changed when there is an accompanying FOMC announcement, but we show that forward guidance and LSAPs both have effects that are consistent across monetary policy announcement types and can be pooled together into single measures of forward guidance and LSAPs. Our results thus suggest that researchers who want to study the effects of forward guidance or LSAPs would benefit greatly from considering all five types of monetary policy announcements in their analysis. Indeed, Swanson (2023b) estimates the effects of forward guidance on the U.S. economy using the data from this paper and obtains a first-stage F -statistic of more than 40, as compared to just 3.4 using forward guidance from FOMC announcements alone.

Going forward, empirical research using high-frequency monetary policy surprises should strive to include all five types of monetary policy announcements above, instead of focusing on FOMC announcements alone. Bauer and Swanson (2023b), Graves, Huckfeldt, and Swanson (2023), and Swanson (2023b) all use the data from the present paper to help estimate the effects of monetary policy on the economy and obtained substantially more precise and less biased estimates by doing so. We believe that these improvements are representative of large potential gains that any empirical analysis of the effects of monetary policy on macroeconomic variables using high-frequency data would realize from making use of our extended high-frequency data set.

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