Learning About Fed Policy From Macro Announcements: A Tale of Two FOMC Days

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Abstract

I show that pre-FOMC drift and high announcement returns on FOMC day are realized only on the small subset of FOMC days preceded by key macro data releases. On the other roughly two-thirds of all FOMC days, there is neither drift nor any announcement premium. These returns are thus not unconditionally high around FOMC statements. Instead, they represent responses to new information, in particular to expectations regarding the path of monetary policy that are updated on key macro announcements. More broadly, financial market movements around FOMC statements strongly differ when key macro announcements immediately precede FOMC announcements. On this subset of FOMC days, conventional monetary policy shocks are predictable using past data, the Fed information effect can be observed, the secular decline in interest rates phenomenon around FOMC statements can be seen and the security market line is upward sloping. On all other FOMC days not preceded by macro news, the Fed information effect is absent, monetary policy shocks are not predictable, there is no decline in interest rates around FOMC statements and the security market line is flat.

Keywords: Pre-FOMC Drift, Announcement Premium, Macroeconomic Announcements, FOMC Announcements.

1 Introduction

Average daily stock returns on FOMC days are 15 basis points over a sample spanning 1994-2019, while pre-FOMC drift is about 22 basis points over the same period. These stock price movements are subject to much academic inquiry.[1] As there are typically only 8 FOMC announcements in a year, these findings appear striking, as they are often interpreted as implying that a huge fraction of the annual equity premium is concentrated around a few days. Lucca and Moench (2015) report that pre-FOMC drift tends to be higher in periods the Fed reduces rates.[2] Given the close relationship macro news have in the setting of monetary policy, I investigate the role macro announcements have in explaining these large equity price movements around FOMC statements. I focus on four macroeconomic announcements: GDP, CPI, unemployment and industrial production. This set of announcements has direct relevance to Fed policy, as discussed in Alam (2020).

I find that both announcement-day returns and pre-announcement drift are high only on particular kind of FOMC days: those that are associated with a relevant macroeconomic announcement occurring earlier in the morning, or a few days earlier. These large stock price movements are entirely absent around all other FOMC announcement days. Moreover, the closer the macro announcement is to a forthcoming Fed announcement, the greater the pre-FOMC drift and FOMC-day return are. For example, FOMC-day returns are statistically greater than zero only on FOMC days that had one of the four macro news released earlier in the morning (37 or 18% of all 202 FOMC announcements).

Furthermore, key predictors of pre-FOMC drift, such as monetary attention, stock and bond uncertainty only buildup ahead of FOMC announcements that immediately follow macro data releases. There is no buildup in any of these variables ahead of Fed statements that are not preceded by macro news. Thus, the behavior of financial markets around FOMC statements tends to strongly differ across the two sets of FOMC announcements.

[1] See for example, Savor and Wilson (2013) and Savor and Wilson (2014) who discuss asset pricing implications of high equity returns on key macroeconomic announcements. Recently, Ernst, Gilbert and Hrdlicka (2019) show heterogeneity in stock returns that are realized across a broad set of macro announcements, and show that FOMC announcements are among those events where daily stock returns move most. Lucca and Moench (2015) first showed equity prices rise prior to the announcement of Fed policy. Ai and Bansal (2018), Laarits (2019), Ying (2020), Ai, Bansal and Han (2021), Hu, Pan, Wang and Xu (2021) provide theoretical explanations for pre-FOMC drift.

[2] See discussion around Table IX of Lucca and Moench (2015).

To investigate whether pre-FOMC drift and announcement returns respond to changing expectations regarding path of Fed policy, I regress these equity movements on prior changes in the market's interest rate expectations realized on macro announcements preceding FOMC statements. I use federal fund futures and eurodollar futures to gauge the market's expectations regarding Fed policy. I find that both announcement-day return and pre-FOMC drift respond to changes in expectations regarding the path of Fed policy. Adjusted R^2 of these regressions are well over 30%, and about 50% for the period before the Great Financial Crisis (GFC), when Fed policy was "conventional".

Conventional Fed actions involve changing the federal funds target rate in multiples of 25bps. Post-GFC, however, Fed engaged in "unconventional" monetary policy, which involved purchase of various securities, like USTs and mortgage-backed-securities (MBS) worth billions of dollars. As Alam (2020) also shows, using macro data to form expectations regarding upcoming Fed decisions might be simpler when policy is conventional rather than unconventional. For example, it is easier to use the latest CPI numbers to predict rate hikes of 25bps or 50bps than it is to pin down the precise size and composition of the portfolio of securities that the Fed will purchase on its next FOMC statement.

I also consider changes in risk measures on macro announcements, and find that they do not explain either upcoming pre-FOMC drift or announcement return. This is not to say that risk may not have any role in explaining pre-FOMC drift or FOMC-day-returns. Instead, my findings suggest that the channel through which macro announcements preceding FOMC statements affect pre-FOMC drift and FOMC-day-return is mainly by influencing market expectations regarding upcoming Fed decisions.

Given that pre-FOMC drift is also found in international stocks (Lucca and Moench, 2015), I extend the analysis to non-U.S. stocks too. Similarly, I also extend the analysis to announcement returns among the cross-section of U.S. equities. The picture remains the same: pre-FOMC drift among international stocks and high announcement returns in the cross-section of U.S. equities are only realized prior to those FOMC statements that immediately follow key macro announcements, they tend to respond to the path of Fed policy and the effect is stronger pre-GFC.

Overall, these results suggest two main takeaways. Firstly, there are two types of FOMC days: those that are preceded by key macro news and those that are not. Asset

price behavior around FOMC statements strongly differs across the two sets of FOMC days. Secondly, pre-FOMC drift and announcement return reflect markets responding to fresh information released *before* FOMC statements. In particular, these equity responses reflect in large part market's changing expectations regarding Fed policy that they make on macro announcements preceding FOMC statements. The results are consistent with models in which agents learn about future Fed policy from macro announcements. Such learning models (see e.g., Andrei and Hasler, 2014) can explain the buildup in attention, VIX and also explain the predictability of future returns using past data, the central theme of this paper.

Finally, I try to address the question: what generates the *unconditional* observation of significantly positive FOMC-day return and pre-FOMC drift documented by the literature? To answer this question, I focus my attention on changes in proxies of Fed policy expectations on macro announcements that just precede FOMC statements, given the important role they have in determining returns around FOMC statements. Based on my regression estimates, I find that market proxies of Fed policy expectations declined on these macro announcements, on average. This is particularly true pre-GFC. Furthermore, since earlier work has shown that risk premium in short-term fed fund future contracts do not change at daily frequency (Piazzesi and Swanson, 2008), it seems unlikely that daily changes in fed fund futures on macro announcements reflect time-varying risk premium. This suggests that markets have tended to reduce their interest rate expectations on macro announcements prior to the Crisis, the period during which both pre-FOMC drift and announcement return were *unconditionally* positive on FOMC days. In contrast, there is neither significant unconditional pre-FOMC drift nor significant announcement return on FOMC days post-GFC. Based on all these observations, I ultimately conclude that pre-FOMC drift and the FOMC-day announcement "premium" represent, in large parts, markets *learning* about Fed policy using freshly available macro data released just prior to Fed statements.

I present a simple information framework to describe the key learning dynamics of my analysis. I show that when market participants receive private signals on macro announcements regarding forthcoming Fed actions, future returns (realized around FOMC statements) can be *ex-post* predictable with past returns (realized around macro announcements preceding FOMC statements). This predictability happens as long as markets

continue to develop views about the path of Fed policy from the latest macro data release. Once this learning process has concluded, returns computed over windows starting from that point onward will not be predictable with past returns. This helps explain why empirically, the predictability with past data is only statistically detectable for a few days. Under certain conditions, this predictability is stronger when the *precision* of private signals regarding forthcoming Fed actions is greater. This may explain why my empirical results show stronger predictability of pre-FOMC drift and FOMC-day announcement returns with past macro data in the pre-GFC period, when policy was conventional and arguably easier to predict using macro data as suggested above.

I also discuss some key extensions using these insights. Accounting for macro announcements that occur just within a few days of FOMC statements can potentially explain the Fed information effect (see e.g., Nakamura and Steinsson, 2018), the predictability of conventional monetary policy surprises (see Cieslak, 2018; Miranda-Agrippino, 2016; Bauer and Swanson, 2020), the secular decline in interest rates which appears to have been realized in 3-day windows around FOMC statements (Hillenbrand, 2022) and the observation that the security market line tends to be upward sloping on FOMC days (Savor and Wilson, 2014). I discuss all these phenomena and show they all crucially depend on the presence of macro announcements within the very recent past.

Specifically, when there are no macro announcements happening within a few days ahead of FOMC announcements, the Fed information effect is entirely absent. High frequency interest rate movements around such FOMC statements co-move negatively with GDP survey expectations: the standard theoretical response of these surveys to monetary policy shocks. However, on FOMC announcements that occur just a few days after a macro announcement, high frequency interest rate movements around FOMC statements comove positively with GDP survey expectations, i.e., the Fed information effect can be observed. Similarly, monetary policy shocks such as those constructed by Nakamura and Steinsson (2018) are predictable when FOMC statements occur just a few days after macro announcements. They are not predictable on other FOMC announcements, which do not have macro data releases happening just before. While Bauer and Swanson (2022) account for past macro data in their proposed shock measure, theirs too is predictable albeit less strongly so. This may be because they do not differentiate between macro data that is released in the relatively more distant past versus that which is released in the more

immediate past.

Similarly, accounting for key macro announcements occurring just prior to FOMC statements can also explain the finding that the entire secular decline in long-term yields tended to be concentrated in 3-day windows around FOMC announcements, as suggested by Hillenbrand (2022). I show that all the downward movement in yields over 3-day windows are concentrated around those FOMC announcements that immediately followed key macro announcements. Across all other FOMC announcements, movements in yields appear transitory. This is supported by carrying out more conventional event-analysis using daily changes in bond yields. The cumulative daily yields changes across the 4 macro announcements I consider over a sample spanning 1994-2019 leads to an overall decline in the 10y UST of 438bps.[3] This compares well with the *actual* decline of 400bps in the 10y UST over the same sample. On the other hand, cumulative decline in daily yields across FOMC announcements that did not have one of the four macro announcements earlier the same morning is a relatively modest 58bps over a sample spanning 1994-2019. Thus, the observation of yields substantially falling on FOMC days seems to be driven by a parsimonious set of key macro announcements that occurred immediately before FOMC statements.

Lastly, I show that the security market line on FOMC days, shown to be upward sloping by Savor and Wilson (2014), only has a positive slope when FOMC announcements follow key macro announcements. Across all other FOMC announcements, the security market line is flat. Firm-level FOMC-day returns only seem to be explained by their CAPM beta exposure when FOMC announcements follow macro announcements, while on all other FOMC days, firm-level announcement day returns are un-related to their respective CAPM beta.

Savor and Wilson (2014) suggest that asset pricing is a tale of two days: macro announcements and regular trading days. In this paper I focus on FOMC days alone. All my findings together suggest that there is also a tale of two FOMC days: those preceded by macro news and those that are not.

[3] To avoid confounding, I ignore the macro announcements that had an FOMC statement on the same day.

2 Data: Variables, Sources and Definitions

All U.S. Treasury yields are obtained from FRED. All other financial variables at daily frequency are obtained from Bloomberg. Intra-day equity prices are E-mini S&P 500 futures and are obtained from Refinitiv. I obtain FOMC announcement dates from the Fed's website, while I obtain timestamps of FOMC statements from Bloomberg, appendix of of Lucca and Moench (2015), appendix of Weber and Gorodnichenko (2016) and the Fed's website from January 2016 onward. There are some minor differences across the three sources for the period prior to 2016. I resolve this discrepancy by making the following two adjustments: first I round all timestamp minutes to the nearest multiple of 5. Then I set all adjusted timestamps that are between 2:10pm and 2:15pm to be 2:15pm. These adjustments remove the idiosyncratic differences in timestamps across Bloomberg, Lucca and Moench (2015) and Gorodnichenko and Weber (2016). In my regression analyses, the pre-FOMC drift is computed as the cumulative excess return from 2:00pm from the day prior to FOMC day and ending 15 minutes prior to this adjusted timestamp. Selection of 2:00pm of the day prior as the starting point is chosen to be consistent with Lucca and Moench (2015). The risk-free rate is obtained from Ken French's website. Announcement dates for the four macro announcements (GDP, CPI, unemployment and industrial production) are obtained from Bloomberg and official sources. All four of these macro announcements occur monthly, and become public at 8:30am. My sample spans 1994-2019. I end the sample in 2019 to ensure that the COVID-19 period does not affect my findings.

Throughout the analysis I remove the data between July 01, 2008 to June 30, 2009 to ensure that the exceptional period of the Great Financial Crisis (GFC) does not contaminate my estimates. Selection of these dates is consistent with Nakamura and Steinsson (2018). Thus, I end up dropping 8 FOMC announcements and am ultimately left with 202 scheduled FOMC announcements in my sample. Table 1 lists the number of FOMC announcements that have at least one of GDP, CPI, unemployment or industrial production announcements happening just before FOMC statements.

It shows that about 1/5 of all FOMC announcements have one of the four macro announcements occurring earlier in the day, at 8:30am. And about 2/3 of all FOMC announcements have one of the four macro announcements occurring either earlier in the morning, one day, two days, or at most 3 days before. Over 80% of all FOMC announce-

ments have at least one of the four macro announcements occurring within a week (5 business days). Thus there is an opportunity for markets to learn about forthcoming Fed policy from fresh macro news on a sizeable number of occasions.

Table 1: FOMC Statements Preceded/Not Preceded by Macro News Within

	Same Day	1 day	2 days	3 days	4 days	5 days
FOMC Preceded by Macro ($MacroFOMC$)	37	54	83	136	153	165
Ratio of Total	18%	27%	41%	67%	76%	82%
FOMC Not Preceded by Macro ($FOMCOnly$)	165	148	119	66	49	37
Ratio of Total	82%	73%	59%	33%	24%	18%
Total FOMC Announcements	202	202	202	202	202	202

Note: This table reports the number of FOMC announcements that were preceded or not preceded by one of the four macro announcements over the sample spanning 1994-2019 and excluding the period between July 01, 2008 and June 30, 2009. Each column indicates whether an FOMC statement had a macro announcement at most "x" days before or not. For example, under the column "2 days", this table reports that 83 of the 202 announcements had one of the four macro announcements occurring either earlier in the morning, the day before or two days before while 119 FOMC statements did not have one of the four macro announcements earlier in the morning, nor the day before, nor two days before, but may have had one or multiple 3 days or more before. Here and throughout this paper, "macro announcement" refers to GDP, CPI, unemployment or industrial production announcements.

3 Two Different Types of FOMC Days

Here, I introduce the first of my two key messages: there are two types of FOMC days. Asset price behavior around FOMC announcements strongly varies across the set of those FOMC days that immediately follow macro news ($MacroFOMC$ days) versus those that do not ($FOMCOnly$ days). Grouping FOMC statements into two mutually exclusive sets helps study whether pre-FOMC drift and FOMC announcement "premium" can truly be attributed to Fed statements alone or not. My findings suggest they cannot. In fact, as Section 3.1 shows, the entire FOMC-day announcement "premium" is driven by

those 37 FOMC announcements that had one of the four macro announcements occurring earlier in the morning. Across all other 165 FOMC announcements (202 - 37), there is no announcement "premium". Pre-FOMC drift too is similarly only significantly positive on those FOMC days that had one of the four macro announcements in the prior couple of days. The closer a macro announcement is to a forthcoming FOMC announcement, the greater pre-FOMC drift and announcement return are. I establish these empirical findings in Section 3 for U.S. aggregate stock market (Section 3.1), international stock markets (Section 3.2) and for the cross-section of U.S. equities (Section 3.3). Section 4 will then provide reasons for these empirical facts by showing these equity movements represent markets learning about forthcoming Fed actions from fresh macro news.

3.1 FOMC Announcement "Premium" & PreFOMC Drift: When Are They *Actually* Happening?

Regressing daily excess returns of the S&P 500 index (SPX) on a constant and a dummy variable that takes a value of 1 on each of the scheduled FOMC announcement gives a significant coefficient of 0.15, suggesting that equity prices rise by 15bps more on each FOMC announcement. Given that the annual equity premium is about 7.16% or 716bps over the same sample and that there are 8 FOMC announcements in any given year, the dummy estimate tends to imply that roughly 17% of the annual equity premium is earned on just 8 days (FOMC announcements).

Similarly, regressing intra-day excess returns computed over a 24-hour window, starting and ending at 2:00pm, on a dummy variable that takes a value of 1 for each scheduled FOMC announcement shows that excess equity returns rise by about 22bps *prior* to FOMC statements (a loading of 0.22 on the dummy variable). As this rise happens *before* the Fed releases its statement, it implies an even more striking implication: about 24% of the annual equity premium is earned even before markets receive news from the Fed.

These substantial-positive equity movements are realized only around those FOMC announcements that have key macro announcements occurring just before release of FOMC statements. This is true for both FOMC-day announcement returns and pre-FOMC

drift.[4] Table 2 shows estimations of equation (1), where the dummies $\mathbb{1}^{MacroFOMC}$ and $\mathbb{1}^{FOMCOnly}$ are defined differently in each column, showing a different regression estimation. It delivers a striking message: the entire FOMC announcement "premium" is entirely driven by those FOMC announcements that had one of the four macro announcements occurring earlier the same day. That is, the entire FOMC announcement "premium" is driven by just 37 observations; daily excess returns do not rise significantly on the remaining 165 FOMC announcements.

$$\Delta y_t = \alpha + \beta_1 \mathbb{1}_t^{MacroFOMC} + \beta_2 \mathbb{1}_t^{FOMCOnly} + \epsilon_t \tag{1}$$

Pre-FOMC drift too is only realized on those FOMC announcements that had key macro news occurring in the immediate past ($MacroFOMC$ days). Table 2 suggests that if an FOMC announcement did not have one of the four macro announcement within the past 3 days ($\mathbb{1}^{FOMCOnly}$ row, column 5), there is not even weak evidence of any rise in returns happening prior to Fed statements. Annualized Sharpe ratios shown at the bottom suggest that the superior Sharpe ratios observed in the pre-FOMC window too are driven by those FOMC announcements that were immediately preceded by macro news.[5] As the annual Sharpe ratio of the S&P 500 is about 0.5 over this sample, the bottom row suggests that when FOMC announcements are *not* preceded by macro news, risk-adjusted returns realized around FOMC statements are low. This can be seen both for daily returns and pre-FOMC drift.

[4] Daily equity returns are calculated using close-of-day values of equity prices. Pre-FOMC drift is computed as the return from 2:00pm the day before FOMC day to 15 minutes prior to FOMC statements.

[5] Since there are 8 scheduled FOMC announcements each year, Sharpe ratios are annualized by multiplying the per-meeting Sharpe ratio by $\sqrt{8}$ times the square-root of the ratio of each type of FOMC announcement (see Table 1). To compute the per-meeting Sharpe ratio, I estimate the mean excess returns and standard deviation individually for each meeting-type. For example, when estimating the annualized Sharpe ratio of pre-FOMC drift for $MacroFOMC$ under the Table 2 column titled "2 days" (those FOMC statements that had a macro announcement occurring earlier in the morning, the day before, or at most two days before), I estimate the mean and standard deviation of pre-FOMC drift over this particular set of FOMC statements only. Then, I multiply that ratio by $\sqrt{8}$ times $\sqrt{41\%}$, the ratio of total number of FOMC statements that had a macro announcement occurring within the previous 2 days (see Table 1).

Table 2: Returns Around Two Types of FOMC Days

	All FOMC	Same Day	1 Day	2 Days	3 Days	4 Days	5 Days
Panel A: FOMC-Day Excess Return							
$\mathbb{1}^{FOMC}$	0.15**						
	(0.07)						
$\mathbb{1}^{MacroFOMC}$		0.32**	0.35**	0.35***	0.23**	0.20**	0.19**
		(0.14)	(0.14)	(0.13)	(0.09)	(0.09)	(0.08)
$\mathbb{1}^{FOMCOnly}$		0.11	0.08	0.01	-0.00	-0.01	0.00
		(0.08)	(0.08)	(0.08)	(0.11)	(0.11)	(0.14)
$Constant$	0.02**	0.02**	0.02**	0.02**	0.02**	0.02**	0.02**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	6,563	6,563	6,563	6,563	6,563	6,563	6,563
Sharpe Ratios							
$AllFOMC$	0.49						
$MacroFOMC$		0.48	0.55	0.57	0.54	0.52	0.51
$FOMCOnly$		0.16	0.15	0.08	0.06	0.04	0.08
Panel B: Pre-FOMC Drift							
$\mathbb{1}^{FOMC}$	0.22***						
	(0.06)						
$\mathbb{1}^{MacroFOMC}$		0.26**	0.29**	0.32***	0.28***	0.24***	0.25***
		(0.11)	(0.11)	(0.09)	(0.07)	(0.07)	(0.06)
$\mathbb{1}^{FOMCOnly}$		0.20***	0.19***	0.13*	0.06	0.12	0.05
		(0.07)	(0.07)	(0.07)	(0.11)	(0.12)	(0.14)
$Constant$	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	5,451	5,451	5,451	5,451	5,451	5,451	5,451
Sharpe Ratios							
$AllFOMC$	0.89						
$MacroFOMC$		0.52	0.58	0.78	0.97	0.88	0.96
$FOMCOnly$		0.35	0.41	0.39	0.22	0.44	0.22
Newey-West standard errors in parentheses							
*** p<0.01, ** p<0.05, * p<0.1							

Note: This table shows estimations of equation (1), where the LHS variable is the daily excess return (panel A) and pre-FOMC drift (panel B). Dummy variables, $\mathbb{1}^{MacroFOMC}$ and $\mathbb{1}^{FOMCOnly}$, represent mutually exclusive sets of FOMC announcements that are defined differently for each regression. Column headers help identify their definitions. Under "1 day", $\mathbb{1}^{MacroFOMC}$ takes a value of 1 for all FOMC announcements that either had one of the four macro announcements occurring the same day or the day before, and is zero otherwise, while $\mathbb{1}^{FOMCOnly}$ takes a value of 1 on all FOMC announcements that did not have one of the 4 macro announcements the same day or the day before. And so on. See Table 1 for more details. For reference, the 1st column displays output for all FOMC announcements. Annualized Sharpe ratios are computed as $\sqrt{8}$ times the square-root of ratio of each type of FOMC announcement (see Table 1) times the per FOMC announcement type Sharpe ratio.

Since pre-FOMC drift is perhaps better recognized visually, Figure 1 illustrates the difference in the realizations of these returns ahead of FOMC statements preceded by macro news (charts on the left), and those that were not preceded by macro data releases (charts on the right). Figure 1 helps visualize the findings reported in Table 2, by showing that the significant buildup in returns ahead of FOMC statements is driven by a small subset of FOMC announcements: those that are immediately preceded by macro news.

Figure 1. Pre-FOMC Drift on Two Types of FOMC Days

Note: This figure shows cumulative excess returns starting at 9:30am a day before FOMC statements. Charts on the left show cumulative excess returns ahead of $MacroFOMC$ and those on the right show for $FOMCOnly$ announcements. These mutually exclusive set of FOMC announcements are defined differently in each row. For example, the top-left chart shows the pre-FOMC drift realization on the set of FOMC announcements that had one of the four macro announcement occurring earlier in the morning or the day before FOMC statements are released. The top-right chart displays the pre-FOMC drift on the set of FOMC announcements that did not have one of the four macro announcements earlier in the morning or the day before, but may have macro announcements two days or more before the release of FOMC statements. The solid lines show the means, while the dotted lines show associated 2 standard deviations above and below the mean. The vertical line marks 2:00pm. Typically, FOMC statements are released at either 2:00pm or 2:15pm over the sample my data spans. For consistency, I exclude FOMC statements that were announced before 2:00pm and thus drop 8 FOMC statements (all released at 12:30pm) in this figure.

Thus, the presence of macro data releases just prior to FOMC statements has a first order effect on equity price realizations on FOMC day. The closer macro data releases are to forthcoming FOMC announcements, the greater the returns realized around FOMC statements tend to be. While the declining point estimates as one moves from left to right in the $\mathbb{1}^{FOMCOnly}$ rows of Table 2 and the flattening of lines as one moves down in the right column of Figure 1 suggest the same, estimations of equation (2) provide more direct evidence. Equity returns around FOMC statements (announcement return or pre-FOMC drift) are regressed against the number of days one of the four macro announcements is away. The significantly negative coefficient on the $DaystoFOMC$ variable confirms that as the most recent macro announcement occurs farther back in time, future returns realized around FOMC statements monotonically decline.

$$\Delta y_t = \alpha + \beta_1 DaystoFOMC_t + \epsilon_t \tag{2}$$

Table 3: Returns Realized on FOMC Day are Higher the Closer Macro Announcements Are

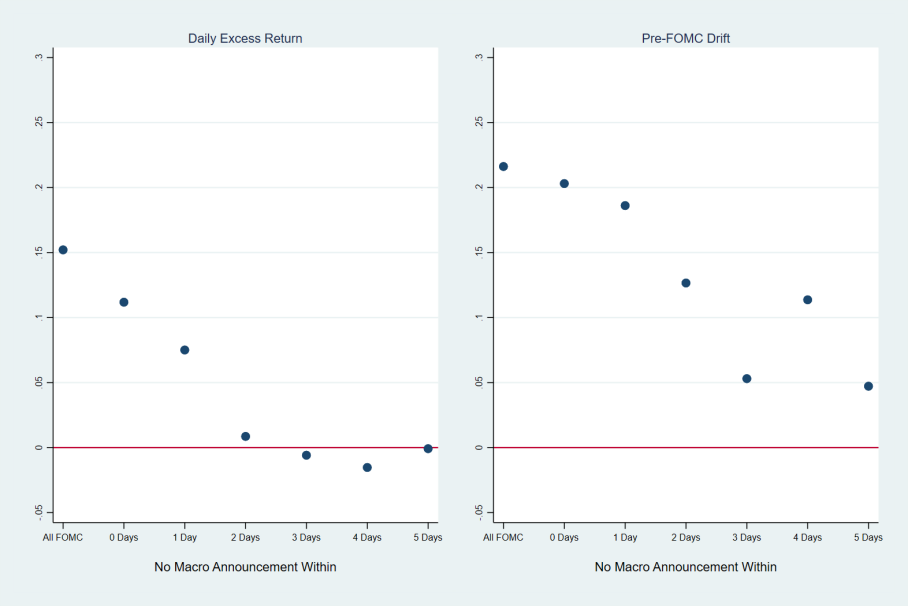
	Announcement Return	Pre-FOMC Drift
$DaystoFOMC$	-0.12***	-0.07*
	(0.04)	(0.04)
$Constant$	0.53***	0.42***
	(0.14)	(0.12)
Observations	212	179
Robust standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

Note: This table reports estimations of equation (2) where the LHS variable, Δy_t, is either the daily excess return or pre-FOMC drift (cumulative excess returns from 2:00pm from the prior day to 15mins before release of FOMC statements). The RHS variable, $DaystoFOMC$, notes the number of days a macro announcement is away from its nearest forthcoming FOMC announcement. If a macro announcement occurs earlier in the morning, the variable takes a value of 0. If the macro announcement occurs the day before its associated FOMC statement, $DaystoFOMC$ takes a value of -1, and so on.

Observing this relationship visually in Figure 2 helps reveal that macro announcements that are closer have have a much larger influence on future stock returns around FOMC statements than macro announcements that are further away. For reference, the first dot shows the unconditional daily excess return (left chart) and pre-FOMC drift (right chart)

across all FOMC announcements, without any distinction. As one moves to the right along the x-axis, I plot the announcement returns across the set of $FOMCOnly$ announcements. I sequentially ignore FOMC announcements that had macro announcements in the near past. For instance, when x-axis says "0 Days", I ignore all FOMC statements that had a macro announcement earlier the same morning (37 announcements - see Table 1), and show the announcement return or drift estimated on the remaining 165 announcements. Similarly, when x-axis says "1 Day", I ignore all FOMC statements that had a macro announcement either earlier in the day or the day before (54 announcements - see Table 1), and show the estimated excess return around the remaining 148 FOMC statements.

Figure 2. Closeness of Macro Announcement With FOMC Day Returns & Pre-FOMC Drift



Note: This figure plots the average daily equity announcement return (left) and pre-FOMC drift (right). Pre-FOMC drift is computed as the cumulative return from 2:00pm the day before FOMC day till 15 minutes before release of FOMC statements. In each chart, the left-most dot shows the unconditional return across all FOMC statements. As one moves along the x-axis, I show announcement returns for $FOMCOnly$ announcements. When x-axis says "0 Days", I ignore all FOMC statements that had a macro announcement earlier the same morning. And then compute the announcement daily return and pre-FOMC drift, respectively. At the right-most end, when x-axis says "5 days", I ignore all FOMC announcements that had one of the four macro announcement in the previous 5 days, and estimate the announcement daily excess return and pre-FOMC drift over the remaining FOMC statements.

3.2 International Evidence

Lucca and Moench (2015) document pre-FOMC drift among major international stock markets: Canada, UK, Europe and Japan. That is, benchmark stock indices of these markets rise ahead of Federal Reserve announcements, just like the S&P 500 does. I show that similar to pre-FOMC drift in U.S. stock markets, these substantial excess returns are only realized ahead of those FOMC statements that are preceded by U.S. macro news. To show that, I again estimate equation (1) but with returns of the major international indices now as regressands, and report my findings in Table 4 below.[6] In all cases, pre-FOMC returns are higher ahead of those FOMC announcements preceded by macro news ($MacroFOMC$ days) and are low and insignificant on FOMC days not preceded by macro news ($FOMCOnly$ days).

The results are most striking for Japan's Nikkei 225. Similar to Lucca and Moench (2015), I too do not find evidence of *unconditional* pre-FOMC drift in Nikkei 225 (see column 1 of panel D below). However, pre-FOMC drift in Nikkei becomes immediately evident once FOMC announcements are separated into mutually exclusive sets of those that are immediately preceded by macro news and those that are not. Just like for U.S. daily announcement returns, for the very small subset of those FOMC announcements that have one of the four macro news release happening earlier in the morning (37 of 202 FOMC days - see Table 1), there is strong evidence of pre-FOMC drift in the Nikkei.

Annualized Sharpe ratios of these indices show the same pattern: they are high on FOMC statements preceded by macro news ($MacroFOMC$ days), and relatively low on those FOMC statements that are not preceded by macro news ($FOMCOnly$ days). For reference, over the same sample, holding the benchmark for a full year would yield Sharpe ratios of 0.32, 0.18, 0.21 and 0.04 for the TSX60, FTSE100, STOXX 50 and Nikkei, respectively.

[6] I estimate pre-FOMC returns similarly as Lucca and Moench (2015). For non-Canadian stocks, I use close-of-day prices (from Bloomberg). For all non-Canadian stocks, since their markets close before FOMC statements are released, close-prices can be used to measure pre-FOMC returns. For Canada, I obtain intra-day data on the TSX60 from Refinitiv, and construct pre-FOMC returns similar to the U.S.. In the benchmark, I use cumulative excess returns from 2:00pm EST of the previous day prior until 15 mins prior to the release of FOMC statements.

Table 4: Pre-FOMC Drift Around Two Types of FOMC Days

	All FOMC	Same Day	1 Day	2 Days	3 Days	4 Days	5 Days
Panel A: Canada (TSX60)							
$\mathbb{1}^{FOMC}$	0.16***						
	(0.06)						
$\mathbb{1}^{MacroFOMC}$		0.23	0.23*	0.25***	0.23***	0.21***	0.22***
		(0.15)	(0.12)	(0.09)	(0.07)	(0.07)	(0.07)
$\mathbb{1}^{FOMCOnly}$		0.15**	0.14**	0.10	0.01	0.00	-0.08
		(0.07)	(0.07)	(0.08)	(0.10)	(0.11)	(0.13)
$Constant$	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	4,876	4,876	4,876	4,876	4,876	4,876	4,876
Sharpe Ratios							
$AllFOMC$	0.67						
$MacroFOMC$		0.35	0.45	0.62	0.76	0.75	0.82
$FOMCOnly$		0.27	0.30	0.27	0.07	0.06	-0.23
Panel B: UK (FTSE100)							
$\mathbb{1}^{FOMC}$	0.20***						
	(0.06)						
$\mathbb{1}^{MacroFOMC}$		0.29**	0.28**	0.33***	0.23***	0.21***	0.22***
		(0.14)	(0.13)	(0.10)	(0.08)	(0.07)	(0.07)
$\mathbb{1}^{FOMCOnly}$		0.18***	0.17**	0.11	0.13	0.16	0.12
		(0.07)	(0.07)	(0.07)	(0.10)	(0.10)	(0.12)
$Constant$	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	6,563	6,563	6,563	6,563	6,563	6,563	6,563

Sharpe Ratios							
$AllFOMC$	0.78						
$MacroFOMC$		0.41	0.44	0.65	0.64	0.60	0.66
$FOMCOnly$		0.26	0.31	0.26	0.38	0.54	0.40

Panel C: EU (STOXX50)

$\mathbb{1}^{FOMC}$	0.24***						
	(0.06)						
$\mathbb{1}^{MacroFOMC}$		0.34*	0.36**	0.39***	0.30***	0.27***	0.26***
		(0.17)	(0.14)	(0.11)	(0.08)	(0.08)	(0.07)
$\mathbb{1}^{FOMCOnly}$		0.21***	0.19***	0.13*	0.11	0.14	0.13
		(0.07)	(0.07)	(0.07)	(0.10)	(0.11)	(0.13)
$Constant$	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	6,563	6,563	6,563	6,563	6,563	6,563	6,563
Sharpe Ratios							
$AllFOMC$	0.78						
$MacroFOMC$		0.39	0.50	0.75	0.77	0.74	0.77
$FOMCOnly$		0.32	0.36	0.31	0.35	0.49	0.43

Panel D: Japan (Nikkei225)

$\mathbb{1}^{FOMC}$	0.12						
	(0.10)						
$\mathbb{1}^{MacroFOMC}$		0.31**	0.41***	0.35***	0.19**	0.20**	0.22**
		(0.15)	(0.12)	(0.12)	(0.09)	(0.09)	(0.09)
$\mathbb{1}^{FOMCOnly}$		0.08	0.02	-0.04	-0.01	-0.13	-0.32
		(0.12)	(0.13)	(0.15)	(0.24)	(0.29)	(0.36)
$Constant$	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)

Observations	6,563	6,563	6,563	6,563	6,563	6,563	6,563
Sharpe Ratios							
$AllFOMC$	0.26						
$MacroFOMC$		0.40	0.67	0.61	0.44	0.45	0.51
$FOMCOnly$		0.07	0.02	-0.04	-0.01	-0.15	-0.36
Newey-West standard errors in parentheses							
*** p<0.01, ** p<0.05, * p<0.1							

Note: This table shows estimations of equation (1), where the LHS variable is pre-FOMC drift computed using close-of-day prices for non-Canadian benchmark indices, and intra-day data for the TSX60. Each column in each panel displays output from a separate regression. Dummy variables, $\mathbb{1}^{MacroFOMC}$ and $\mathbb{1}^{FOMCOnly}$, represent mutually exclusive sets of FOMC announcements that are defined differently for each regression. Column headers help identify their definitions. Under "Same Day", $\mathbb{1}^{MacroFOMC}$ takes a value of 1 for all FOMC announcements that had one of the four macro announcements occurring the same day, and is 0 otherwise, while $\mathbb{1}^{FOMCOnly}$ takes a value of 1 on all FOMC announcements that did not have one of the 4 macro announcements earlier the same day. Under "1 day", $\mathbb{1}^{MacroFOMC}$ takes a value of 1 for all FOMC announcements that either had one of the four macro announcements occurring the same day or the day before, and is zero otherwise, while $\mathbb{1}^{FOMCOnly}$ takes a value of 1 on all FOMC announcements that did not have one of the 4 macro announcements the same day or the day before. And so on. For reference, the 1st column displays output for all FOMC announcements. Annualized Sharpe ratios are computed as $\sqrt{8}$ times the square-root of the ratio of each type of FOMC announcement (see Table 1) times the per FOMC announcement type Sharpe ratio.

3.3 Cross-Sectional Evidence

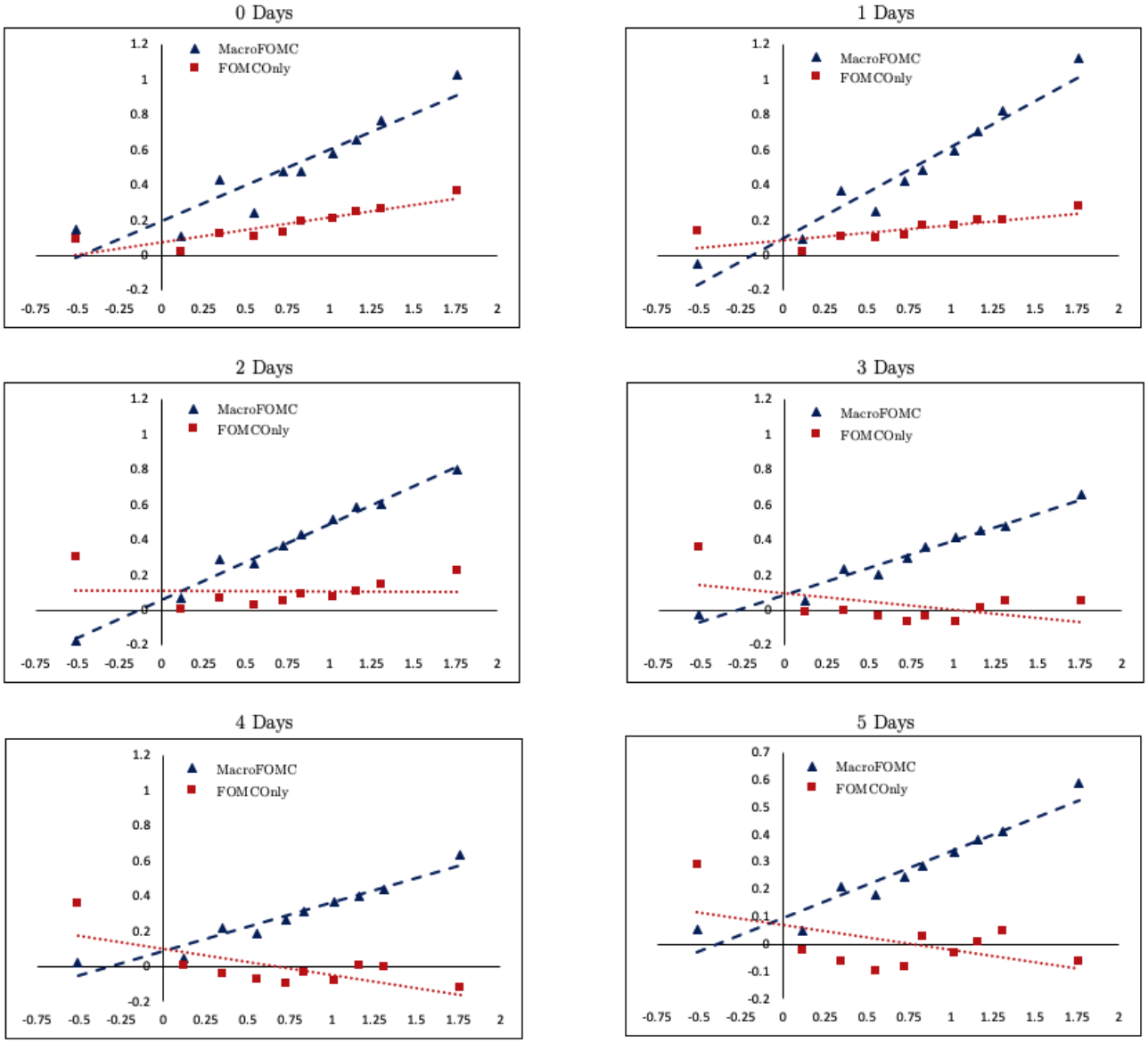
Previous studies have found that the security market line slopes upward on FOMC days (Bernanke and Kuttner, 2005; Savor and Wilson, 2014; Lucca and Moench, 2015). Savor and Wilson (2014) focus on the behavior of the cross-section of U.S. stocks on select macro announcement days (including FOMC announcements), and show in Figure 1 of their paper that the security market line is upward sloping on macro announcement days. Given the high market return on macro announcements, stocks with high CAPM beta earn large excess returns compared to those that have low CAPM betas. Since the security market line tends to generally be flat, Savor and Wilson (2014) use their key finding to conclude that asset pricing is a tale of two days: macro announcements and regular trading days. I

focus exclusively on FOMC days, and reproduce a modified version of Figure 1 of Savor and Wilson (2014) to further advance one of two key messages of this paper: *there is a tale of two FOMC days*. Asset price behavior strongly contrasts across the set of those FOMC days preceded by key macro news and those that are not.

In particular, I estimate equation (3) below for the entire CRSP universe to estimate each firm's unconditional CAPM beta. Then I rank firms into 10 beta-sorted portfolios, and plot the average returns of those beta-sorted portfolios against their CAPM betas in Figure 3. It shows that the security market line is upward sloping only on those FOMC days that are preceded by macro news ($MacroFOMC$ days), and is flat or downward sloping on FOMC days that are not preceded by macro news ($FOMCOnly$ days). Regression estimates confirm the patterns that can be visually observed in Figure 3: even the cross-section of U.S. stocks display significant announcement returns on those FOMC days preceded by macro news ($MacroFOMC$ days) and display no significant returns on those FOMC days that are not preceded by macro news ($FOMCOnly$ days).

$$EquityReturn_{i,t} = \alpha_i + \beta_{i,1} MarketReturn_t + \epsilon_{i,t} \tag{3}$$

Figure 3. Security Market Line at Two Types of FOMC Days



Note: This figure shows the SML for two types of FOMC days: those associated with macro announcements ($MacroFOMC$); and those that are not ($FOMCOnly$). Chart titles indicate the definition of the two categories of FOMC days. For example, under the chart title "0 Days", $MacroFOMC$ represents all those FOMC announcements that had one of the four macro announcements earlier in the morning in the same day. $FOMCOnly$ in that chart represents all other FOMC days: those that did not have a macro announcement earlier the same day. The entire CRSP universe of firms are sorted into 10 portfolios based on their CAPM beta estimates. The average returns of each portfolio (y-axis) are plotted against their portfolio ranking.

4 Pre-FOMC Drift & Announcement Return: Learning About Future Fed Actions From Macro Announcements

In Section 3, I establish one of two key messages of this paper: there is a tale of two FOMC days. Here, I establish that pre-FOMC drift and FOMC-day returns respond to *past information* released just a few days ahead of Fed statements. In particular, these returns are strongly explained by movements in proxies of markets expectations of future Fed actions (federal fund and eurodollar futures rates) on macro announcements that precede Fed statements. My interpretation of these findings is also the second of my two key messages of this paper: pre-FOMC drift and FOMC announcement "premium" reflect, in large parts, markets *learning* about future Fed actions from macro announcements.

4.1 Changing Expectations Regarding Path of Fed Policy On Macro News Days Explains Pre-FOMC Drift and Announcement Return

Federal fund futures' payoffs directly depend on the the level of the Federal Funds Rate, which the Fed itself controls. Thus, they are the one of the best proxies of market's expectations regarding future Fed actions as shown previously too (see e.g., Gurkaynak, Sack and Swanson, 2007). A large body of literature has used these contracts to measure market's monetary policy expectations (e.g, Kuttner, 2001).[7] I follow Kuttner (2001) to extract market's expectations regarding the upcoming Fed announcement.

To be more concrete, here I explain how I compute expectations regarding upcoming Fed statements (variable labelled $\Delta E[Upcoming]$ in the tables that follow). Firstly, I match each macro announcement to its nearest forthcoming FOMC statement. Then I compute the change in expectations regarding the upcoming Fed statement from federal funds futures using equation (4) below. Δf^i denotes the daily change in the futures rate of the relevant month "i". If a macro announcement and its nearest FOMC announcement occur in the

[7] Every federal funds futures contract's payoff depends on the average effective federal funds rate for its reference month. For example, if today is February 07, 2022, the same month's fed fund futures contract will depend on the average of the effective federal funds rate prevalent between February 01, 2022 and February 28, 2022. Similarly, the payoff of the 3-months-ahead federal fund futures contract (labelled f^3 in this paper) will depend on the average effective federal funds rate prevalent between April 01, 2022 and April 30, 2022. Price quotations for each contract are 100 - R, where R is the arithmetic average of the daily effective federal funds rate for that contract month. For more information, visit CME here.

same month, i=1. If the nearest FOMC statement happens in the next month, i=2. This change is multiplied by a scaling factor, to account for the number of days the relevant futures' payoff that will be affected and the number of days that will not be affected by the upcoming Fed announcement. Upper case "D" represents the total number of days in the month in which the nearest FOMC statement occurs. Lower case "d" is the day the nearest upcoming policy is to be announced.[8]

$$\Delta E[Upcoming] = \frac{D}{D-d}\Delta f^i \tag{4}$$

Similar to Bernanke and Kuttner (2005), I also control for the change in the 3-month-ahead futures rate (variable labeled Δf^3 below) to account for what they call "timing": whether a change in market's expectation regarding the upcoming Fed action arises because they now expect a future action to be committed earlier, or whether it represents a change in expectations regarding the short-term path of policy. As a first pass, I only focus on the realizations of $\Delta E[Upcoming]$ and Δf^3 on macro announcements, and assess whether they explain pre-FOMC drift and announcement returns of upcoming Fed statements.

For the rest of this paper, I only focus on those macro announcements that occurred at most 5 days before an FOMC statement. This is for two reasons. Firstly, as shown in Section 3.1, macro announcements that are closer to upcoming Fed statements are more relevant in determining future FOMC returns than those macro announcements that are further away. Including macro announcements that are far away can thus reduce precision of estimates. Secondly, as Table 1 shows, over 80% of all FOMC statements had one of the four macro announcements occurring within the past 5 days. Hence, I am still accounting for the overwhelming majority of FOMC announcements, and only drop a few in my benchmark analysis. Nonetheless, the results I present in the rest of the paper extend to broader cutoff days.

My regression specification is given in equation (5) below. The regressand is either the upcoming FOMC announcement excess return or the pre-FOMC drift. "n" notes the total number of main explanatory variables. Subscript $t-$ is meant to remind the reader that

[8] Following Gurkaynak, Sack and Swanson (2007), if an FOMC announcement occurs in the last 7 days of the month, I use the next month's unscaled change in the future's rate to avoid multiplying by a very large scaling factor.

values of RHS are realized *before* upcoming FOMC days. Each RHS variable is interacted with "$Days$", which is equal to the number of days each macro announcement is away to its nearest upcoming FOMC announcement. As the RHS variables I use here are at daily frequency, I ignore all macro announcements that occur on the same day as an FOMC announcement. Therefore, the estimations reported in Table 5 are truly predictive for announcement returns (columns 4-6). Since the baseline pre-FOMC drift is the cumulative excess return from 2:00pm of the day prior to FOMC announcement to 15 minutes prior to release of FOMC statement, there would be some overlap in the LHS and RHS variables on occasions when the macro announcement occurs 1 day before an FOMC announcement. In columns 1-3, I allow this possibility. In columns 7-9, I ignore all macro announcements that occurred not only earlier in the morning (as is always the case), but also those that occurred 1 day prior to FOMC release. Thus, the last 3 columns too report estimations from a predictive regression.

$$forthFOMCreturn_t = \alpha + \sum_{i=1}^{n} \beta_{1,i} x_{i,t-} + \sum_{i=1}^{n} \beta_{2,i} x_{i,t-} * Days_{t-} + \gamma Days_{t-} + \epsilon_t \quad (5)$$

$Days = 0$ one day before an FOMC day in columns 1-6, and two days before in columns 7-9. This reference point is chosen to reflect the closest available day with reference to each FOMC statement in each specification. Defining the variables $Days$ in this manner helps to simplify interpretation of the interaction terms and main variables. In columns 1-6 of Table 5, where only those macro announcements are ignored that occur earlier in the morning, $Days = 0$ on the day before FOMC day. Thus, the main variable coefficient estimates (rows 1 and 3) describe the explanatory relationship when a macro announcement occurs 1 day prior to an FOMC statement. In columns 7-9, where those macro announcements that not only occurred the same day but also those that occurred 1 day prior to an upcoming FOMC statement are dropped, $Days = 0$ on 2 days prior to FOMC statements. Under columns 7-9, the main variable estimates (rows 1 and 3) describe the relationship for those macro announcements that occurred 2 days prior to FOMC statements. The interaction terms (rows 2 and 4) then represent the attenuation of this relationship as the number of days between macro announcements and upcoming FOMC statements increases.

The negative loadings on the main variables in rows 1 and 3 of Table 5 show that pre-

FOMC drift and announcement returns are high when markets lower their expectations regarding the policy rate to be announced on the upcoming FOMC statement (a negative value of $\Delta E[Upcoming]$) and/or future FOMC statements as proxied by Δf^3. Given the interaction terms in rows 2 and 4 are of the opposite sign, it means that the explanatory power of these variables is stronger for macro announcements that are closer to upcoming FOMC statements. In fact, the estimations from column 9 suggests that the predictive power of $\Delta E[Upcoming]$ (Δf^3) is negligible for macro announcements that occur 3 days (5 days) or more away from upcoming FOMC statements. These findings are consistent with Figure 1, which showed that pre-FOMC drift is marginally significant for those FOMC statements that may have had macro announcements 3 days or more away (2nd row, right chart), and completely insignificant for those FOMC statements that may have had macro announcements 4 days or more away (3rd row, right chart). The significance of $\Delta E[Upcoming]$ in both the announcement return and pre-FOMC drift regressions and the significance of Δf^3 only in the pre-FOMC drift regressions suggest that future FOMC-day-announcement-returns respond more strongly to expectations regarding immediate Fed actions, while pre-FOMC drift tends to respond to expectations regarding the medium-term path of Fed policy.

The adjusted R^2 of these regressions suggest that a substantial fraction of pre-FOMC drift and FOMC-day-announcement-returns are explained by *past* realizations of mainly just two variables ($\Delta E[Upcoming]$ and Δf^3) around macro news releases just preceding FOMC announcements. Even after excluding changes in these variables around those macro announcements that occurred the same day as FOMC announcements, over 30% of the variation in pre-FOMC drift is still mainly explained by the realizations of just two variables on macro announcements. Even when there is no overlap in LHS and RHS variables, the predictive regression reported in column 9 of Table 5 has an adjusted R^2 of 25%.

Table 5: Learning About Forthcoming Fed Policy From Macro Announcements

				Predictive Regressions					
	Pre-FOMC Drift			Announcement Return			Pre-FOMC Drift		
$\Delta E[Upcoming]$	-17.99***		-15.00***	-18.21***		-17.71***	-8.44*		-8.59***
	(6.47)		(3.68)	(6.29)		(5.91)	(4.26)		(2.95)
$\Delta E[Upcoming] * Days$	8.32**		6.50***	6.11***		5.94***	6.64**		6.59**
	(3.25)		(2.24)	(2.14)		(2.01)	(3.32)		(3.07)
Δf^3		-24.03**	-19.81***		-8.29	-4.30		-17.90***	-18.17***
		(9.51)	(3.37)		(12.50)	(9.36)		(5.29)	(3.46)
$\Delta f^3 * Days$		5.77	3.99**		3.17	1.61		5.48*	5.96**
		(3.81)	(1.60)		(3.74)	(2.60)		(3.00)	(2.33)
$Days$	-0.12**	-0.14**	-0.12**	-0.18***	-0.19***	-0.18***	-0.11	-0.12*	-0.10
	(0.06)	(0.06)	(0.05)	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)
$Constant$	0.44***	0.51***	0.45***	0.54***	0.58***	0.53***	0.32***	0.34***	0.31***
	(0.12)	(0.14)	(0.11)	(0.16)	(0.18)	(0.16)	(0.10)	(0.10)	(0.09)
Observations	145	145	145	175	175	175	125	125	125
Adjusted R^2	0.196	0.209	0.320	0.118	0.037	0.110	0.104	0.156	0.245

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table shows estimations of equation (5), where the LHS variable is either the daily excess announcement return or pre-FOMC drift of the nearest upcoming FOMC announcement with respect to each macro announcement. The RHS variables are realizations on macro announcement days preceding FOMC statements. In the baseline reported here, I only focus on those macro announcements that occur at most 5 days before its nearest upcoming FOMC statement. $\Delta E[Upcoming]$ uses federal funds futures to measure market's expectation regarding the nearest upcoming FOMC policy announcement. Δf^3 is the daily change in 3-month-ahead federal funds futures futures rate. $Days$ represents the number of days each macro announcement is away from its nearest upcoming FOMC statement. Since I use daily changes in my RHS variables, I ignore all macro announcements that occur on the same day as an FOMC announcement. For ease of interpretation of main variables and interaction terms, in the first 6 columns, $Days$ = 0 if a macro announcement occurred the day before FOMC. In the last 3 columns (7-9), I ignore all macro announcements that occurred not only in the same day as FOMC statement, but also those that occurred one day before, to avoid any overlapping periods in the LHS and RHS variables. Hence, in the last 3 columns $Days$ = 0 when a macro announcement occurs 2 days before FOMC statements. See Section 4.1 for more details.

While results in Table 5 do suggest a strong role of macro announcements in determining future returns around FOMC statements, they do not offer evidence of causality. To establish the causal impact of macro announcements preceding FOMC statements, I estimate equation (6) below. $\mathbb{1}^{Macro} = 1$ each day there is a GDP, CPI, unemployment or industrial production announcement, and is 0 otherwise. For similar reasons as provided

earlier, I only focus on 5 trading days preceding each FOMC statement in the baseline estimations reported in Table 6. $Days$ is defined for each specification as before.

$$\begin{aligned} forthFOMCreturn_t &= \alpha + \sum_{i=1}^{n} \beta_{1,i} x_{i,t-} + \sum_{i=1}^{n} \beta_{2,i} x_{i,t-} * \mathbb{1}_{t-}^{Macro} + \sum_{i=1}^{n} \beta_{3,i} x_{i,t-} * Days_{t-} * \mathbb{1}_{t-}^{Macro} \\ &\quad + \gamma_1 Days_{t-} + \gamma_2 \mathbb{1}_{t-}^{Macro} + \gamma_3 Days_{t-} * \mathbb{1}_{t-}^{Macro} + \epsilon_t \end{aligned} \tag{6}$$

The significant loadings on the interaction with $\mathbb{1}^{Macro}$ (rows 2 and 5) confirm that indeed it is realizations of key explanatory variables on macro announcement days that explains future FOMC-day-announcement-return and pre-FOMC drift. The double interaction terms (rows 3 and 6) also confirm that macro announcements that are closer to upcoming FOMC statements exert a stronger impact on future returns than those that are further away. The estimations in column 9 of Table 6 also support the back-of-envelope calculations mentioned above: the power of $\Delta E[Upcoming]$ (Δf^3) to predict pre-FOMC drift is negligible when macro announcements occur 3 days (5 days) or more away. The far lower adjusted R^2 in Table 6 compared to those reported in Table 5 also further substantiate the importance of macro announcements. Including regular trading reduces the explanatory power of the estimating equation.

Table 6: Learning About Forthcoming Fed Policy From Macro Announcements

	Predictive Regressions								
	Pre-FOMC Drift			Announcement Return			Pre-FOMC Drift		
$\Delta E[Upcoming]$	1.54		1.45	0.85		0.72	1.30		1.20
	(1.30)		(1.26)	(1.06)		(1.02)	(1.29)		(1.28)
$\Delta E[Upcoming] * \mathbb{1}^{Macro}$	-19.53***		-16.45***	-19.05***		-18.43***	-9.75*		-9.79**
	(7.31)		(4.40)	(6.63)		(6.22)	(5.18)		(3.77)
$\Delta E[Upcoming] * Days * \mathbb{1}^{Macro}$	8.32**		6.50***	6.11***		5.94***	6.64**		6.59**
	(3.22)		(2.21)	(2.12)		(1.98)	(3.28)		(3.02)
Δf^3		0.66	0.47		1.68	1.62		0.71	0.55
		(0.76)	(0.71)		(1.19)	(1.20)		(0.83)	(0.80)
$\Delta f^3 * \mathbb{1}^{Macro}$		-24.70**	-20.28***		-9.98	-5.92		-18.61***	-18.72***
		(9.98)	(3.60)		(12.79)	(9.42)		(5.66)	(3.71)
$\Delta f^3 * Days * \mathbb{1}^{Macro}$		5.77	3.99**		3.17	1.61		5.48*	5.96**
		(3.78)	(1.58)		(3.72)	(2.57)		(2.97)	(2.30)
$Days$	0.02*	0.02*	0.02*	0.03**	0.03**	0.03**	0.02*	0.02	0.02*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\mathbb{1}^{Macro}$	0.26**	0.32**	0.26**	0.44***	0.47***	0.43***	0.13	0.14	0.11
	(0.12)	(0.14)	(0.11)	(0.16)	(0.17)	(0.15)	(0.11)	(0.10)	(0.10)
$Days * \mathbb{1}^{Macro}$	-0.14**	-0.16**	-0.14**	-0.21***	-0.22***	-0.21***	-0.14	-0.14*	-0.13*
	(0.06)	(0.07)	(0.06)	(0.08)	(0.08)	(0.07)	(0.08)	(0.08)	(0.08)
$Constant$	0.19***	0.19***	0.19***	0.10	0.10	0.10	0.20***	0.20***	0.20***
	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)
Observations	848	848	848	992	992	992	678	678	678
Adjusted R^2	0.036	0.036	0.057	0.024	0.009	0.024	0.016	0.024	0.039

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table shows estimations of equation (6), where the LHS variable is either the daily excess announcement return or pre-FOMC drift of the nearest upcoming FOMC announcement. I focus on 5 trading days preceding each FOMC statement. $\Delta E[Upcoming]$ uses federal funds futures to measure market's expectation regarding the nearest upcoming FOMC policy announcement. Δf^3 is the daily change in 3-month-ahead federal funds futures futures rate. $Days$ represents the number of days each trading day is away from its nearest upcoming FOMC statement. Since I use daily changes in my RHS variables, I do not use values of explanatory variables that occur on the same day as an FOMC announcement. For ease of interpretation of main variables and interaction terms, in the first 6 columns, $Days$ = 0 on the day before FOMC. In the last 3 columns (7-9), I not only discard the RHS realizations on FOMC day but also the day before FOMC day, to avoid any overlapping periods in the LHS and RHS variables. Hence, in the last 3 columns $Days = 0$ two days before FOMC statements. See Section 4.1 for more details.

Near term federal fund futures are known to have minimal risk premium (Sack, 2004). Daily changes of these contracts removes any traces of risk premium altogether (Piazzesi and Swanson, 2008). Thus, it is unlikely that the significant predictability in returns reported in Tables 5 and 6 is fundamentally driven by time-varying risk premium. Yet, risk may have some role in explaining pre-FOMC drift and announcement returns, as discussed next in Section 4.2.

4.2 Role of Risk

Earlier studies have shown that VIX levels are elevated before FOMC days (Lucca and Moench, 2015; Hu, Pan, Wang and Zhu, 2021), while a body of research has focused on risk-based reasons to explain announcement returns and pre-FOMC drift (Ai and Bansal, 2018; Ai, Bansal and Han, 2021; Hu, Pan, Wang and Zhu, 2021). Given the critical role of key macro announcements situated just before FOMC statements in determining pre-FOMC drift and FOMC-day-returns as shown thus far, I examine if changes in risk measures on these macro announcements explain forthcoming returns around FOMC statements. I do so by estimating equation (5), now with a larger set of regressors including daily changes in VIX and MOVE index, which measures implied volatility in bond markets using options on USTs. I also include the data release itself, labelled $MacroData$ below. I use the actual vintage released on the macro announcement day instead of their revisions. I standardize these released statistics by subtracting their unconditional averages and dividing the difference with their unconditional standard deviations. I standardize the following data releases: GDP growth, CPI inflation, unemployment rate, non-farm-payroll growth and industrial production growth. All growth variables are year-over-year changes.

As Table 7 shows, changes in VIX or MOVE on macro announcements just preceding upcoming FOMC statements do not explain forthcoming returns around FOMC statements. Similarly, the data release itself does not have much explanatory power either, especially once proxies of market's Fed expectations ($\Delta E[Upcoming]$ and Δf^3) are included, as columns 3 and 4 show. Using "surprise" measures instead of the data release does not change these findings, and in fact its effect is weaker than that of macro data release reported here. Surprises in macro data releases may be measured by taking the difference between the announcement and its associated expectation taken from Bloomberg's survey.[9]

[9]The reduced significance when $MacroData$ shown here is replaced with its associated surprise may

However, the explanatory power of market proxies of Fed expectations remains unchanged, as shown in columns 4, 8 and 12 below. This is perhaps not surprising after all, given that these contracts are not known to have risk premia, particularly in their daily changes (Sack, 2004; Piazzesi and Swanson, 2008). This is not to say that risk has no role altogether in explaining pre-FOMC drift and/or FOMC-day-announcement-returns. Rather, it appears that the *channel* through which *macro announcements* affect upcoming returns around FOMC statements is primarily by influencing the market's expectations regarding forthcoming Fed decisions. Accounting for this channel is critical in understanding pre-FOMC drift and FOMC-day-returns, given the significance of market proxies and high R^2 of regressions reported throughout Section 4, as well as the key difference the presence of macro announcements just ahead of FOMC statements makes (Section 3).

be because Bloomberg surveys are done several days before macro announcements. This could make these surveys noisy measures of the market's true expectations just before macro announcements.

Table 7: Learning About Fed Policy From Macro News: *Role of Risk*

	Predictive Regressions											
	Pre-FOMC Drift				Announcement Return				Pre-FOMC Drift			
$\Delta E[Upcoming]$				-14.80***				-18.53***				-6.97**
				(3.92)				(6.49)				(3.10)
$\Delta E[Upcoming] * Days$				6.70***				6.26***				5.54*
				(2.47)				(2.21)				(3.18)
Δf^3				-18.87***				-4.96				-17.43***
				(3.45)				(10.92)				(2.81)
$\Delta f^3 * Days$				3.68**				1.31				5.87***
				(1.85)				(2.96)				(2.12)
ΔVIX	0.18			-0.04	0.12			-0.05	0.24*			0.06
	(0.20)			(0.11)	(0.22)			(0.12)	(0.13)			(0.08)
$\Delta VIX * Days$	-0.03			0.04	-0.09			-0.04	-0.09			0.00
	(0.07)			(0.05)	(0.08)			(0.05)	(0.07)			(0.05)
$\Delta MOVE$		0.05		0.03		0.03		0.01		0.03		0.02
		(0.04)		(0.03)		(0.04)		(0.05)		(0.03)		(0.02)
$\Delta MOVE * Days$		-0.02		-0.01		-0.00		0.00		-0.02		-0.02
		(0.02)		(0.02)		(0.02)		(0.02)		(0.02)		(0.02)
$MacroData$			0.26*	0.14			0.01	-0.01			0.22	0.07
			(0.15)	(0.13)			(0.17)	(0.17)			(0.21)	(0.14)
$MacroData * Days$			-0.09*	-0.05			0.00	0.02			-0.11	-0.04
			(0.05)	(0.05)			(0.06)	(0.06)			(0.10)	(0.07)
$Days$	-0.14**	-0.14*	-0.17**	-0.14**	-0.20***	-0.19**	-0.19**	-0.18***	-0.11	-0.11	-0.14*	-0.10
	(0.07)	(0.07)	(0.08)	(0.06)	(0.07)	(0.07)	(0.08)	(0.06)	(0.07)	(0.08)	(0.08)	(0.08)
$Constant$	0.52***	0.51***	0.60***	0.50***	0.60***	0.59***	0.58***	0.53***	0.35***	0.34***	0.38***	0.31***
	(0.17)	(0.17)	(0.20)	(0.13)	(0.20)	(0.20)	(0.21)	(0.16)	(0.10)	(0.11)	(0.12)	(0.09)
Observations	145	145	145	145	174	175	171	170	125	125	125	125
R^2	0.089	0.064	0.073	0.364	0.067	0.050	0.043	0.165	0.121	0.052	0.057	0.304
Adjusted R^2	0.069	0.044	0.054	0.312	0.051	0.033	0.025	0.107	0.099	0.028	0.034	0.236

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table shows estimations of equation (5), where the LHS variable is either the pre-FOMC drift or excess announcement return of the nearest upcoming FOMC announcement. The RHS variables are realizations on macro announcement days preceding FOMC statements. I only focus on those macro announcements that occur at most 5 days before its nearest upcoming FOMC statement. $\Delta E[Upcoming]$ uses federal funds futures to measure market's expectation regarding the nearest upcoming FOMC policy announcement. Δf^3 is the daily change in 3-month-ahead federal funds futures futures rate. $Days$ represents the number of days each macro announcement is away from its nearest upcoming FOMC statement. Since I use daily changes in my RHS variables, I do not use macro announcements that occur on the same day as an FOMC announcement. For ease of interpretation of main variables and interaction terms, in the first 6 columns, $Days = 0$ on the day before FOMC. In the last 3 columns (7-9), I not only discard macro announcements occurring the same day as FOMC statements but also the day before FOMC, to avoid any overlapping periods in the LHS and RHS variables. Hence, in the last 3 columns $Days = 0$ two days before FOMC statements. See Section 4.1 for more details. ΔVIX and $\Delta MOVE$ are daily changes in VIX and MOVE indices, respectively. $MacroData$ is the standardized macro data release. See Section 4.2 for more details on the macro time series included in $MacroData$.

4.3 Changing Dynamics of Pre-FOMC Drift & Announcement Returns

Having established that macro announcements affect pre-FOMC drift and upcoming FOMC-day-returns by influencing market's expectations regarding forthcoming Fed decisions (Sections 4.1 and 4.2), I dive deeper into this channel by exploring how this relationship might have evolved as the Fed changed the way it did monetary policy after the Great Financial Crisis (GFC) of 2008. Pre-GFC Fed policy was "conventional", which involved changing the federal funds target rate in multiples of 25bps. Post-GFC, the Fed engaged in "unconventional" monetary policy, which involved purchase of various securities, like USTs of different maturities and mortgage backed securities (MBS), worth billions of dollars.

As Alam (2020) also shows, using macro data to form expectations regarding upcoming Fed decisions might be simpler when policy is conventional rather than unconventional. Intuitively, it would appear easier to use macro data to predict conventional Fed actions, e.g., observe the latest CPI/unemployment numbers to forecast rate hikes of 25bps or 50bps or none at all. In contrast, it would be relatively hard to use similar macro data to precisely pin down upcoming unconventional Fed actions, e.g., observe the latest CPI/unemployment numbers to forecast the precise size and composition of the portfolio of securities that the Fed will announce purchasing on its upcoming FOMC statement.

Thus, I estimate equation (5) separately for pre-GFC and post-GFC samples. Since the policy rate was effectively zero and unchanged for a long time post-GFC, I use eurodollar futures rates of 12-month and 48-month horizons instead of Δf^3 to capture changes in expectations regarding the medium-term and long-term path of policy, respectively.[10] See Appendix <> for why it is critical to control for measures of short-term and long-term expectations together, so that their individual effects can be cleanly estimated.

Table 8 shows that proxies of Fed policy expectations only have an effect pre-GFC. This is not only true for predictive regressions (columns 3-6), but also when one allows for some overlap between LHS and RHS variables (columns 1 and 2). Differences in R^2 further substantiate the notion that the explanatory power of market proxies of Fed policy expectations

[10]Similar to federal fund futures, eurodollar futures can be used to gauge market's expectations regarding Federal Reserve policy, since eurodollar rates and federal funds rate co-move strongly. Eurodollar future prices are quoted such that 100 - price quote will provide market's expectation for the 3-month London interbank offered rate that will prevail over the contract's term. Visit CME's website for more details.

was greater in the pre-GFC era, when policy was conventional. For ease of comparison, Table 8 reports results with $\Delta E[Upcoming]$, ΔED^{12m} and ΔED^{48m} as regressors in both pre-GFC and post-GFC samples. Performing these regressions with $\Delta E[Upcoming]$ and Δf^3, as done earlier, would show that R^2 (adjusted R^2) of regressions with pre-FOMC drift as the regressand is 0.53 (0.49) in the pre-GFC sample. Thus, nearly half of the variation in pre-FOMC drift can be explained by the market's changing expectations about Fed policy.

Table 8: Learning About Fed Policy From Macro News: *Changing Dynamics*

			Predictive Regressions			
	Pre-FOMC Drift		Announcement Return		Pre-FOMC Drift	
	Pre-GFC	Post-GFC	Pre-GFC	Post-GFC	Pre-GFC	Post-GFC
$\Delta E[Upcoming]$	-16.75***	8.90	-15.86**	-7.39	-9.76**	14.81
	(5.60)	(12.20)	(7.14)	(15.64)	(3.83)	(11.18)
$\Delta E[Upcoming] * Days$	8.07***	-1.81	5.45**	-9.51	9.71**	-6.60
	(2.86)	(11.46)	(2.39)	(14.00)	(3.94)	(16.72)
ΔED^{12m}	5.41**	0.58	0.07	-2.98	3.52*	2.50
	(2.21)	(0.67)	(3.39)	(4.22)	(1.85)	(1.88)
$\Delta ED^{12m} * Days$	-2.03***	1.10	-0.28	1.33	-2.27**	0.50
	(0.75)	(1.70)	(1.07)	(2.71)	(0.97)	(2.80)
ΔED^{48m}	-6.28***	0.40	-3.41	3.72	-4.27***	1.95
	(1.95)	(1.11)	(3.76)	(5.10)	(1.52)	(1.48)
$\Delta ED^{48m} * Days$	2.23*	0.36	1.25	-0.23	2.58	-0.37
	(1.23)	(1.19)	(1.67)	(2.13)	(1.57)	(1.74)
$Days$	-0.13	0.02	-0.11	-0.16	-0.11	0.06
	(0.09)	(0.09)	(0.09)	(0.10)	(0.11)	(0.10)
$Constant$	0.74***	-0.10	0.44**	0.43	0.60***	-0.15
	(0.20)	(0.17)	(0.21)	(0.26)	(0.16)	(0.10)
Observations	74	71	104	71	65	60
Adjusted R^2	0.324	0.005	0.136	0.032	0.214	0.029

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table shows estimations of equation (5), where the LHS variable is either the pre-FOMC drift or the excess announcement return of the nearest upcoming FOMC announcement. The RHS variables are realizations on macro announcement days preceding FOMC statements. I only focus on those macro announcements that occur at most 5 days before its nearest upcoming FOMC statement. $\Delta E[Upcoming]$ uses federal funds futures to measure market's expectation regarding the nearest upcoming FOMC policy announcement. ΔED^{12m} and ΔED^{48m} are daily changes in the 12-month-ahead and 48-month-ahead eurodollar futures rates, respectively. $Days$ represents the number of days each macro announcement is away from its nearest upcoming FOMC statement. Since I use daily changes in my RHS variables, I do not use macro announcements that occur on the same day as an FOMC announcement. For ease of interpretation of main variables and interaction terms, in the first 4 columns, $Days$ = 0 on the day before FOMC. In the last 2 columns (5 and 6), I not only discard macro announcements occurring the same day as FOMC statements but also the day before FOMC, to avoid any overlapping periods in the LHS and RHS variables. Hence, in the last 3 columns $Days = 0$ two days before FOMC statements. See Section 4.1 for more details. Pre-GFC is defined as the period before 01 July, 2008. Post-GFC is the period after July 01, 2009.

4.4 Unconditional Pre-FOMC Drift and Announcement Returns

The results thus far are silent on why an econometrician might observe both pre-FOMC drift and high announcement returns *unconditionally*. I try to shed light on it here in the context of learning about future Fed policy from macro announcements. The gist of the reasoning given here lies in the observation that, on average, markets have tended to reduce their interest rate expectations on macro announcements just preceding FOMC statements, particularly pre-GFC. I only focus on those macro announcements that happen just before FOMC statements, since as I show in this paper, only macro announcements that are close to upcoming FOMC statements (within the last 3-5 days) have any explanatory power in describing pre-FOMC drift and FOMC-day-returns.

Regressing $\Delta E[Upcoming]$ on $\mathbb{1}^{Macro}$ gives a negative loading on the dummy variable, suggesting that the market's expectations of the policy rate have, on average, fallen on macro announcements just preceding FOMC statements. To be consistent with the rest of the paper, $\mathbb{1}^{Macro}$ takes a value of 1 on all macro announcements that occur at most 5 days before FOMC days, and is 0 otherwise. Also as before, to avoid any confounding effects, I ignore observations in which both macro announcements and FOMC statements happened on the same day. Table 9 reports results of these regressions over the entire, pre-GFC and post-GFC samples, and with and without other controls.[11]

It is important to note what the regressions in Table 9 say and do not say. Since the focus is only on the subset of those macro announcement days that occur within the last 5 days of FOMC statements, these regressions do not say that on macro announcements markets overall anticipated expansionary monetary policy pre-GFC and contractionary policy post-GFC. Gauging that would require running a similar set of regression as the ones below but with $\mathbb{1}^{Macro}$ taking a value of 1 on *all macro announcements*. The regressions of Table 9 instead only suggest that markets revised their policy rate expectations downward (upward) pre-GFC (post-GFC) on the subset of macro announcements that happened up to 5 days before FOMC statements.

[11] Given that there was little variation in short-term rates post-GFC, if one were to repeat this exercise by replacing $\Delta E[Upcoming]$ with ΔED^{48m}, one would see a negative loading on $\mathbb{1}^{Macro}$ over the pre-GFC period and a positive loading on 1^{Macro} over the post-GFC period. This substantiates that, on macro announcements that just precede FOMC statements, market expectations of the long-term path of the policy rate have tended to fall (rise) in the pre-GFC (post-GFC) periods .

Table 9: Falling Policy Rate Expectations on Macro Announcements Preceding FOMC

	Full Sample			Pre-GFC			Post-GFC		
$\mathbb{1}^{Macro}$	-0.37	-0.36	-0.38	-0.77	-0.74	-0.75	0.22***	0.21***	0.22***
	(0.39)	(0.39)	(0.39)	(0.66)	(0.66)	(0.65)	(0.07)	(0.07)	(0.08)
Δf^3		18.26***	18.38***		19.03***	19.19***		8.60	8.59
		(4.82)	(4.84)		(5.18)	(5.19)		(8.71)	(8.70)
ΔED^{12m}			2.69			3.03			-0.72
			(1.99)			(2.79)			(2.07)
ΔED^{48m}			-0.21			0.00			0.12
			(1.41)			(2.85)			(0.42)
$Constant$	-0.09*	-0.09**	-0.09**	-0.16**	-0.16**	-0.15**	0.01	0.00	0.00
	(0.05)	(0.04)	(0.04)	(0.08)	(0.07)	(0.07)	(0.02)	(0.02)	(0.02)
Observations	5,878	5,878	5,878	3,386	3,386	3,386	2,492	2,492	2,492

Newey-West standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table shows estimations of $\Delta E[Upcoming]_t = \alpha + \mathbb{1}_t^{Macro} + Controls_t + \epsilon_t$. $\Delta E[Upcoming]$ uses federal funds futures to measure market's expectation regarding the nearest upcoming FOMC policy announcement. Δf^3 is the daily change in 3-month-ahead federal funds futures futures rate. ΔED^{12m} and ΔED^{48m} are daily changes in the 12-month-ahead and 48-month-ahead eurodollar futures rate, respectively. Full sample is the period spanning 1994-2019, excluding observations between July 01, 2008 and June 30, 2009. Pre-GFC is defined as the period before 01 July, 2008. Post-GFC is the period after July 01, 2009.

Finally, I show in Table 10 that both pre-FOMC drift and high announcement returns are *unconditionally* only a pre-GFC phenomenon. I show that by regressing daily excess returns, computed using close-of-day prices, and excess returns computed over a 24-hour window starting at 2:00pm a day prior to FOMC statements against $\mathbb{1}^{FOMC}$, which is a dummy variable that takes a value of 1 on *all FOMC days* and is 0 otherwise. That is, I do not distinguish between FOMC statements that were or were not preceded by macro announcements. I run these regressions separately for pre-GFC and post-GFC subsamples to show the *unconditional* movement in daily excess returns and pre-FOMC drift before and after the Crisis.

Table 10: Pre-FOMC Drift and Announcement Returns a Pre-GFC Phenomenon

	Announcement Return		Pre-FOMC Drift	
	Pre-GFC	Post-GFC	Pre-GFC	Post-GFC
$\mathbb{1}^{FOMC}$	0.21**	0.07	0.45***	-0.02
	(0.10)	(0.11)	(0.09)	(0.06)
$Constant$	0.01	0.04**	0.01	0.04**
	(0.02)	(0.02)	(0.02)	(0.02)
Observations	3,780	2,783	2,724	2,727
Newey-West standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

Note: This table shows estimations of $\Delta y_t = \alpha + \mathbb{1}_t^{FOMC} + \epsilon_t$, where Δy_t is either daily excess return or the excess return over a 24-hour window starting and ending at 2:00pm. $\mathbb{1}^{FOMC}$ is the set of all scheduled FOMC statements, without distinguishing them based on the presence/absence of macro announcements before their announcement. Pre-GFC is defined as the period before 01 July, 2008. Post-GFC is the period after July 01, 2009.

4.5 International and Cross-Sectional Evidence

For the sake of brevity, I only report below results from estimating equation (5), where the regressand is pre-FOMC drift in international stock indices (Table 11), and excess announcement-return in the cross-section of U.S. equities (Table 12). Both Tables 11 and 12 report estimates from predictive regressions: there is no overlap between LHS and RHS variables.

The results are consistent with the aggregate U.S. stock market. Both pre-FOMC drift in international stock indices and announcement return among the cross-section of U.S. equities strongly respond to market proxies of Fed policy expectations, just like the aggregate U.S. stock market. Similarly, the explanatory power of market proxies is greater when they are realized on macro announcements that are closer to upcoming Fed announcements. While for the sake of comparison Table 12 documents results for the beta sorted portfolios discussed in Section 3.3, carrying out the same exercise for Fama-French industry or book-market portfolios yields similar results.

Table 11: Learning About Fed Policy From Macro News: *International Evidence*

	TSX60	FTSE100	Stoxx50	Nikkei225
$\Delta E[Upcoming]$	-4.48**	-14.28***	-13.82***	-6.42**
	(1.73)	(4.25)	(4.74)	(2.89)
$\Delta E[Upcoming] * Days$	-1.89	4.35***	4.47***	1.90*
	(1.91)	(1.46)	(1.58)	(1.06)
Δf^3	-12.69***	-11.28	-14.55***	-2.67
	(2.05)	(7.02)	(4.77)	(6.22)
$\Delta f^3 * Days$	2.72*	2.99	4.15**	-0.74
	(1.42)	(2.63)	(2.07)	(2.32)
$Days$	-0.05	-0.12**	-0.17***	-0.12
	(0.06)	(0.06)	(0.05)	(0.09)
$Constant$	0.25***	0.39***	0.57***	0.51***
	(0.09)	(0.13)	(0.13)	(0.16)
Observations	114	175	175	175
Adjusted R^2	0.099	0.153	0.194	0.007
Robust standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

Note: This table shows estimations of equation (5), where the LHS variable is the pre-FOMC drift of the nearest upcoming FOMC announcement. The RHS variables are realizations on U.S. macro announcement days preceding FOMC statements. I only focus on those macro announcements that occur at most 5 days before its nearest upcoming FOMC statement. $\Delta E[Upcoming]$ uses federal funds futures to measure market's expectation regarding the nearest upcoming FOMC policy announcement. Δf^3 is the daily change in 3-month-ahead federal funds futures futures rate. $Days$ represents the number of days each trading day is away from its nearest upcoming FOMC statement.

Table 12: Learning About Fed Policy From Macro News: *Cross-Sectional Evidence*

	Lowest β	3	4	5	6	7	8	9	10	Highest β
$\Delta E[Upcoming]$	17.02***	-2.65	-7.71***	-8.15**	-12.04***	-15.42***	-21.51***	-21.92**	-38.94***	-38.94***
	(3.18)	(1.67)	(2.36)	(3.93)	(4.19)	(5.83)	(6.46)	(9.99)	(13.38)	(13.38)
$\Delta E[Upcoming] * Days$	-5.68***	0.80	2.49***	2.62**	4.07***	5.07**	7.15***	7.07**	12.81***	12.81***
	(1.06)	(0.57)	(0.80)	(1.32)	(1.41)	(1.98)	(2.21)	(3.43)	(4.60)	(4.60)
Δf^3	9.94**	-2.65	-7.02	-8.55	-6.04	-0.31	-0.89	1.99	-2.66	-2.66
	(3.95)	(3.17)	(4.93)	(7.26)	(6.35)	(8.47)	(10.41)	(12.91)	(19.41)	(19.41)
$\Delta f^3 * Days$	-3.35**	0.01	1.78	2.75	1.02	-0.28	-0.29	-2.88	1.25	1.25
	(1.49)	(1.01)	(1.34)	(2.17)	(1.77)	(2.41)	(3.09)	(4.26)	(5.51)	(5.51)
$Days$	0.15***	-0.06	-0.10*	-0.16***	-0.19***	-0.20***	-0.21***	-0.25***	-0.30**	-0.30**
	(0.06)	(0.05)	(0.05)	(0.05)	(0.06)	(0.08)	(0.08)	(0.09)	(0.13)	(0.13)
$Constant$	-0.22	0.24**	0.30**	0.49***	0.53***	0.62***	0.67***	0.79***	1.01***	1.01***
	(0.19)	(0.11)	(0.13)	(0.14)	(0.15)	(0.18)	(0.20)	(0.22)	(0.29)	(0.29)
Observations	165	165	165	165	165	165	165	165	165	165
Adjusted R^2	0.048	0.008	0.073	0.089	0.102	0.082	0.107	0.092	0.134	0.134

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table shows estimations of equation (5), where the LHS variable is the announcement return of each portfolio on the nearest upcoming FOMC announcement. The RHS variables are realizations on macro announcement days preceding FOMC statements. I only focus on those macro announcements that occur at most 5 days before its nearest upcoming FOMC statement. $\Delta E[Upcoming]$ uses federal funds futures to measure market's expectation regarding the nearest upcoming FOMC policy announcement. Δf^3 is the daily change in 3-month-ahead federal funds futures futures rate. $Days$ represents the number of days each trading day is away from its nearest upcoming FOMC statement. Since I use daily changes in my RHS variables, I do not use macro announcements that occur on the same day as an FOMC announcement. For ease of interpretation of main variables and interaction terms, $Days$ = 0 on the day before FOMC. See Section 4.1 for more details. Portfolios are formed based on each stock's unconditional beta estimated over the entire sample spanning 1994-2019, excluding the period between July 01, 2008 and June 30, 2009.

Also consistent with the aggregate U.S. stock market, the effects reported above in Tables 11 and 12 are stronger pre-GFC. Furthermore, pre-FOMC drift in international stock indices and announcement returns of U.S. equities are unconditionally significantly positive in the pre-GFC period only. Post-GFC there is neither unconditional drift in international markets, nor unconditional announcement premium in the U.S. cross-section.

5 Key Extensions

The evidence documented thus far shows that asset price behavior around FOMC statements strongly contrasts when FOMC statements occur soon after macro announcements, versus when they do not (Section 3). The key channel through which macro announcements impact future returns around Fed statements is by influencing market expectations regarding the path of monetary policy (Section 4). Here I use these two key insights to discuss the Fed information effect and predictability of conventional monetary policy surprise measures (Section 5.1). In Section 5.2, I show that the finding that the secular decline in interest rates appears to be concentrated around 3-day windows depends crucially on the presence of macro announcements just ahead of FOMC statements. Movements in yields appear transitory around FOMC statements not preceded by macro news.

5.1 Fed Information Effect & Predictable Monetary Policy Surprise

Nakamura and Steinsson (2018) document a "Fed Information Effect", whereby monetary policy surprises on FOMC days are positively associated with future GDP forecasts. This is puzzling since these surprise measures are, on average, negatively associated with equity returns realized on FOMC days. While the latter finding is consistent with standard monetary theory, the former finding is not. Textbook monetary models suggest that expansionary monetary policy should raise future GDP. The results in Table 13 below suggest that the puzzling positive association between GDP forecasts and their shock measure is driven by those FOMC announcements that did occur just after key macro data releases. On all other FOMC announcements, their policy news shock is negatively associated with GDP forecasts, consistent with theory.

My findings documented in Section 4 show that asset price changes on FOMC days reflect responses to *past information*, particularly to macro news released up to a few days prior to FOMC statements. Juxtaposing those findings with the evidence in Table 13 suggest that the Fed information effect may be driven by the market's response to past information, consistent with the findings of Bauer and Swanson (2020).

Table 13: $\Delta GDPForecasts_{i,t} = \alpha_i + \beta_i NSPolicyShock_t + \epsilon_{i,t}$

	1 Quarter	2 Quarters	3 Quarters
Panel A: $AllFOMC$			
$NSPolicyShock$	0.40	0.98*	0.84
	(0.70)	(1.67)	(2.05)
Panel B: $MacroFOMC$			
$NSPolicyShock$	1.12	1.91**	0.75
	(1.42)	(2.35)	(1.09)
Panel C: $FOMCOnly$			
$NSPolicyShock$	-1.21*	-0.73	0.46
	(-1.72)	(-1.00)	(1.04)
Robust t-statistics in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Note: Estimations of the equation written in the table's caption are reported here. The LHS variable, $\Delta GDPForecasts_{i,t}$ captures the change in Blue Chip GDP forecast over a horizon (subscript "i") of 1 to 3 quarters. Forecast horizons are noted in column headers. Estimations are done over different types of FOMC announcements. In Panel A, they are done over all FOMC announcements, without distinguishing them. Panel B shows estimates of regressions done over only those FOMC announcements that had one of the four macro announcements occurring within the last 3 days ($MacroFOMC$). Panel C shows output of regressions performed over all other FOMC announcements, i.e., that did not have one of the four macro announcements occurring within the last 3 days ($FOMCOnly$). Thus each entry in the table shows a point estimate (β_i) and associated t-stat obtained from a separate regression.

Bauer and Swanson (2020) highlight a few outliers (in Figure 1 of their paper) that drive the positive association between GDP forecasts and the Nakamura and Steinsson (2018) policy news variable. Nearly all the outliers they identify have one of the four macro announcements occurring within the last 5 days.[12] In a related study, Bauer and

[12]There are only two exceptions. One is the FOMC announcement on June, 2003 which had both industrial

Swanson (2022) use findings of their prior work in Bauer and Swanson (2020) to show that conventional monetary policy measures, such as the ones constructed by Nakamura and Steinsson (2018), are predictable with past macro and financial data. They propose to regress conventional surprise measures on such past information, and use the residual as an exogenous measure of monetary policy shock on Fed announcements.

However, Bauer and Swanson (2022) do not differentiate between macro data that is released just before FOMC statements with that which is released much prior to FOMC statements. This makes their proposed orthogonalized shock measure predictable too, albeit weakly than the unadjusted measure. While predictability is detectable over the entire sample, it is stronger pre-GFC. This is consistent with the findings of Section 4.3, which showed that learning about upcoming Fed statements from macro news is stronger when policy was conventional (pre-GFC).

In Table 14 below, I regress the unadjusted surprise measure and its orthogonalized counterpart against macro data release, that I standardize as explained in Section 4.2 earlier. I only focus on macro data that is released within the past 3 days of FOMC statements. I obtain shock measures from Michael Bauer's website. The unadjusted and orthogonalized series are the variables listed "MPS" and "MPS_ORTH", respectively, in the data file located under Bauer and Swanson (2022).

production and CPI announcements occurring 6 days prior to FOMC announcement. The other is the FOMC statement released on January, 2004 which had an industrial production announcement happening 8 days prior. The outliers referenced here are those identified in Figure 1 of Bauer and Swanson (2020).

Table 14: Predictability of Monetary Policy Surprise Measures

	Unadjusted MP Shock			Orthogonalized MP Shock		
	Full Sample	Pre-GFC	Post-GFC	Full Sample	Pre-GFC	Post-GFC
$MacroData$	0.011***	0.024***	0.000	0.007*	0.014**	0.001
	(0.004)	(0.007)	(0.005)	(0.004)	(0.006)	(0.004)
Constant	-0.010**	-0.016**	-0.008*	-0.000	-0.005	0.002
	(0.004)	(0.007)	(0.005)	(0.004)	(0.006)	(0.004)
Observations	120	69	51	120	69	51
Adjusted R^2	0.035	0.102	-0.020	0.011	0.033	-0.018
Robust standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

Note: This table shows estimations of $MPShock_t = \alpha + \beta MacroData_{t-} + \epsilon_t$. $MPShock_t$ is either the unadjusted or orthgonalized monetary policy surprise measure obtained from Michael Bauer's website. $MacroData_{t-}$ is standardized past macro data that is announced at most 3 days prior to upcoming FOMC statements. See Section 4.2 for more details on the macro time series used here. Full sample is the period spanning 1994-2019, excluding observations between July 01, 2008 and June 30, 2009. Pre-GFC is defined as the period before 01 July, 2008. Post-GFC is the period after July 01, 2009.

5.2 The Secular Decline of Interest Rates Around FOMC Announcements

Hillenbrand (2022) documents that the entire secular decline in bond yields appears to be concentrated in 3-day windows around FOMC days. One way this case is made is by comparing the hypothetical evolution of the 10-year UST against the actual 10-year UST, where the hypothetical 10y is constructed by cumulating changes in yields over a 3-day window around FOMC statements. The observation that the secular decline in yields is concentrated around FOMC days too seems to be driven by macro announcements.

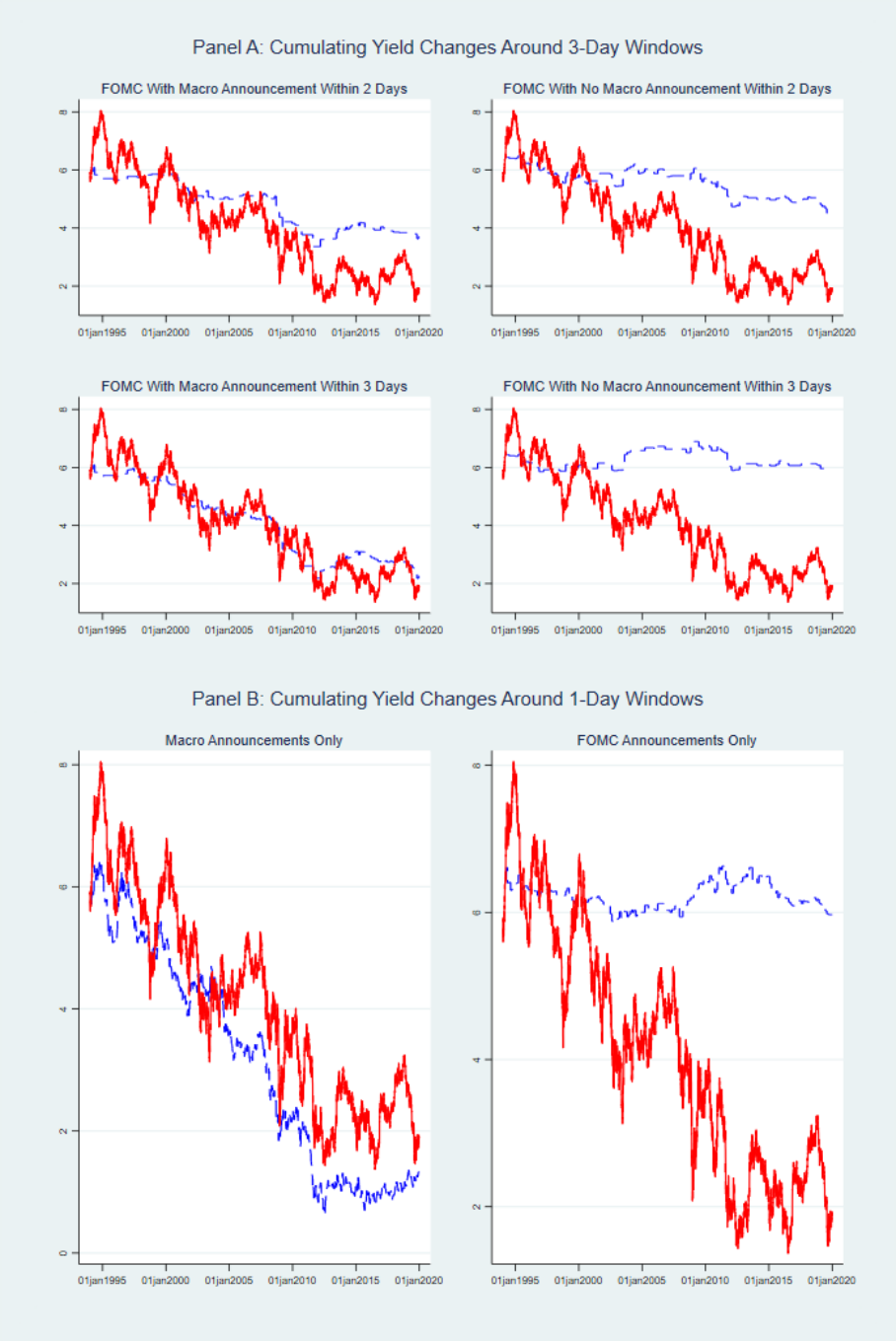
As panel A of Figure 4 shows, cumulating yield changes over 3-day windows around FOMC statements, separated into mutually exclusive sets depending on whether they were preceded by key macro news or not, shows that the decline is concentrated around those FOMC statements that followed soon after macro data releases. Yield changes across the set of those FOMC announcements that did not have a macro announcement within 2 (top-right chart) or 3 days (middle-right chart) appear transitory.

Doing a more conventional event-analysis by only considering 1-day changes in yields

on announcement days shows that the decline in 10y UST is perhaps better described by movements in yields on macro announcements. In panel B of Figure 4, I redo the above exercise but now only cumulate 1-day changes in yields. I do so for the 4 macro announcements I consider in this paper (bottom-left chart) and across all FOMC announcements (bottom-right chart). To avoid confounding in panel B, I ignore the few observations in which one of the four macro announcements occurred the same day as an FOMC announcement. This ensures that in the bottom-left chart changes in yields are truly driven by macro announcements and not by FOMC statements. Similarly, the same ensures that yield changes are truly driven by FOMC statements in the bottom-right chart.[13]

[13] I lose 41 of a total of 209 FOMC statements over the entire sample spanning 1994-2019. Here I include observations between July 2008 and July 2009, which had been ignored throughout this paper. That is why there are 41 FOMC statements that have a macro announcement earlier the same day and not 37 FOMC statements as shown in Table 1. Between July 01 2008 and June 30, 2009, there were 4 FOMC statements that had a macro announcement earlier the same day. Each of the FOMC statements on September 16, 2008, December 16, 2008 and March 18, 2009 had a CPI announcement earlier in the morning. The FOMC announcement on April 29, 2009 had a GDP announcement earlier the same day.

Figure 4. Evolution of 10y UST: Hypothetical (Dotted) vs. Actual (Solid)



Note: This figure compares the hypothetical evolution of the 10-year UST (dotted blue line) against the actual 10-year UST (solid red line), where the hypothetical 10y is constructed by cumulating yield changes over 3-day windows in Panel A and 1-day windows in panel B. In Panel A, I focus on FOMC announcements, and divide them into mutually exclusive sets in each row. In panel B, I plot the hypothetical 10y by cumulating the sum of 1-day yield changes across all FOMC (macro) announcements in the bottom-right (bottom-left) charts. To avoid confounding in panel B, I ignore those observations in which one of the four macro announcements occurred the same day as an FOMC announcement to obtain the true contribution of each type of announcement.

6 A Simple Model

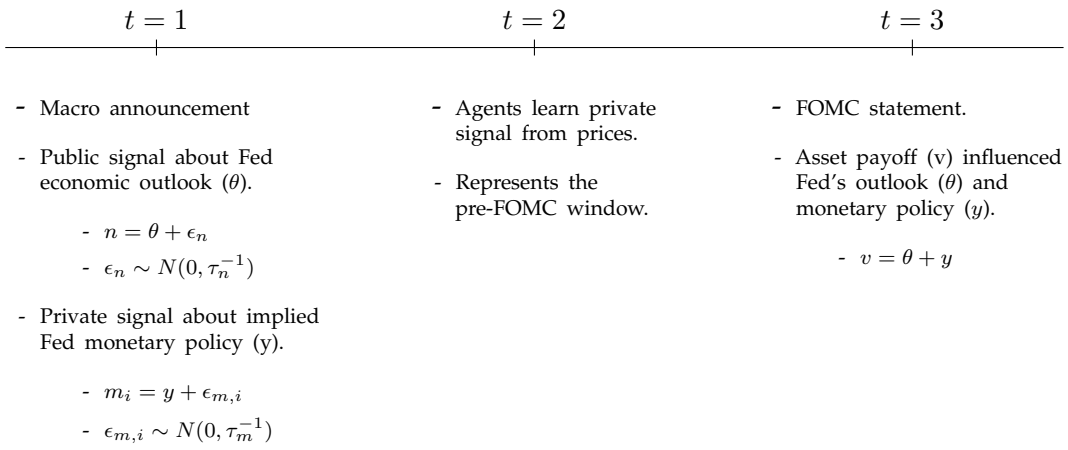
I present a simple information framework to describe the key dynamics of my empirical findings. The setup and timeline are given in the figure below. It shows that informed agents, who have CARA preferences, observe a public signal regarding the economic outlook and a private signal regarding upcoming Fed announcement on a macro announcement that precedes FOMC statement. The macro announcement occurs on the first day, at t=1. On the following day, informed-rational agents might use traded prices to learn other agents' private signals.

This setup is meant to model the idea that after observing the latest macro news (e.g., jobs report), agents might take some time to form their *ultimate views* regarding the latest data release's implications for Fed policy. Agents first form private views on macro announcement day, at t=1. On the following day, agents may learn other people's views e.g., from interviews others give to news agencies, private conversations they may have with other people in their network, or truly from the price reactions agents observe following the macro announcement. The model thereby allows for *a bit of time* to elapse before all information in the economy gets fully reflected in asset prices. That is, learning from the data release, asset prices and from all the agents in the economy is not assumed to occur simultaneously and instantaneously.

Instead the model helps to break down this learning process in a discrete time setup to describe how prices might evolve at high-frequency towards their equilibrium value. This helps to show that predictability of future returns can be ex-post observed for as long as this learning process ensues. In the timeline shown below, t=2 represents the pre-FOMC window. Returns over this period will be ex-post predictable to the econometrician as long as markets continue to learn from the latest macro news. If all learning has concluded by the start of the pre-FOMC window, returns over this period will then not be ex-post predictable.

Figure 5. Model Setup and Timeline

- Two economic fundamentals driving asset price: economic outlook and Fed's monetary policy.
- Total supply of risky asset: Q.
- Two types of agents: informed & noise traders. Informed have CARA preferences.
- Noise traders aggregate demand is x, where $x \sim N(0, \tau_x^{-1})$.
- Informed agents' common priors regarding economic outlook: $\theta \sim N(\mu_\theta, \tau_\theta^{-1})$.
- Informed agents' common priors regarding Fed's monetary policy: $y \sim N(\mu_y, \tau_y^{-1})$.
- Asset payoff realized in $t = 2$ with payoff $v = \theta + y$



Following Goldstein and Yang (2017), I obtain a linear solution of the model by conjecturing a relationship and then verifying it. Prices are conjectured to be linear in priors, agents' signals and noise traders' aggregate demand as follows:

$$P_1 = P_{k1} + P_n n + P_y y + P_x x_1 \tag{7}$$

Given that informed agents have CARA preferences, each of these agents will demand the following quantity of the risky asset.

$$D_{i,1} = \frac{\mu_\theta \tau_\theta + \mu_y \tau_y + n\tau_n + m_i \tau_m - (\tau_\theta + \tau_y + \tau_n + \tau_m) P_1}{\gamma} \tag{8}$$

Using market clearing condition, $\int_0^1 D_{i,1} \ + x = Q$, one can derive the equilibrium price at t=1 to be:

$$P_1 = \left(\frac{1}{\tau_\theta + \tau_y + \tau_n + \tau_m} \right) \left[(-\gamma Q) + (\mu_\theta \tau_\theta + \mu_y \tau_y) + (n\tau_n) + (y\tau_m) + (\gamma x_1) \right] \tag{9}$$

At t=2, rational agents can use prices observed thus far to extract one anothers private signals regarding upcoming Fed policy. The price signal will take the following form:

$$s_p = \frac{P_1 - P_{k1} - P_n n}{P_y} = y + \frac{\gamma}{\tau_m} x_1 = y + \rho^{-1} x_1 \tag{10}$$

This newer information will be reflected in prices at t=2 as follows:

$$P_2 = \left(\frac{1}{\tau_\theta + \tau_y + \tau_n + \tau_m + \rho^2 \tau_x} \right) \left[(-\gamma Q) + (\mu_\theta \tau_\theta + \mu_y \tau_y) + (n\tau_n) + y(\tau_m + \rho^2 \tau_x) + \rho \tau_x x_1 + (\gamma x_2) \right] \tag{11}$$

Defining returns as simply the difference in prices, one can obtain expressions for returns over consecutive days. Note, given the model's timeline, ret_2 represents pre-FOMC drift.

$$\begin{aligned} ret_1 = P_1 - P_0 &\approx \frac{n\tau_n + y\tau_m + \gamma x_1}{\tau_\theta + \tau_y + \tau_n + \tau_m} = \frac{n\tau_n + y\tau_m + \gamma x_1}{a_1} \\ ret_2 = P_2 - P_1 &\approx \frac{y\rho^2 \tau_x + \rho \tau_x x_1 + \gamma x_2}{\tau_\theta + \tau_y + \tau_n + \tau_m + \rho^2 \tau_x} = \frac{y\rho^2 \tau_x + \rho \tau_x x_1 + \gamma x_2}{a_2} \end{aligned} \tag{12}$$

The covariance between pre-FOMC drift and past returns will then be non-zero as shown below

$$Cov(ret_2, ret_1) = \frac{1}{a_1 a_2} \left[\sigma_y^2 \tau_m \rho^2 \tau_x + \gamma \rho \tau_x \sigma_x^2 \right] \tag{13}$$

Finally, one can use equation (13) to observe two key implications. Firstly, covariance or predictability is greater the closer the macro announcement is to forthcoming FOMC days. For example, if there were another trading period between t=2 and FOMC day, that is FOMC occurred on t=4, the expression for $ret_3 = P_3 - P_2$ would simply be noise, introduced by noise traders. Thus, the covariance between ret_3, which would now represent pre-FOMC drift, and past returns on macro days (ret_1) would be zero. Hence, when macro announcement is in the more distant past, the predictability of returns over the pre-FOMC window using past returns would vanish. Secondly, equation (13) also shows that, under certain conditions, predictability is higher the greater the precision of the private signal regarding upcoming Fed decisions is, i.e., predictability rises with τ_m under certain conditions.

7 Conclusion

Often, high returns realized around FOMC statements are interpreted as compensation for holding risk or a puzzle. The results in this paper suggest that these heightened returns may be manifestations of markets learning about forthcoming Fed policy from prior macro data releases. This ability to learn about future Fed policy from macro data is stronger in the pre-GFC era, a period characterized by conventional monetary policies. Intuitively, it is easier to predict Fed actions from macro data, when Fed actions mainly comprise adjusting the federal funds rate (conventional policy). However, when Fed actions comprise various asset purchases (unconventional policies), the same kind of macro data may not be *as helpful* in predicting - with similar precision - announcements of forthcoming unconventional Fed actions .

Broadly speaking, differentiating between FOMC statements preceded by macro news and those that are not helps explain various issues of interest surrounding FOMC announcements. This separation not only helps to understand the pre-FOMC drift and announcement return - the main focus of this paper -, but also explains the Fed information effect, the slope of the security market line realized on FOMC days, the secular decline of interest rates observed in 3-day windows around FOMC statements, as well as the measurement of monetary policy surprise, a key variable of interest for researchers interested in issues surrounding monetary policy. Thus, there is a tale of two FOMC days:

economic outcomes around FOMC statements strongly differ by the presence of macro announcements immediately prior to FOMC announcements. Future research in this space could benefit from this categorization of FOMC announcements.

A final point before I conclude. While I focus on four macro announcements, I do not mean to claim that these are the *only* data releases that might matter. Saying that would require a separate exercise that extensively compares and contrasts contributions of the constellation of macro announcements. When this paper demonstrates that closeness of macro announcements that seem directly relevant in shaping monetary policy expectations appear to be driving the returns realized on FOMC day, it highlights the importance of questioning whether observations made around FOMC statements are solely due to those FOMC announcements, or whether other events may drive or contribute to them.

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