Premium for Heightened Uncertainty

Solving the FOMC Puzzle

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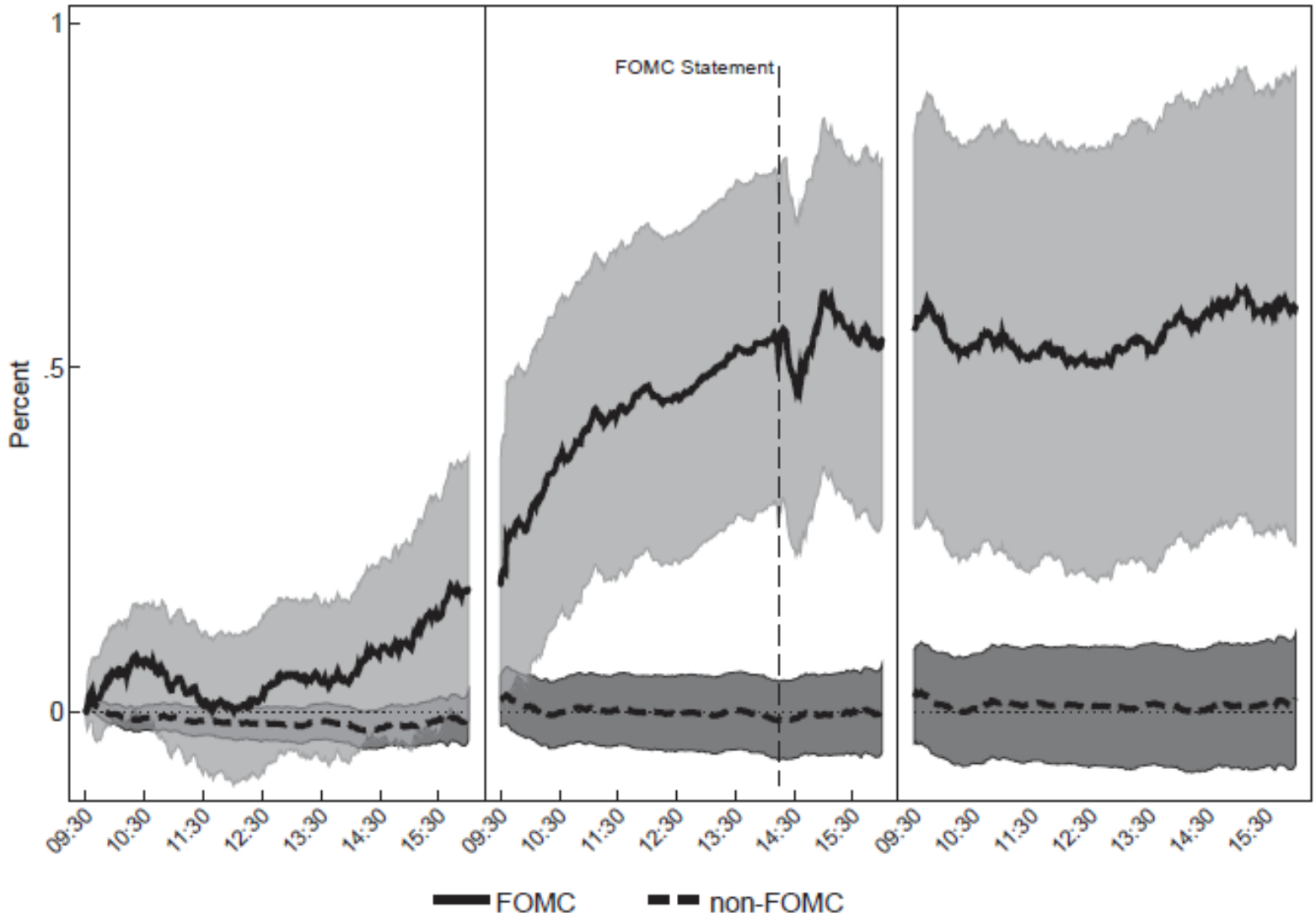
The FOMC Puzzle

Lucca and Moench (2015):

- Over the 24-hour window *before* the scheduled announcements by the Federal Open Market Committee (FOMC), the return on the S&P 500 index is on average **49 bps** per day.
- Markets do not appear to be unusually risky during this window, as measured by return volatility, skewness, kurtosis, or VIX. In fact, this 24-hour window is characterized by lower volatility and lower trading volume.
- This disproportionately large return in the absence of any unusual risk poses an interesting challenge to our understanding of risk and return tradeoff. Why don't investors take advantage of this seemingly attractive opportunity?

The Pre-FOMC Drift



Source: "The Pre-FOMC Announcement Drift" by Lucca and Moench (2015)

Our Hypothesis

- The arrival of important news brings heightened uncertainty to the market. This includes the FOMC announcements and the release of other major macroeconomic indicators (e.g., Nonfarm Payroll, GDP and ISM).
- The pre-scheduled nature of such announcements allows investors to prepare and trade well in advance. The price impact is therefore spread over a relatively long window, making it difficult to measure the real impact of the heightened uncertainty on stock prices.
- By contrast, the resolution of this heightened uncertainty happens over a short window. The condensed nature allows for a better measurement of the risk premium, giving rise to the large pre-FOMC price drift documented in Lucca and Moench (2015).
- Sequentially, there are two resolutions of uncertainty. One occurs before the announcement and the other at the announcement. The pre-FOMC drift arises out of the resolution of the first uncertainty.

Implications

The FOMC result is not unique. As a premium for heightened uncertainty, this pattern of disproportionately large return can occur whenever there is heightened uncertainty.

- **Other pre-scheduled macro announcements:** We find statistically significant pre-announcement returns for the releases of Nonfarm Payroll, GDP, and ISM around **10 bps** per day, compared with **27 bps** per day for FOMC.
- **Heightened uncertainty triggered unexpectedly:** We find disproportionately large returns, around **48 bps** per day, on days following large increases in VIX. Akin to the FOMC result, such heightened-uncertainty days occur on average only eight times per year, but account for more than 30% of the average annual return on the S&P 500 index.

FOMC and Other Macro Announcements

	FOMC	NFP	GDP (Adv+Fin)	ISM	IP	PI	GDP (Pre)	HST	INC	PPI	CPI	CSI
Pre-Announcement [4pm, ann-5min]												
Ret	**27.14**	**10.10**	**9.62**	**9.14**	5.23	3.50	3.48	2.46	1.51	-0.58	-2.14	-4.03
	[5.95]	[3.63]	[2.06]	[2.10]	[1.19]	[0.94]	[0.63]	[0.69]	[0.92]	[-0.17]	[-0.69]	[-0.88]
Post-Announcement [ann-5min, 4pm]												
Ret	1.68	1.51	-4.89	11.39	5.23	2.26	-7.37	1.31	0.99	4.72	-2.31	-1.57
	[0.23]	[0.21]	[-0.59]	[1.85]	[1.19]	[-0.83]	[0.35]	[0.20]	[0.30]	[0.64]	[-0.32]	[-0.30]
Announcement [ann-5min, ann+5min]												
Ret	2.84	4.93	-1.74	2.90	-0.35	0.29	1.89	1.18	0.14	-1.51	1.56	-2.17
	[1.07]	[1.58]	[-0.71]	[1.53]	[-0.52]	[0.36]	[0.90]	[1.28]	[0.25]	[-1.14]	[0.87]	[-1.36]
|Ret|	25.66	35.97	18.04	22.61	6.73	8.03	11.8	9.33	11.27	13.8	17.46	16.60

Heightened Uncertainty Captured by Heightened VIX

- **Heightened VIX:** Day t is defined as a heightened VIX day if

$$\Delta \text{VIX}_t = \text{VIX}_t - \text{VIX}_{t-1} \geq \text{cutoff}\,,$$

for a pre-determined cutoff value. The premium for the heightened uncertainty is measured from the next-day return R_{t+1}.

- **Refining the Signal:** Day t is defined as a heightened VIX day if

$$\text{VIX}_t - \mu_{t-1} \geq \text{cutoff}\,,$$

where

$$\mu_{t-1} = \lambda\, \mu_{t-2} + (1-\lambda)\, \text{VIX}_{t-1}\,,$$

with λ serving as the decay factor.

Premium for Heightened VIX

1986-2018				1994-2018			
cutoff (%)	N Days (/year)	Ret (bps)	T-stat	cutoff (%)	N Days (/year)	Ret (bps)	T-stat
4.0	3.6	36	1.19	4.0	3.9	**59**	2.07
3.8	4.2	24	0.90	3.8	4.6	43	1.63
3.6	4.7	22	0.90	3.6	5.1	38	1.57
3.4	5.1	25	1.11	3.4	5.5	40	1.78
3.2	5.7	27	1.31	3.2	6.3	**42**	2.07
3.0	6.9	31	1.73	3.0	7.7	**43**	2.46
2.8	7.8	**34**	2.15	2.8	8.7	**44**	2.83
2.6	9.3	**31**	2.26	2.6	10.5	**39**	2.89
2.4	10.4	**29**	2.33	2.4	11.6	**38**	3.03
2.2	12.3	**22**	2.02	2.2	13.7	**29**	2.65
2.0	14.3	17	1.78	2.0	15.9	**24**	2.45
$\text{std}(\Delta \text{VIX}_t) = 2.16\%$				$\text{std}(\Delta \text{VIX}_t) = 1.59\%$			

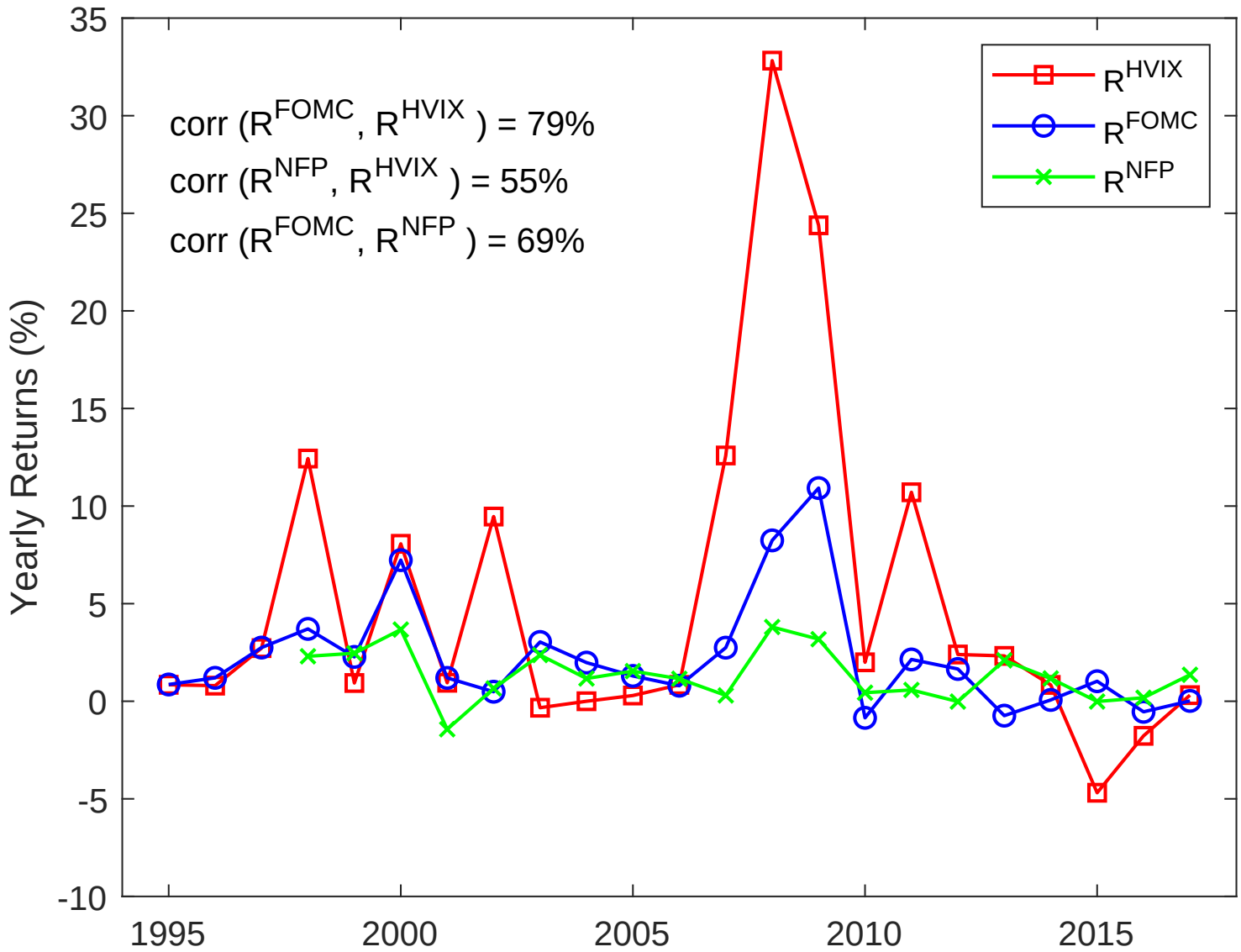
Premium for Heightened VIX, Refined with $\lambda = 0.3$

1986-2018				1994-2018			
cutoff (%)	N Days (/year)	Ret (bps)	T-stat	cutoff (%)	N Days (/year)	Ret (bps)	T-stat
4.0	4.0	53	1.74	4.0	4.5	**66**	2.29
3.8	4.5	52	1.90	3.8	5.0	**67**	2.55
3.6	5.1	46	1.87	3.6	5.7	**59**	2.48
3.4	5.7	**47**	2.13	3.4	6.3	**61**	2.83
3.2	6.4	**43**	2.16	3.2	7.3	**55**	2.80
3.0	7.6	**48**	2.71	3.0	8.5	**57**	3.24
2.8	8.5	**43**	2.68	2.8	9.5	**51**	3.15
2.6	9.9	**33**	2.31	2.6	10.9	**39**	2.68
2.4	11.1	**27**	2.12	2.4	12.5	**31**	2.41
2.2	12.9	**24**	2.14	2.2	14.3	**29**	2.48
2.0	14.9	**22**	2.16	2.0	16.4	**28**	2.70

Yearly Pre-Announcement Returns

	Event Days						All Days
	FOMC 95-17	NFP 98-17	GDP 98-17	ISM 95-17	HVIX 95-17	HVIX 86-17	SPX 95-17
Return (%)	2.24 [3.68]	1.35 [4.47]	0.78 [3.47]	1.23 [1.82]	5.17 [2.83]	3.71 [2.62]	9.61 [2.55]
N Days/Year	8	12	7	12	9	8	252
N Days	184	235	145	268	196	240	5791
N Years	23	20	20	23	23	32	23
Avg VIX (%)	19.83	19.92	19.67	20.20	32.91	33.84	19.82

Yearly Pre-Announcement Returns



Yearly Pre-Announcement Returns: Commonality

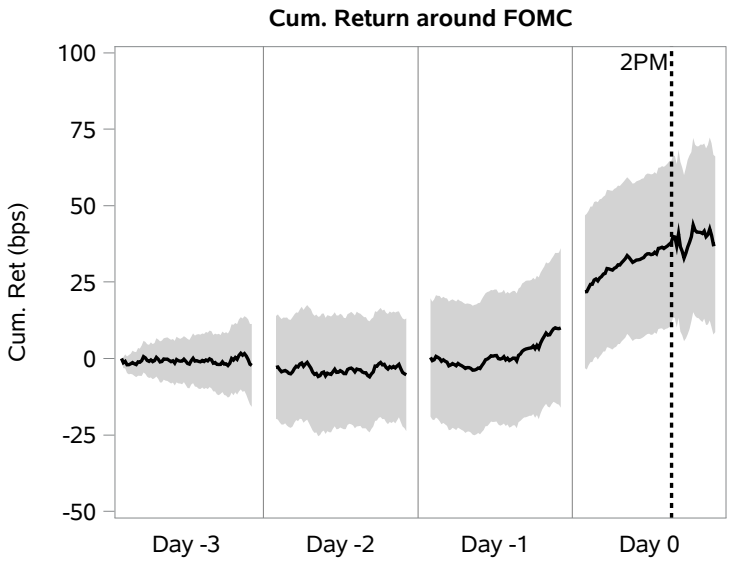
	Dependent Variable: Yearly Pre-Announcement Returns (%)						
	FOMC	FOMC	NFP	NFP	GDP	ISM	HVIX
Intercept	-4.62	-1.71	-0.73	0.73	-0.08	0.12	-13.09
	[-2.59]	[-1.06]	[-0.68]	[0.68]	[-0.09]	[0.04]	[-2.64]
SPX Ret (%)	0.01	0.03	0.02	0.03	-0.01	0.06	-0.07
	[0.48]	[1.27]	[1.05]	[1.65]	[-0.84]	[1.68]	[-0.87]
VIX (%)	**0.34**	0.13	**0.10**	-0.01	0.04	0.06	**0.95**
	[4.21]	[1.49]	[1.99]	[-0.12]	[0.89]	[0.39]	[4.26]
HVIX Ret (%)		**0.22**		**0.10**	0.01	-0.12	
		[3.68]		[2.63]	[0.34]	[-1.16]	
R-Squared (%)	47.5	67.5	17.4	39.5	22.1	24.8	55.3
N Obs	23	23	20	20	20	23	23

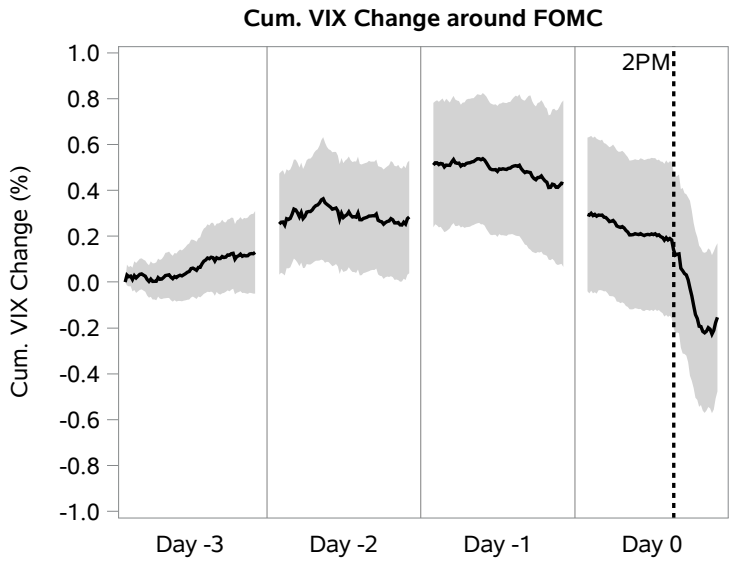
Direct Evidence of Heightened Uncertainty

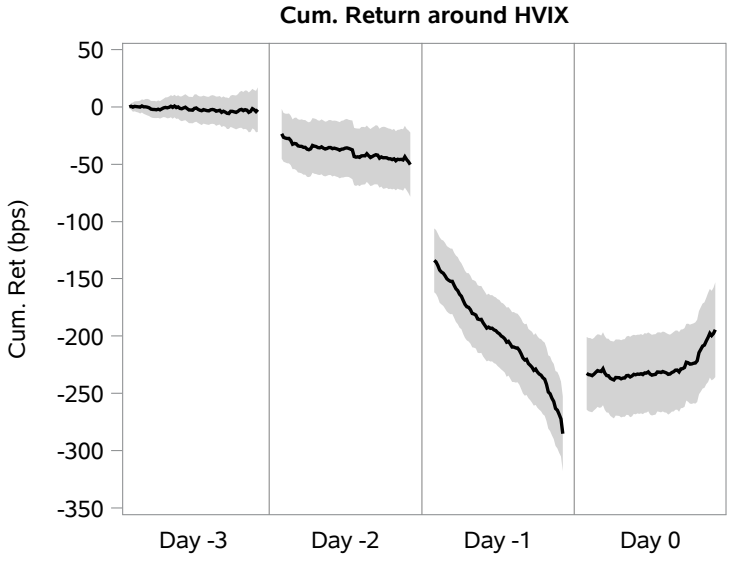
Inspired by the Heightened VIX result, we search for direct evidence of heightened uncertainty using VIX as a proxy.

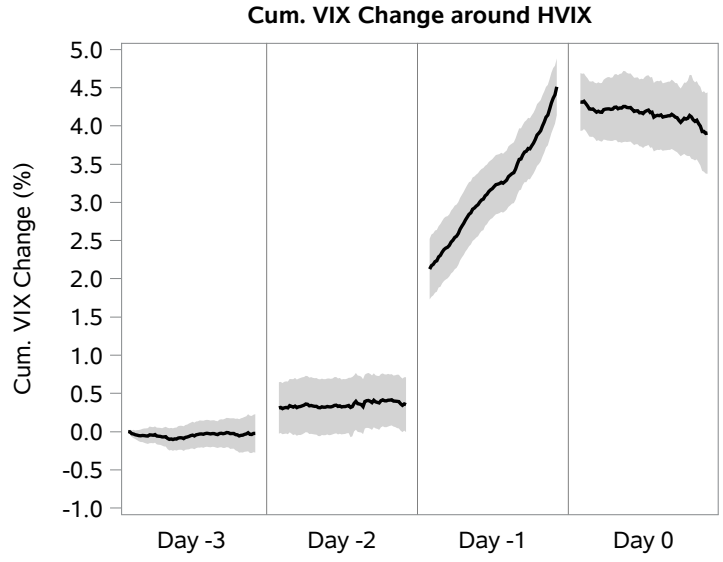
- We find a gradual but significant build-up in VIX over a window of up to six business days prior to the FOMC announcements.
- Sorting FOMC days by their pre-FOMC drift, we find that the prolonged build-up in VIX is driven mostly by the high-drift group.
- Focusing on this high-drift group, we find a gradual but significant price drop of **83 bps** over the span of six business days prior to the FOMC announcements. Interestingly, the pre-FOMC drift is on average **92 bps** for this group.

FOMC vs. Heightened VIX: Patterns in Price and VIX

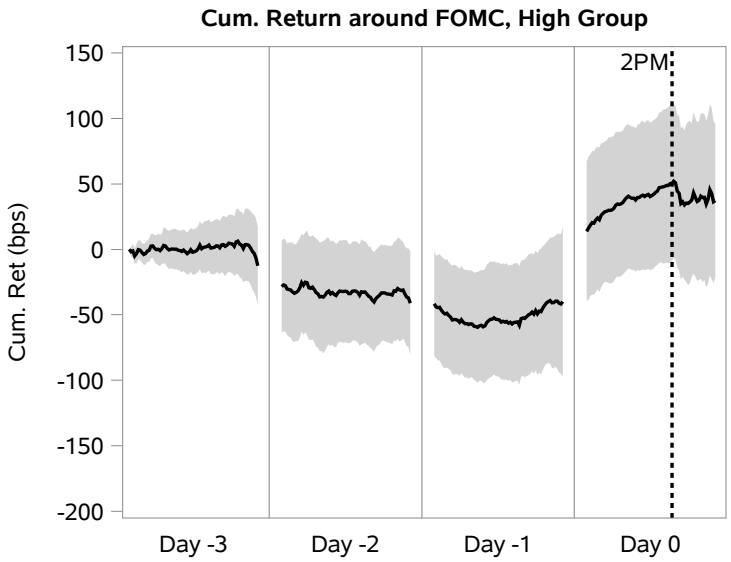


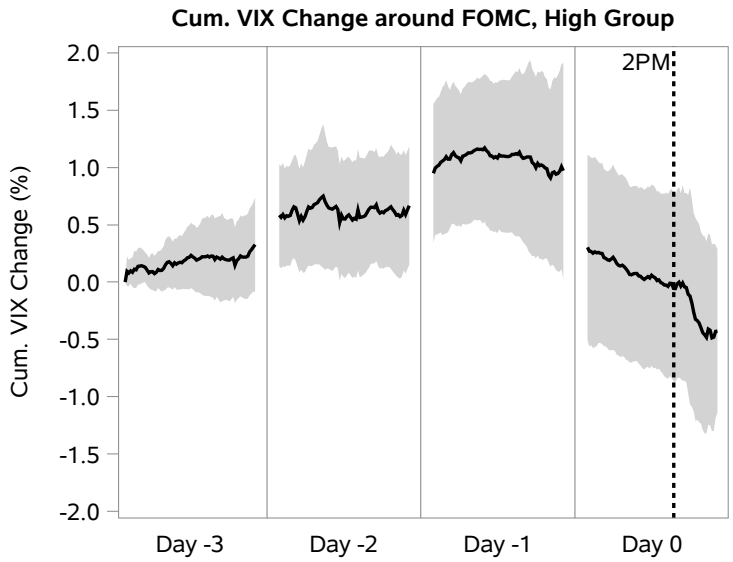


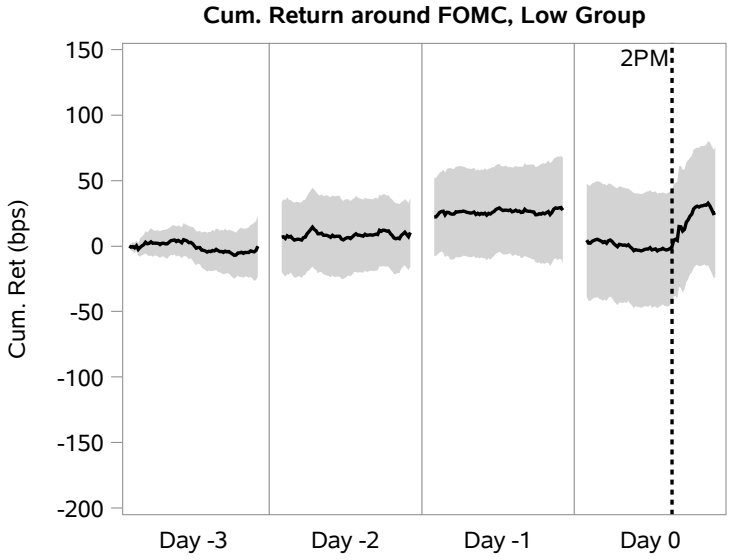


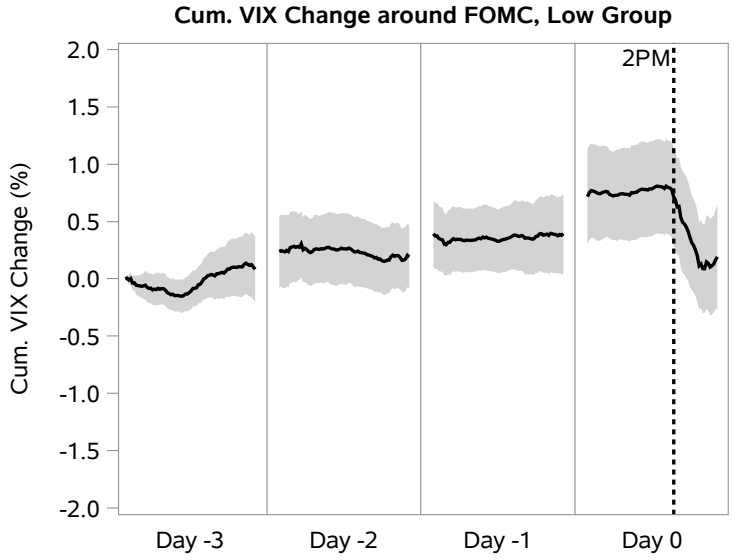


FOMC Days: High and Low Pre-FOMC Drift









Sorting FOMC Days by Pre-Announcement Returns

	FOMC			Matched			Wed			Unconditional		
	High	Med	Low	High	Med	Low	High	Med	Low	FOMC	Matched	Wed
Event Day Avg Returns (bps)												
4pm - ann	**92**	**19**	**-29**	**47**	0.6	-8.8	**102**	**8.4**	**-73**	**27**	**13**	12
	[12.53]	[12.83]	[-7.64]	[3.76]	[0.08]	[-0.86]	[10.62]	[4.39]	[-8.01]	[5.95]	[2.12]	[1.80]
ann - 4pm	-11	-12	**28**	**20**	3.8	8.4	6.4	2.0	**-22**	1.7	**11**	-4.4
	[-0.70]	[-1.16]	[2.57]	[2.96]	[0.57]	[1.20]	[0.77]	[0.36]	[-2.69]	[0.23]	[2.70]	[-1.01]
4pm - 4pm	**81**	7.4	-1.5	**67**	4.3	-0.5	**109**	10	**-95**	**29**	**24**	8.1
	[4.27]	[0.77]	[-0.14]	[4.58]	[0.46]	[-0.05]	[7.89]	[1.83]	[-6.15]	[3.44]	[3.33]	[0.87]
Event Day Changes in VIX (%)												
4pm - ann	**-0.96**	-0.11	**0.40**	**-0.57**	0.11	0.14	**-0.97**	-0.07	**0.71**	**-0.22**	-0.10	-0.12
	[-7.44]	[-1.71]	[4.32]	[-3.13]	[1.22]	[0.91]	[-8.14]	[-1.07]	[5.46]	[-3.18]	[-1.17]	[-1.48]
ann - 4pm	**-0.41**	-0.06	**-0.62**	**-0.23**	-0.04	-0.07	0.03	**-0.13**	**0.24**	**-0.36**	**-0.11**	0.05
	[-2.16]	[-0.61]	[-5.20]	[-3.02]	[-0.65]	[-1.16]	[0.32]	[-2.01]	[2.41]	[-4.35]	[-2.89]	[0.88]
4pm - 4pm	**-1.37**	-0.17	-0.22	**-0.80**	0.07	0.07	**-0.94**	**-0.20**	**0.95**	**-0.58**	**-0.21**	-0.07
	[-4.95]	[-1.67]	[-1.57]	[-3.94]	[0.69]	[0.41]	[-6.26]	[-2.04]	[5.15]	[-5.07]	[-2.21]	[-0.71]
VIX Level	23.5	17.1	18.4	23.2	17.1	18.0	19.8	18.2	21.3	19.7	19.4	19.8
Cumulative Changes in VIX (%)												
Cum [-3 -1]	**1.20**	-0.20	**0.41**	0.35	-0.21	0.01	-0.06	-0.11	0.14	**0.47**	0.05	-0.01
	[2.52]	[-0.85]	[1.98]	[1.06]	[-0.91]	[0.05]	[-0.20]	[-0.42]	[0.43]	[2.43]	[0.33]	[-0.04]
Cum [-6 -1]	**1.74**	-0.40	0.44	0.04	-0.24	-0.24	-0.14	-0.05	-0.05	**0.59**	-0.14	-0.08
	[3.30]	[-1.21]	[1.44]	[0.11]	[-0.82]	[-0.75]	[-0.33]	[-0.13]	[-0.12]	[2.46]	[-0.76]	[-0.34]
Cumulative Returns (bps)												
Cum [-3 -1]	-55	**46**	27	-20	36	4.8	6.1	28	4.8	6.4	7.1	13
	[-1.84]	[2.78]	[1.21]	[-0.71]	[1.86]	[0.23]	[0.22]	[1.40]	[0.19]	[0.46]	[0.53]	[0.92]
Cum [-6 -1]	**-83**	**98**	42	-8.4	**48**	44	7.4	50	26	20	28	28
	[-2.40]	[3.07]	[1.57]	[-0.22]	[2.13]	[1.58]	[0.21]	[1.56]	[0.72]	[1.04]	[1.59]	[1.41]
N Days	63	64	63	63	64	63	63	64	63	190	190	190

Conclusions

- Our results provide compelling evidence that the FOMC days are not unique in yielding the disproportionately large returns. When viewed from the perspective of heightened uncertainty, the FOMC puzzle is not really a puzzle, but a manifestation of risk and return trade-off.
- Investigating heightened uncertainty and its asset pricing implications, we are the first to document:
  - Significant pre-announcement returns for macroeconomic releases such as NFP, GDP, and ISM.
  - Disproportionately large returns after heightened VIX.
  - Significant buildup in VIX prior to FOMC announcements.