The Economics of the Fed "Put"

Anna Cieślak, Duke University Fuqua, CEPR

Annette Vissing-Jorgensen, UC Berkeley Haas, NBER

2018 JHU Carey Finance Conference
Frontiers in Macrofinance

June 1, 2018

Research agenda

Q1. How much does the Fed *affect* the stock market?
→ *Cieslak, Morse, Vissing-Jorgensen (JF, forth)*

Q2. How much does the Fed *react to* the stock market?
→ *This paper*

Q1 and **Q2** are linked via **Fed put**: Unexpectedly large accommodation after stock market declines.

– The Fed responds aggressively to the stock market.

– This Fed response boosts the stock market.

This paper focuses on Q2

(a)   How does the stock market <u>compare</u> to economic indicators as predictor of Fed policy?

This paper focuses on Q2

(a) How does the stock market <u>compare</u> to economic indicators as predictor of Fed policy?

(b) Is the Fed reacting to the stock market or to variables <u>correlated</u> with the stock market?

→ *Causality by textual analysis*

This paper focuses on Q2

(a) How does the stock market <u>compare</u> to economic indicators as predictor of Fed policy?

(b) Is the Fed reacting to the stock market or to variables <u>correlated</u> with the stock market?

  → *Causality by textual analysis*

(c) If the Fed does in fact react to the stock market, then <u>why</u> are they doing it?

  → *Mechanism by textual analysis*

This paper focuses on Q2

(a) How does the stock market <u>compare</u> to economic indicators as predictor of Fed policy?

(b) Is the Fed reacting to the stock market or to variables <u>correlated</u> with the stock market?

→ *Causality by textual analysis*

(c) If the Fed does in fact react to the stock market, then <u>why</u> are they doing it?

→ *Mechanism by textual analysis*

(d) If the Fed does in fact react to the stock market, are they doing it <u>too much</u>?

This paper focuses on Q2

(a) How does the stock market <u>compare</u> to economic indicators as predictor of Fed policy?

(b) Is the Fed reacting to the stock market or to variables <u>correlated</u> with the stock market?

→ *Causality by textual analysis*

(c) If the Fed does in fact react to the stock market, then <u>why</u> are they doing it?

→ *Mechanism by textual analysis*

(d) If the Fed does in fact react to the stock market, are they doing it <u>too much</u>?

Main findings:

(1) The stock market <u>does cause</u> Fed policy

(2) Largely <u>rational</u> given Fed's view of the stock market driving the economy

→ *About 80% of the effect runs through Fed's update of growth expectations*

→ *Mainly via consumption wealth effect*

Fed funds target and intermeeting stock returns

Changes in FFR target (m-1 to m+X) conditional on intermeeting stock returns (m-1 to m)
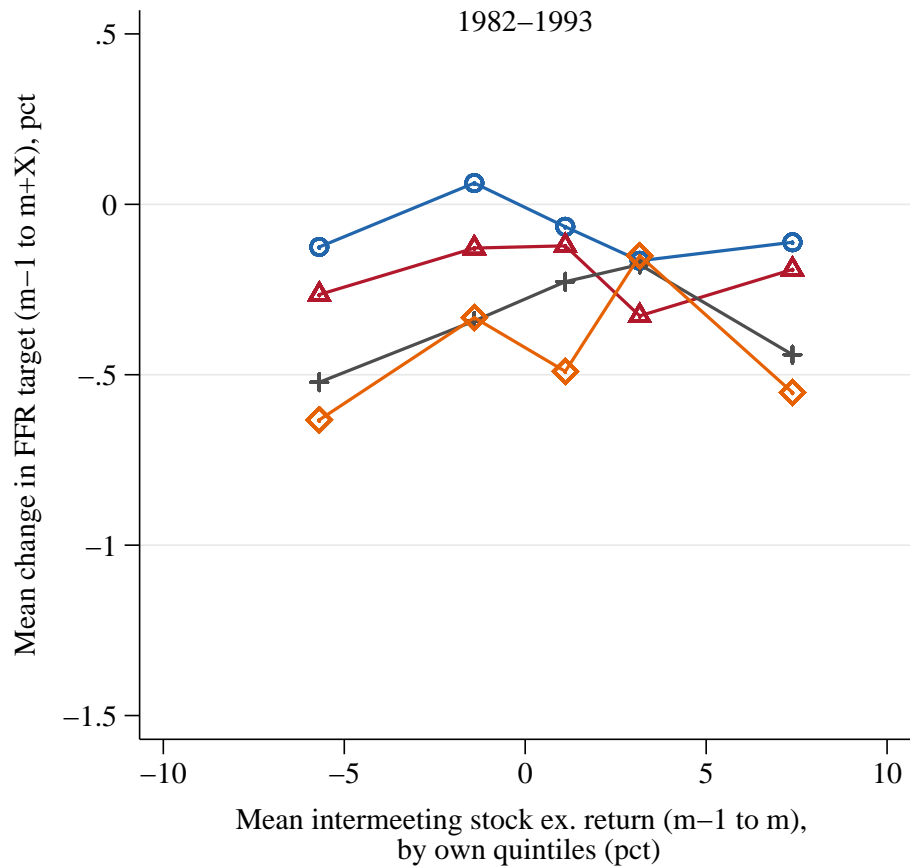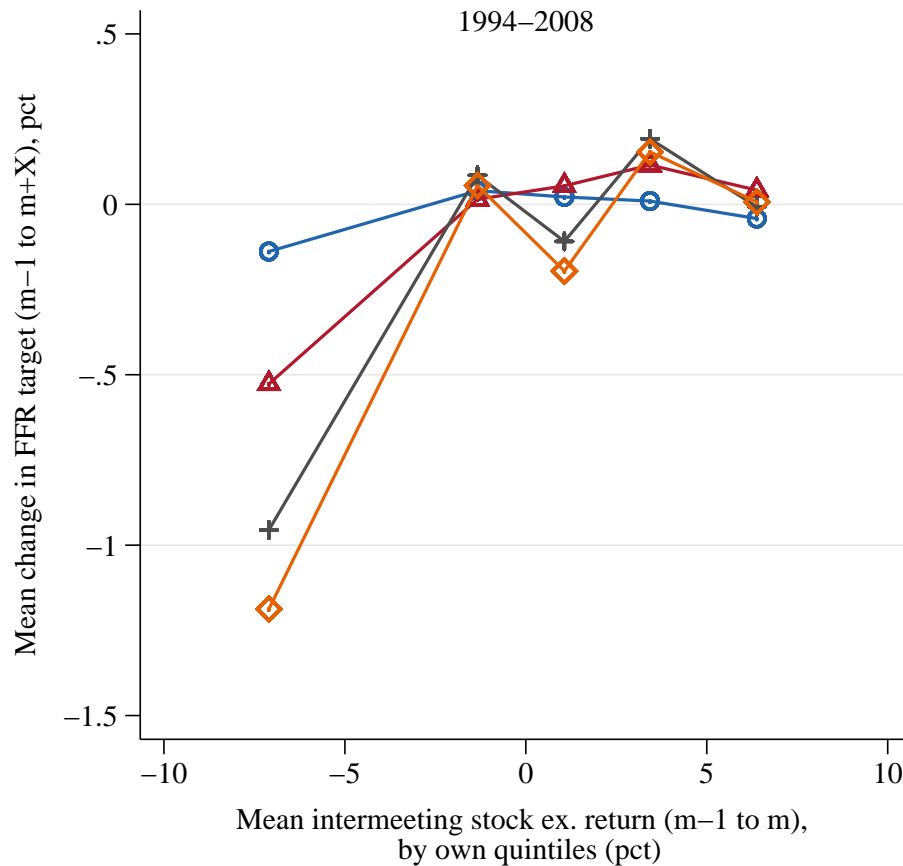
- The Fed's reaction to the stock market (Q2), and/or variables correlated with the stock market, shows up as a <u>Fed put in the target</u>.

Fed policy appears to respond to the stock market

☐ The Fed has come under criticism for being driven by the stock market rather than economic data:

"It is not obvious what their strategy is. I know they say they're data dependent. I don't know exactly what that means. [...] They look to me asset price dependent, more than they look [economic] data dependent. <u>When the stock market falls like it did in the beginning of this year, they say: 'Oh, we'd better not do anything.'</u> Stock markets are now at career highs. I suspect when they meet over the course of the next 10 days, they will suggest now they look like they can be somewhat more responsible."

Former Governor Kevin Warsh on CNBC's "Squawk Box" interview, July 14, 2016

Outline for the remainder of this paper

(a) How does the stock market <u>compare</u> to economic indicators as predictor of Fed policy?

(b) Is the Fed reacting to the stock market or to variables <u>correlated</u> with the stock market?

(c) If the Fed does in fact react to the stock market, then <u>why</u> are they doing it?

(d) If the Fed does in fact react to the stock market, are they doing it <u>too much</u>?

(a) How does the stock market compare to economic indicators as predictor of Fed policy?

Ability of the stock market "put" and macroeconomic indicators to explain FFR target changes

$$\Delta\text{FFR}_m = \beta_0 + \beta_1\Delta\text{FFR}_{m-1} + \beta_2\Delta\text{FFR}_{m-2} + \delta_1 x_m + \delta_2 x_{m-1} + \gamma_1 \mathbf{1}_{x_m} + \gamma_1 \mathbf{1}_{x_{m-1}} + \varepsilon_m \qquad (1)$$

$$\Delta\text{FFR}_m = \beta_0 + \beta_1\Delta\text{FFR}_{m-1} + \beta_2\Delta\text{FFR}_{m-2} + \gamma_1 \mathbf{1}_{x_m} + \gamma_1 \mathbf{1}_{x_{m-1}} + \varepsilon_m \qquad (2)$$

Indicator, x_m	Bloomberg ticker	Incremental R^2	p-value
1. Stock market put, rx^-		0.182	<0.0001
2. Philadelphia Fed.	OUTFGAF Index	0.159	<0.0001
3. ISM Manufacturing	NAPMPMI Index	0.110	0.0001
4. ISM Non-Manufacturing	NAPMNMI Index	0.096	0.0005
5. Housing Starts	NHSPSTOT Index	0.091	0.001
6. Industrial Production	IP CHNG Index	0.087	0.001
7. Consumer Confidence	CONCCONF Index	0.075	0.003
8. Change in Manufact. Payrolls	USMMMNCH Index	0.061	0.010
9. Import Price Index (MoM)	IMP1CHNG Index	0.060	0.010
10. New Home Sales	NHSLTOT Index	0.054	0.016
11. Change in Nonfarm Payrolls	NFP TCH Index	0.053	0.018
12. Chicago Purchasing Manager	CHPMINDX Index	0.052	0.019
13. U. of Michigan Confidence	CONSSENT Index	0.050	0.023
14. Capacity Utilization	CPTICHNG Index	0.049	0.024
15. Consumer Price Index NSA	CPURNSA Index	0.049	0.025

Note: Bloomberg economic announcements calendar, sample: 1996:10–2008:12.

Indicator x_m is measured before m-th meeting.

Other macro news ⤳

(b) Is the Fed reacting to the stock market or to variables correlated with the stock market?

There are two possible interpretations of the above evidence:

A. *Causal:* The stock market *drives* or *predicts* economic variables the Fed cares about.

$\rightarrow$ Thus, the Fed rationally pays attention to the stock market.

B. *Coincidental:* The Fed does not pay attention to the stock market.

$\rightarrow$ The stock market just happens to be correlated with variables that drive or predict Fed's decision making.

Use of **textual analysis** in establishing **causality** and **mechanism**:

☐ Measuring Fed's attention to the stock market (necessary condition)

☐ Measuring context in which Fed officials discuss the stock market to establish mechanism through which the stock market drives policy

Textual analysis of FOMC minutes and transcripts

☐ FOMC meetings are highly structured events which always include:

1. Staff Review of the Economic Situation

2. Staff Review of the Financial Situation

3. Staff Economic Outlook

4. Participants' Views on Current Conditions and the Economic Outlook

5. Committee Policy Action

☐ We focus on these parts of the meetings, dropping other parts (lists of who attends, authorizations for Fed operations, discussion of particular topics etc.)

Textual analysis of FOMC minutes and transcripts

☐ FOMC minutes:

- *"... record all decisions taken by the Committee with respect to these policy issues and explain the reasoning behind these decisions."*
- Available a few weeks after the FOMC meeting (1994–2016 available).
- 7–10 pages long (focusing on the above sections).

☐ FOMC transcripts:

- 5-year release lag (1994–2011 available).
- 200–300 pages per meeting.

	Sample	Number	Count of sentences			
		of docs	Mean	Stdev	Min	Max
Minutes	1994–2016	184	177.5	44.1	106	287
Transcripts	1994–2011	144	2043.4	2003.6	726	3986

Textual analysis of FOMC minutes

We start by extracting all paragraphs in the FOMC minutes that mention the stock market:

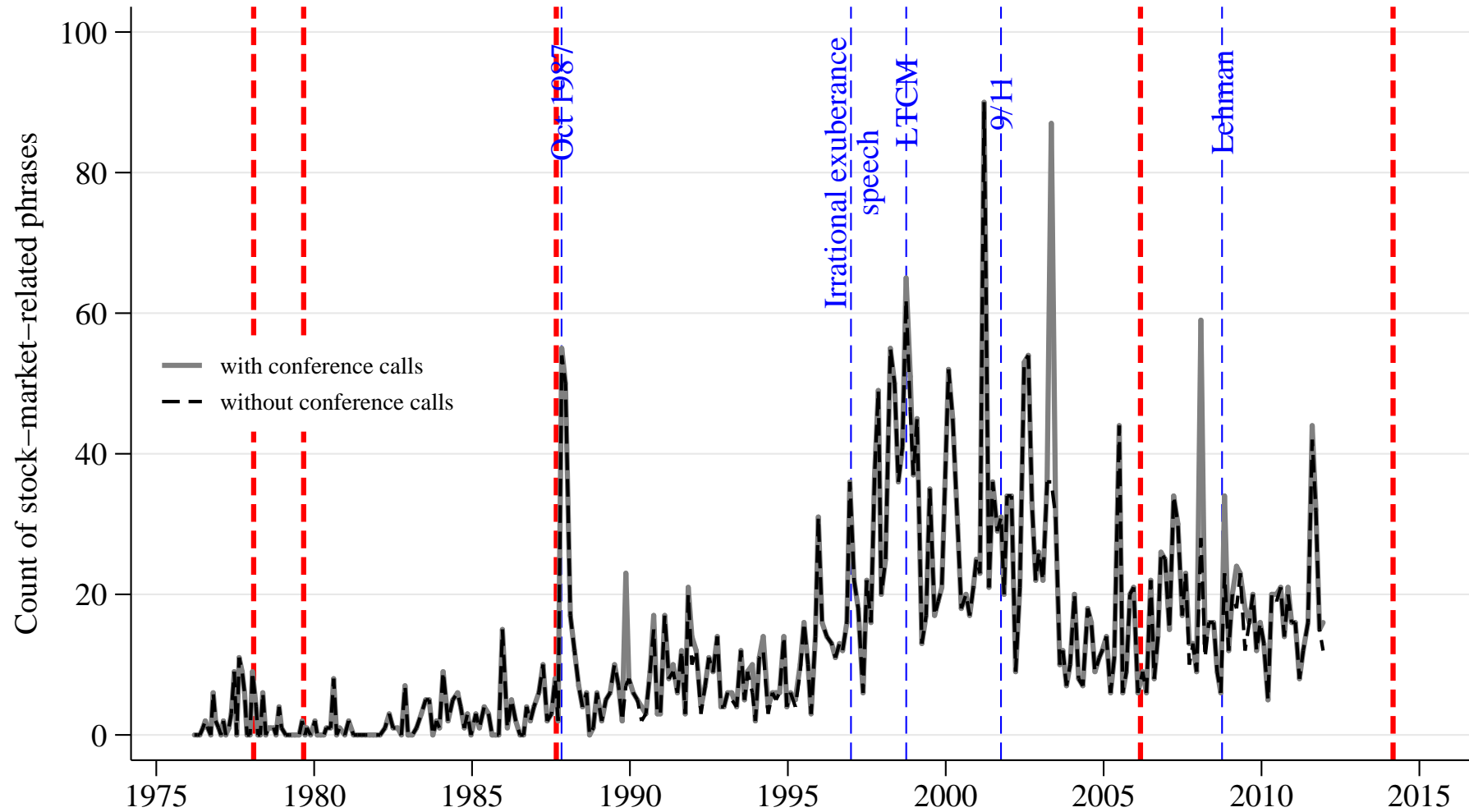| Phrase	Count
stock market	153
stock pri*	137
stock ind*	5
S&P 500 index	51
equities	22
equity and home price*	3
equity and house price*	6
equity and housing price*	2
equity ind*	58
equity market*	125
equity price*	385
equity value*	23
equity wealth	6
home and equity price*	4
house and equity price*	2
housing and equity price*	1
Total	**983**

Stock market mentions in FOMC minutes

Stock market related phrases in FOMC minutes (1976–2016)
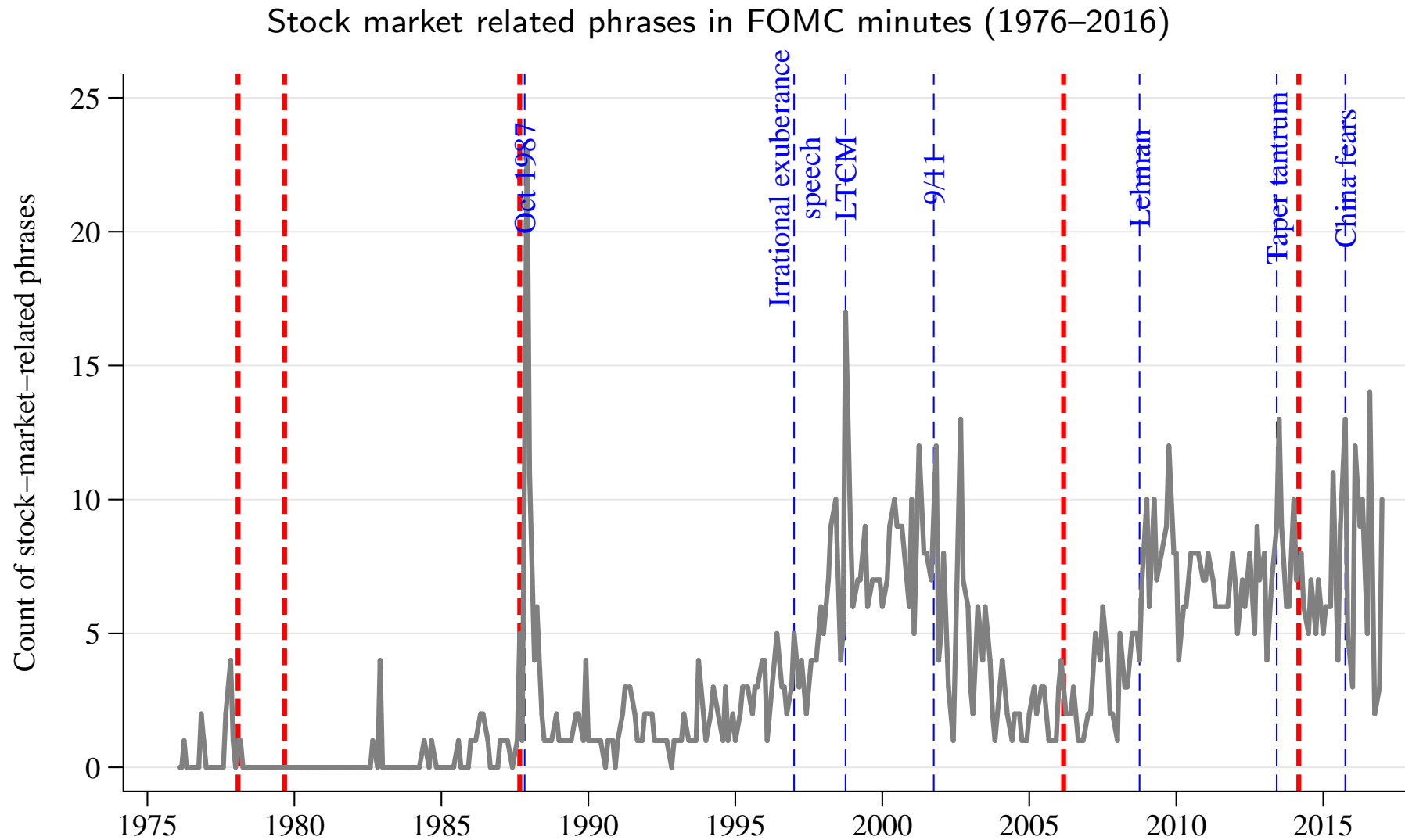
Minutes in their current format are available from 1993. Before 1993, we combine Records of Policy Actions and Minutes of Actions.

Stock market mentions in FOMC transcripts

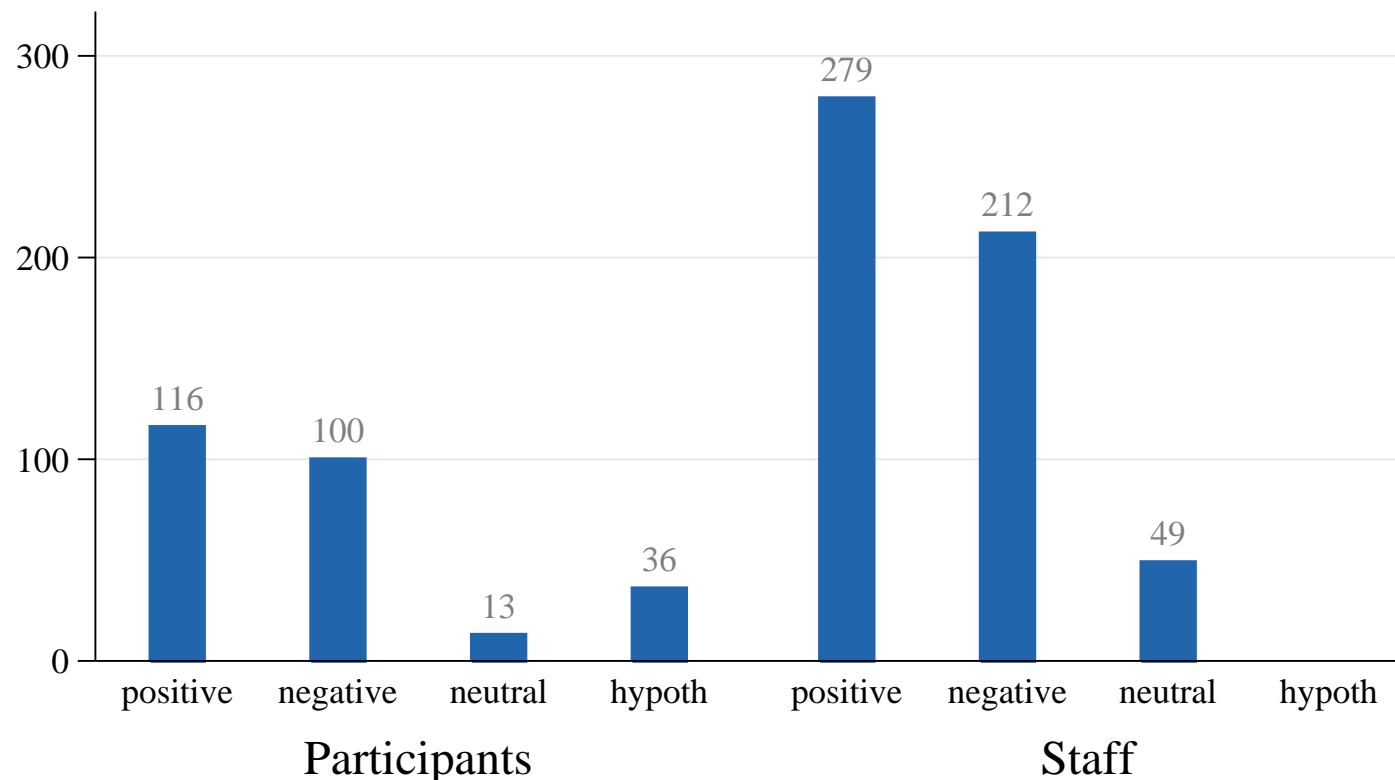Stock market related phrases in FOMC transcripts (1976–2011)

Count of stock–market–related phrases

— with conference calls
-- without conference calls

Oct 1987
Irrational exuberance speech
LTCM
9/H
Lehman

1975 1980 1985 1990 1995 2000 2005 2010 2015

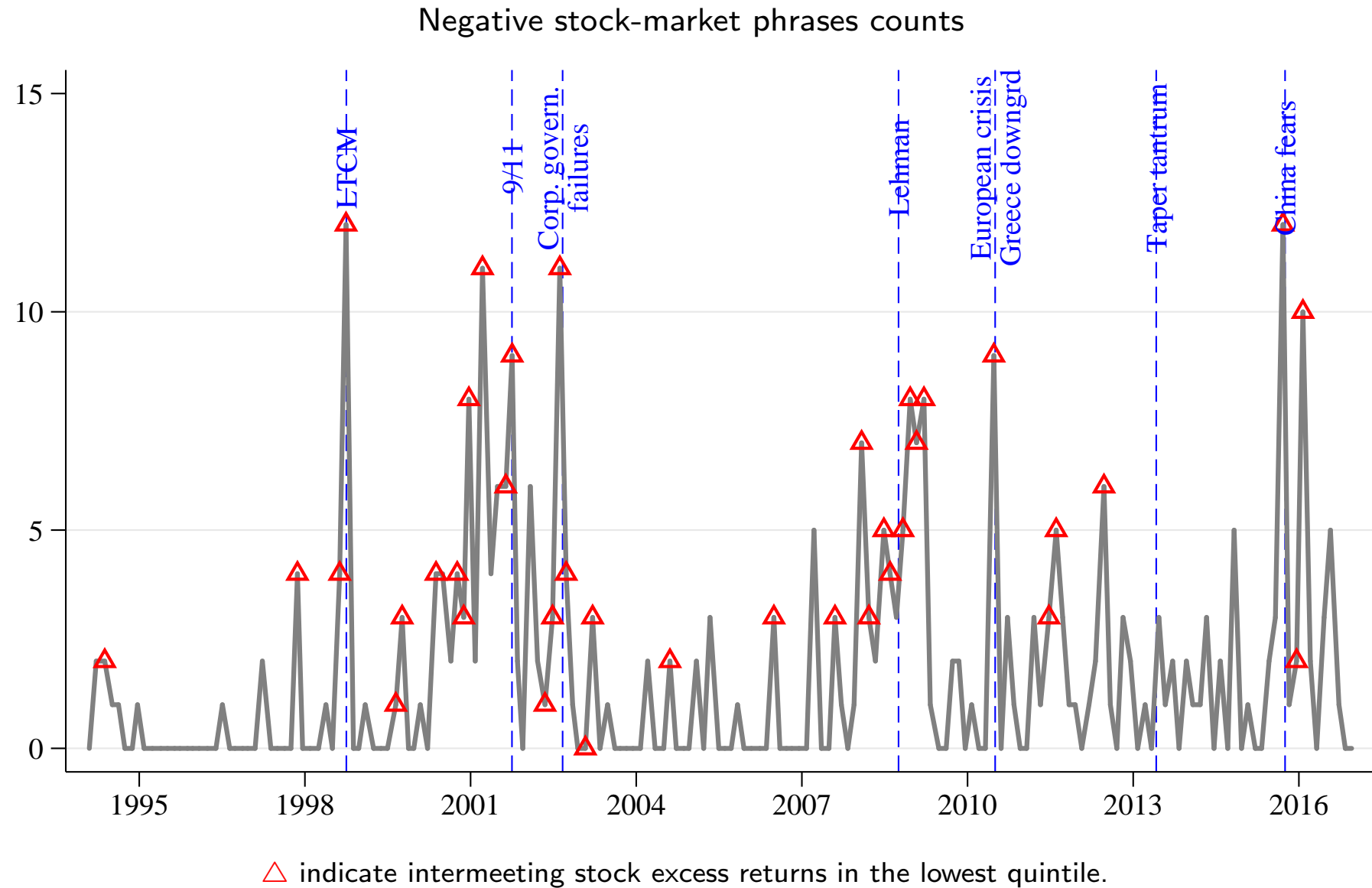0 20 40 60 80 100

Textual analysis of FOMC minutes

We read these 983 paragraphs and classify them into:

– Positive: Discussion of the stock market going up
– Negative: Discussion of the stock market going down
– Neutral: Discussion of the stock market being flat
– Hypothetical: Discussion of what would happen if the stock market were to ...

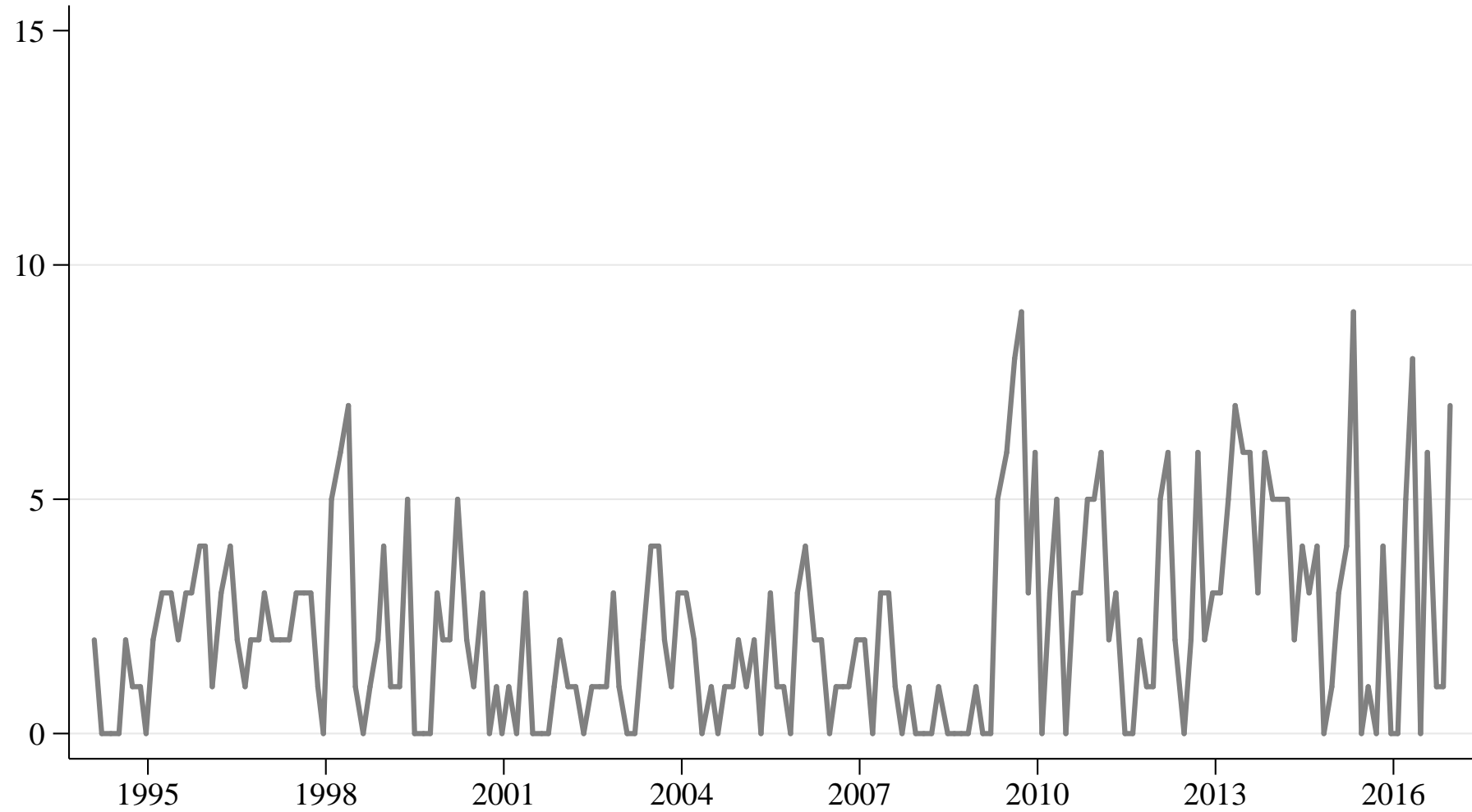Positive/negative counts by staff and participants

Textual analysis of FOMC minutes

Negative stock-market phrases counts

△ indicate intermeeting stock excess returns in the lowest quintile.
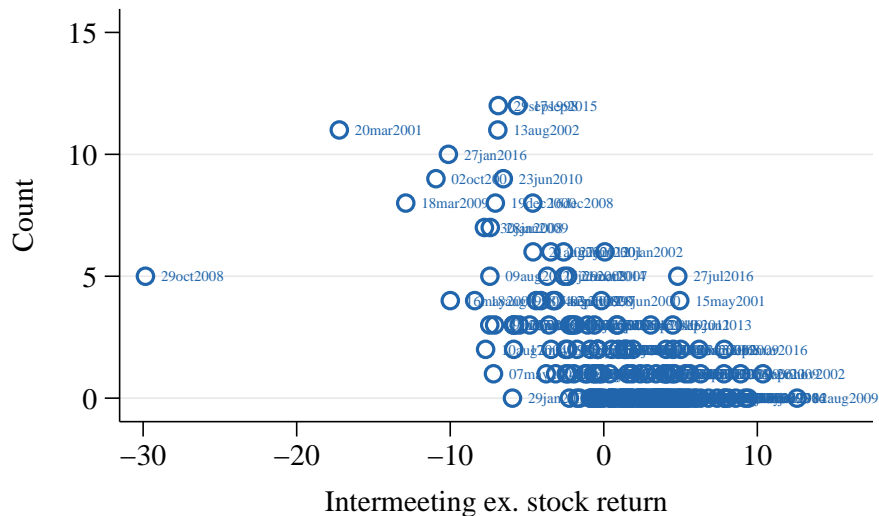
Textual analysis of FOMC minutes

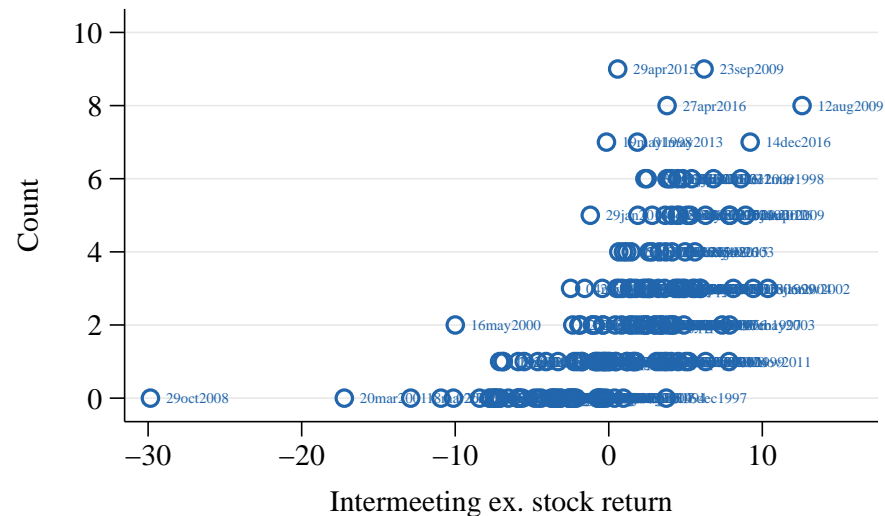
Positive stock-market phrases counts

Pos/neg stock market mentions vs. intermeeting excess return
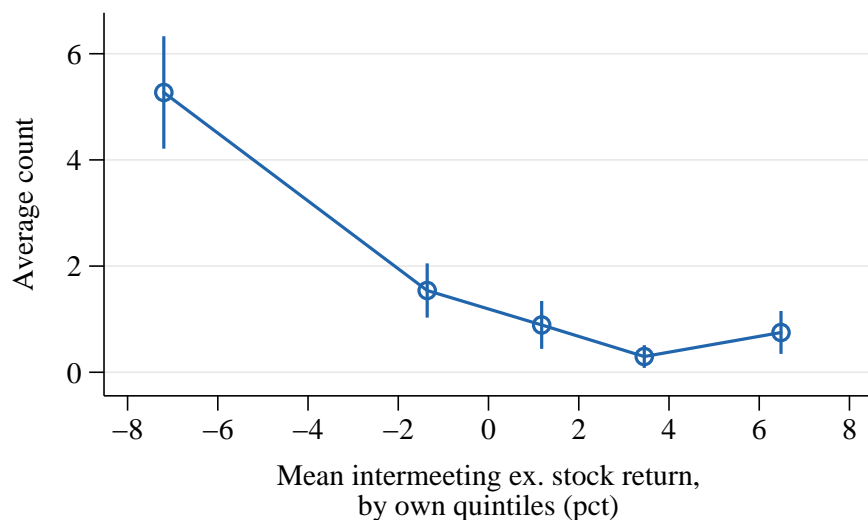

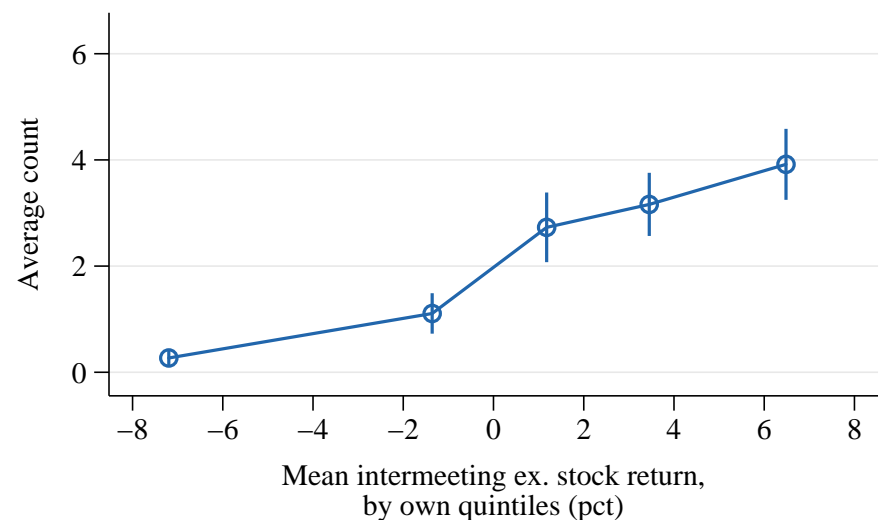Panel A: Negative stock market phrases

Panel B: Positive stock market phrases

Panel C: Negative stock market phrases

Panel D: Postive stock market phrases

Predicting stock-market-related content by intermeeting returns

| | Dependent variable: Count of positive/negative stock market phrases at meeting m | | | | | | | |
| Minutes | Negative stock market phrases: Stocks_m^- | | | | Positive stock market phrases: Stocks_m^+ | | | |
sample:	1994–2016	1994–2016	1994–2008	2009–2016	1994–2016	1994–2016	1994–2008	2009–2016
rx_m	-0.30***				0.22***			
	(-6.10)				(5.87)			
rx_{m-1}	-0.12***				0.082***			
	(-5.59)				(3.52)			
rx_{m-2}	-0.060**				0.021			
	(-2.56)				(0.89)			
rx_m^-		-0.37***	-0.32**	-0.72***		0.086**	0.059**	0.27***
		(-3.00)	(-2.51)	(-4.70)		(2.31)	(2.20)	(3.37)
rx_{m-1}^-		-0.20***	-0.24***	-0.011		0.011	0.0056	-0.00025
		(-7.68)	(-7.27)	(-0.23)		(0.37)	(0.28)	(-0.00)
rx_{m-2}^-		-0.068*	-0.15**	0.021		0.050	0.077*	0.0066
		(-1.81)	(-2.29)	(0.47)		(1.36)	(1.91)	(0.24)
rx_m^+		-0.19***	-0.22***	-0.10**		0.41***	0.30***	0.46***
		(-2.91)	(-3.05)	(-2.37)		(7.40)	(7.42)	(5.31)
rx_{m-1}^+		0.032	0.033	-0.050		0.25***	0.20***	0.24***
		(0.65)	(0.59)	(-0.83)		(4.55)	(2.90)	(3.26)
rx_{m-2}^+		0.023	0.022	-0.048		0.066*	0.038	0.040
		(0.46)	(0.31)	(-0.96)		(1.74)	(1.14)	(0.75)
Constant	2.01***	0.93**	0.60	1.68***	2.06***	0.84**	0.80***	1.73***
	(10.00)	(2.12)	(1.23)	(5.46)	(11.24)	(2.41)	(3.53)	(4.10)
N (meetings)	184	184	120	64	184	184	120	64
R^2	0.49	0.52	0.57	0.65	0.38	0.47	0.43	0.56

The relationship holds also in the zero-lower bound period, 2009–2016.

Predicting target changes with direction of stock-market phrases

Dependent variable: $\Delta\text{FFR}_m = \text{FFR}_m - \text{FFR}_{m-1}$ (1994:01–2008:12)

	(1) All	(2) Staff	(3) Partic.	(4) Desc.	(5) Nondesc.
ΔFFR_{m-1}	0.26**	0.31***	0.30**	0.33***	0.28**
	(2.31)	(2.98)	(2.48)	(3.21)	(2.49)
ΔFFR_{m-2}	0.26*	0.28*	0.23	0.31**	0.22
	(1.90)	(1.93)	(1.64)	(2.22)	(1.62)
$\#\text{Stocks}_m^-$	-0.024**	-0.039	-0.030**	-0.059**	-0.031**
	(-2.11)	(-1.61)	(-2.08)	(-2.22)	(-2.15)
$\#\text{Stocks}_{m-1}^-$	-0.038***	-0.075***	-0.050***	-0.076***	-0.042**
	(-2.95)	(-2.85)	(-2.58)	(-2.85)	(-2.16)
$\#\text{Stocks}_m^+$	-0.016	-0.028	0.011	-0.046**	0.010
	(-1.47)	(-1.27)	(0.50)	(-2.10)	(0.55)
$\#\text{Stocks}_{m-1}^+$	0.0035	0.0086	0.0038	0.028	-0.011
	(0.23)	(0.44)	(0.14)	(1.30)	(-0.47)
Constant	0.099*	0.093*	0.027	0.086	0.048
	(1.88)	(1.91)	(0.68)	(1.62)	(1.09)
N (meetings)	119	119	119	119	119
R^2	0.47	0.46	0.42	0.48	0.43

☐ Magnitude: $+1\sigma$ negative stock market mentions (2.6 more mentions) $\to$ cumulative reduction in the Fed funds target of 34 bps.

Predicting target changes with direction of stock-market phrases

	(1) All	(2) Staff	(3) Partic.	(4) Desc.	(5) Nondesc.
ΔFFR_{m-1}	0.19**	0.26***	0.22***	0.30***	0.20***
	(2.51)	(3.32)	(3.32)	(3.47)	(2.98)
ΔFFR_{m-2}	0.26*	0.28*	0.23	0.31**	0.23
	(1.72)	(1.79)	(1.40)	(2.03)	(1.43)
$\#\text{Stocks}^{-}_{m}$	-0.028***	-0.043**	-0.040***	-0.063***	-0.037***
	(-2.71)	(-2.02)	(-3.01)	(-2.79)	(-2.64)
$\#\text{Stocks}^{-}_{m-1}$	-0.040***	-0.079***	-0.057***	-0.074***	-0.047***
	(-3.25)	(-3.29)	(-3.34)	(-3.15)	(-2.80)
$\#\text{Stocks}^{+}_{m}$	-0.022**	-0.037*	0.003	-0.051***	0.001
	(-2.30)	(-1.83)	(0.19)	(-2.68)	(0.06)
$\#\text{Stocks}^{+}_{m-1}$	0.002	-0.001	0.008	0.023	-0.007
	(0.13)	(-0.07)	(0.37)	(1.14)	(-0.31)
Doc.length_{m}	-0.003***	-0.002***	-0.003**	-0.002***	-0.003**
	(-2.86)	(-2.81)	(-2.48)	(-2.63)	(-2.49)
Constant	0.51***	0.46***	0.47***	0.39***	0.47***
	(4.06)	(4.08)	(3.00)	(3.74)	(3.24)
N	119	119	119	119	119
r2	0.52	0.50	0.48	0.51	0.49

Dependent variable: $\Delta\text{FFR}_m = \text{FFR}_m - \text{FFR}_{m-1}$ (1994:01–2008:12)

☐ Magnitude: $+1\sigma$ negative stock market mentions (2.6 more mentions) $\rightarrow$ cumulative reduction in the Fed funds target of 34 bps.

Robustness: FOMC transcripts and algorithm-based coding

☐ We develop an algorithm to automatically "read" the transcripts and minutes and to code positive/negative stock market mentions.

☐ Adjustments: remove stop words (e.g., "the", "a") and certain descriptive words (e.g., "usually", "quite"), define sentence rules.

☐ List of stock market phrases interacted with negative and positive "direction" words:

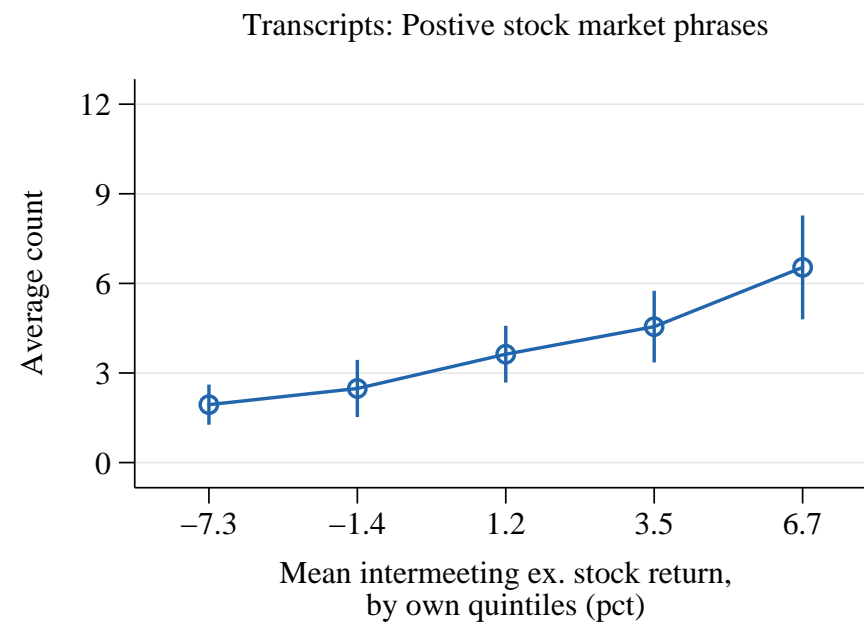| | # Direction words | |
# Phrases	Negative	Positive
47	52	41

☐ Number of matches:

	# Matches	# Neg matches	# Pos matches
	(Match = Phrase + direction word)		
Transcripts	1,197	618	579
Minutes	589	260	329

☐ We run the algorithm on the minutes and, more importantly, on the transcripts. Results are similar.

Robustness: Algorithm-based coding

Phrases		Direction words			
		Negative		**Positive**	
asset index*	house and equity price*	*adjust* downward*	*mov* downward*	*acceler**	*rise**
asset indic*	household wealth	*adverse*	*mov* lower*	*adjust* upward*	*rising*
asset market*	household* net worth	*burst**	*plummet**	*advanc**	*rose*
asset price index*	housing and equity price*	*contract**	*pressure**	*bolster**	*run up*
asset price indic*	price* of risk* asset*	*cool**	*pull* back*	*boost**	*runup*
asset price*	ratio of wealth to income	*deceler**	*pullback*	*edge* up*	*stop decline*
asset valu*	risk* asset price*	*declin**	*reduc**	*elevat**	*strength**
equities	s p 500 index	*decreas**	*revis* down**	*encourag**	*strong**
equity and home price*	stock index*	*deteriorat**	*slow**	*expand**	*tick* up*
equity and home valu*	stock indic*	*down*	*slow* down*	*fast**	*up*
equity and house price*	stock market index*	*downturn*	*soft**	*favor**	*upward*
equity and housing price*	stock market price*	*downward*	*stagnate**	*gain**	*upward adjust**
equity index*	stock market wealth	*downward adjust**	*stall**	*go* up*	*upward movement*
equity indic*	stock market*	*downward movement*	*strain**	*high**	*upward revision*
equity market index*	stock price indic*	*downward revision*	*stress**	*improv**	*went up*
equity market indic*	stock price*	*drop**	*subdu**	*increas**	
equity market price*	stock prices index*	*eas**	*take* toll on*	*mov* high**	
equity market valu*	stock val*	*edge* down*	*tension**	*mov* up*	
equity market*	us stock market price*	*fall**	*tick* down*	*mov* upward*	
equity price index*	wealth effect*	*fell*	*tight**	*pick* up*	
equity price indic*	wealth to income ratio	*go* down*	*took toll on*	*rais**	
equity price measure*		*limit**	*tumbl**	*rallied*	
equity price*		*low**	*weak**	*rally**	
equity valu*		*moderate**	*weigh* on*	*rebound**	
financial wealth		*moderati**	*went down*	*recoup**	
home and equity price*		*mov* down*	*worse**	*revis* up**	

Robustness: FOMC transcripts and algorithm-based coding

Minutes: Negative stock market phrases

Minutes: Postive stock market phrases

Transcripts: Negative stock market phrases

Transcripts: Postive stock market phrases

(Axis labels: Average count; Mean intermeeting ex. stock return, by own quintiles (pct))

Summary on (b): Is the Fed reacting to the stock market or to variables correlated with the stock market?

☐ Lots of discussions about stock market at FOMC meetings by both staff and FOMC participants.

☐ Positive/negative stock market mentions co-move with intermeeting returns in the expected direction.

☐ <u>Asymmetry</u>:

- Attention to the stock market increases disproportionately following extreme negative inter-meeting returns.
- Negative stock market mentions predict FFR target reductions.

→ Our textual analysis indicates that the stock market does cause Fed policy making.

(c) If Fed does in fact react to stock market, then why?

We classify economic content of stock market mentions in FOMC minutes by reading the 983 paragraphs:

☐ Purely descriptive mentions ↷
☐ Various ways in which the stock market *drives* the economy:

  – Consumption ↷
  – Investment ↷
  – Demand (no detail on which component of demand) ↷
  – Financial conditions (stock market as part of financial conditions driving economy) ↷
  – Direct driver of the economy (no mechanism stated)

☐ Economic outlook (stock market as *predictor* of the economy) ↷
☐ Financial stability
☐ Other

Economic content of stock-market mentions in FOMC minutes

	Staff			Participants			
	Staff Rev of Econ Situation	Staff Rev of Fin Situation	Staff Econ Outlook	Particip Views	Committee Policy Action	Other	**Total**
Descriptive	4	**491**	10	11	1	34	**551**
Consumption (wealth effect)	**72**	0	43	**150**	0	0	**265**
Investment (cost of capital)	2	2	1	**29**	0	0	**34**
Demand	0	1	5	9	0	0	**15**
Financial conditions	0	0	0	**40**	4	0	**44**
Driver, no mechanism	3	3	11	12	6	2	**37**
Economic outlook (predictor)	0	1	0	12	0	0	**13**
Financial stability	0	2	0	5	0	0	**7**
Other	0	3	0	4	1	9	**17**
Total	**81**	**503**	**70**	**272**	**12**	**45**	**983**

☐ Stock market as a *driver* of the economy:

– Lots of discussion of consumption in the context of the stock market
– Some discussion of investment and of financial conditions (which affect both consumption and investment)

☐ Stock market as a *predictor* of the economic outlook:

– Much less discussion

Economic content of stock-market mentions in FOMC minutes

Substantial focus on consumption consistent with recent comments by Fed officials:

"Basically we had a tremendous rally and I think a great digestive period is likely to take place now and it may continue because, again, <u>we front-loaded at</u> <u>the Federal Reserve an enormous rally</u> <u>in order to accomplish a wealth effect.</u>"

(Richard Fisher, CNBC interview, Jan 5, 2016)

"A rise in equity prices can <u>boost household wealth</u>, which is one factor that underpins <u>consumer spending</u>."

(William C. Dudley, Remarks at the University of South Florida, Mar 30, 2017)

Robustness: Algorithmic coding of economic content of stock market mentions in FOMC minutes

☐ Using noun phrase extraction, we create a dictionary of economic phrases that appear in FOMC minutes.

☐ We then analyze the most frequently mentioned phrases related to economic conditions that occur in the same paragraph as the stock market.

☐ Stock market mentions appear most frequently in the context of Fed's discussion of <u>consumption</u>.

Robustness: Algorithmic coding of economic content of stock market mentions in FOMC minutes

Phrase	# in par.	# in sec.	Ratio #par./#sec.	Odds ratio
Participants' Views				
wealth effect*	23	30	0.77	5.68
consumer expenditures	32	58	0.55	4.09
consumer confidence	63	126	0.50	3.70
consumer sentiment	31	62	0.50	3.70
retail sales	39	82	0.48	3.52
consumer spending	187	430	0.43	3.22
motor vehicle*	47	114	0.41	3.05
consumption	22	63	0.35	2.59
house prices	20	83	0.24	1.79
economic expansion	26	129	0.20	1.49
household* spending	20	100	0.20	1.48
housing activity	20	106	0.19	1.40
aggregate demand	22	121	0.18	1.35
business investment	38	243	0.16	1.16
productivity	54	356	0.15	1.12
economic activity	62	505	0.12	0.91
energy prices	28	276	0.10	0.75
economic growth	33	372	0.09	0.66
exports	22	256	0.09	0.64
economic outlook	29	365	0.08	0.59
labor market*	51	674	0.08	0.56
un(employment)	73	993	0.07	0.54
inflation	128	2404	0.05	0.39

The odds ratio is defined as $\frac{\#\text{phrase } i \text{ in paragraph mentioning stocks}}{\#\text{all phrases in paragraph mentioning stocks}} \Big/ \frac{\#\text{phrase } i \text{ in section}}{\#\text{all phrases in section}}$.

(d) If the Fed does in fact react to the stock market, are they doing it too much?

Should Fed react to stock market beyond its effect on growth and inflation expectations?

☐ *Bernanke and Gertler (1999, 2001)*: No.

- − Model with consumption-wealth, cost-of-capital channels and financial accelerator.
- − Needs a <u>strong reaction to expected inflation (and output gap)</u> directly, <u>not to the stock market</u>. The latter increases the volatility of inflation and output.
- − Under inflation targeting, changes in asset values should affect monetary policy only to the extent that they affect the Fed's forecasts of inflation.

☐ *Peek, Rosengreen and Tootell (2016)*: Yes, given the <u>fiscal costs</u> of financial crisis.

- − Negative word counts affect the Fed funds target beyond their effect on unemployment and inflation forecasts.
- − Their objective: Does Fed act as if it has a tertiary mandate (financial stability).
  Our objective: What's the economics of the Fed put?

Approaches to benchmark the Fed's focus on the stock market

1. *Expectations updates:* Do Fed's output and inflation expectations update too much in response to the stock market?

   – Fed Greenbook vs private sector forecast updates.
   – Predictability of realized macro variables.

2. *Taylor rule:* Does FFR target respond more to the stock market than what can be explained by updates to Fed macro expectations?

   – Greenbook expectations *and* textual measures of Fed's concern about real activity and inflation.
   – If stock market is not driven out of Taylor rule, the Fed is reacting too much (Bernanke and Gertler, 1999, 2001).

3. *Consumers:* Do consumers pay attention to the stock market (relative to other macro news)?

   – Measure attention to stock market news in the Michigan Survey of Consumers (MSC).

Fed Greenbook forecasts: Real GDP

| | Real GDP growth forecast update | | | | | |
| | 1994–2010 | | | | | 1982:9-1993 |
	q0	q1	q2	q3	q0+q1+q2+q3	q0+q1+q2+q3
rx_m^-	0.86	1.41**	1.61***	1.10***	5.06***	2.33
	(1.24)	(2.30)	(3.96)	(3.77)	(2.98)	(1.40)
rx_{m-1}^-	1.99***	1.71***	0.71**	0.06	4.61***	-0.39
	(3.54)	(3.19)	(2.53)	(0.15)	(3.94)	(-0.19)
rx_m^+	-0.17	0.85	0.42	0.83***	1.95	2.18
	(-0.26)	(1.47)	(1.19)	(2.84)	(1.28)	(1.39)
rx_{m-1}^+	0.57	0.42	0.30	0.83**	2.01	2.2
	(0.77)	(0.78)	(0.95)	(2.60)	(1.50)	(1.26)
Lag of dept. var.	Y	Y	Y	Y	Y	Y
Constant	0.026	0.014	0.014	-0.03*	0.03	-0.10
	(0.72)	(0.53)	(0.81)	(-1.91)	(0.38)	(-1.08)
N (meetings)	136	136	136	136	136	90
R^2	0.19	0.37	0.33	0.31	0.38	0.11

☐ Asymmetry: Effect of negative intermeeting stock returns, but not positive returns.
☐ Sluggish updating: 2 FOMC cycles for Greenbook expectations to fully react to the stock market.
☐ Economic magnitude: 10% drop in stock market associated with about 1pp lower expected GDP growth over the next year.

Fed Greenbook forecasts: Unemployment rate

| | Unemployment rate forecast update | | | | | |
| | 1994–2010 | | | | | 1982:9-1993 |
	q0	q1	q2	q3	q0+q1+q2+q3	q0+q1+q2+q3
rx_m^-	-0.87**	-1.41***	-2.09***	-2.67***	-7.00***	-2.90
	(-2.35)	(-3.15)	(-4.04)	(-4.91)	(-4.09)	(-1.01)
rx_{m-1}^-	-0.90**	-1.75***	-1.78***	-1.89***	-6.16***	-3.61
	(-2.49)	(-2.83)	(-2.82)	(-2.91)	(-2.87)	(-0.97)
rx_m^+	-0.05	-0.24	-0.20	-0.49	-1.02	2.48
	(-0.10)	(-0.48)	(-0.39)	(-0.80)	(-0.57)	(0.61)
rx_{m-1}^+	0.50	0.78	0.54	0.56	2.37	-0.36
	(0.89)	(1.16)	(0.69)	(0.67)	(0.89)	(-0.09)
Lag of dept. var.	Y	Y	Y	Y	Y	Y
Constant	-0.06**	-0.07**	-0.07**	-0.071**	-0.27**	-0.23
	(-2.36)	(-2.32)	(-2.43)	(-2.16)	(-2.52)	(-1.29)
N (meetings)	136	136	136	136	136	90
R^2	0.11	0.29	0.34	0.37	0.32	0.06

☐ Economic magnitude: 10% drop in stock market associated with about 1.3% lower expected change in the unemployment rate over the next year.

Fed Greenbook forecasts: Inflation

| | Update to inflation forecast | | | | | |
| | 1994–2010, q0+q1+q2+q3 | | | 1982:9–1993, q0+q1+q2+q3 | | |
	GDP defl.	CPI	Core CPI	GDP defl.	CPI	Core CPI
rx_m^-	0.52	3.84***	1.08**	-0.25	0.11	0.47
	(1.62)	(3.23)	(2.10)	(-0.40)	(0.06)	(0.27)
rx_{m-1}^-	0.43	0.43	0.38	1.19**	-0.81	-0.64
	(0.57)	(0.26)	(0.57)	(2.53)	(-0.89)	(-0.77)
rx_m^+	-0.93	-2.72**	-1.01	-0.65	-3.26**	-0.87
	(-1.47)	(-2.31)	(-1.59)	(-0.77)	(-2.51)	(-0.85)
rx_{m-1}^+	-1.166**	-0.333	-0.537	-0.622	0.832	1.165
	(-2.11)	(-0.27)	(-0.92)	(-0.87)	(0.53)	(0.99)
Lag of dept. var.	Y	Y	Y	Y	Y	Y
Constant	0.0790**	0.173***	0.0522	0.0209	-0.00492	-0.0332
	(2.37)	(2.65)	(1.58)	(0.51)	(-0.09)	(-0.59)
N (meetings)	136	136	136	90	90	62
R^2	0.05	0.25	0.13	0.12	0.17	0.12

☐ No clear relation between stock market and Greenbook forecasts for inflation.

Private sector forecasts (Survey of Professional Forecasters)

	Forecast update, q0+q1+q2+q3, 1994–2016		
	Real GDP growth	Unemployment rate	Inflation (GDP deflator)
rx_t^-	4.55***	-3.23***	0.36
	(3.11)	(-5.10)	(1.08)
rx_{t-1}^-	4.67***	-2.02***	1.57
	(5.12)	(-3.43)	(1.58)
rx_t^+	1.62	0.69	-0.74
	(1.60)	(1.27)	(-1.52)
rx_{t-1}^+	0.17	0.79	-0.48
	(0.21)	(1.58)	(-0.85)
Lag of dept. var.	0.08	-0.18**	0.16
	(0.71)	(-2.11)	(1.55)
Constant	-0.004	-0.19***	0.037
	(-0.05)	(-4.42)	(0.86)
N (quarters)	92	92	92
R^2	0.54	0.54	0.16

☐ Similar asymmetric effect for real GDP and unemployment rate. Again somewhat sluggish updating. No clear relation with inflation.

☐ Economic magnitudes not that far from those for the Fed:

– Similar for real GDP: 10% drop in stock market associated with about 0.9pp lower expected GDP growth over the next year.

– About half as large for unemployment rate: 10% drop in stock market associated with about 0.5% lower expected change in the unemployment rate over the next year.

Predictive power of stock market for realized variables

	Real GDP growth q0+q1+q2+q3			Unemployment rate change q0+q1+q2+q3		
	1994-2016	1947-1993	1947-2016	1994-2016	1948-1993	1948-2016
rx_t^-	10.11**	13.84***	13.00***	-7.21***	-7.39***	-7.92***
	(2.54)	(2.91)	(3.66)	(-2.69)	(-2.68)	(-3.70)
rx_t^+	5.55**	9.44**	8.06***	-1.79	-1.22	-1.12
	(1.97)	(2.18)	(2.60)	(-1.06)	(-0.47)	(-0.65)
Lag of q0-value of dept. var.	1.04***	0.41**	0.54***	1.50***	0.45*	0.64***
	(3.62)	(1.98)	(2.84)	(4.67)	(1.82)	(2.73)
Constant	1.79***	3.17***	2.76***	-0.14	-0.07	-0.13
	(4.67)	(7.02)	(8.17)	(-0.86)	(-0.36)	(-0.91)
N (quarters)	89	186	275	89	182	271
R^2	0.32	0.13	0.15	0.42	0.10	0.16

☐ As for expectations, asymmetric effect for unemployment rate, less so for real GDP.
☐ Economic magnitudes not that far from those for the Fed:

– Very similar for real GDP: 10% drop in stock market associated with about 1pp lower expected GDP growth over the next year.
– Intermediate effect for unemployment rate: 10% drop in stock market associated with about 0.7% lower expected change in the unemployment rate over the next year.

GDP components ↷

Predictive power of stock market for realized variables

	Inflation (GDP deflator) q0+q1+q2+q3		
	1994-2016	1947-1993	1947-2016
rx_t^-	0.039*	-0.048	-0.012
	(1.92)	(-1.49)	(-0.48)
rx_t^+	-0.02	-0.004	-0.007
	(-1.35)	(-0.14)	(-0.36)
Lag of q0-value of dept. var.	1.61***	2.59***	2.76***
	(4.56)	(7.18)	(8.48)
Constant	0.013***	0.01***	0.01***
	(7.58)	(3.54)	(3.88)
N (quarters)	89	186	275
R^2	0.34	0.56	0.59

☐   No clear relation with inflation.

Does target respond more to stock market than warranted by Fed's expectations updates?

	(1)	(2)	(3)
ΔFFR_{m-1}	0.25***	0.055	0.034
	(3.15)	(0.53)	(0.33)
ΔFFR_{m-1}	0.33***	0.24**	0.25**
	(3.02)	(2.33)	(2.57)
$E_m^{GB}(g_{m,q0})$		0.093***	0.084***
		(4.46)	(3.91)
$E_m^{GB}(\pi_{m,q1})$		0.078***	0.065**
		(2.88)	(2.20)
$E_m^{GB}(y_{m,q1})$		0.058**	0.059**
		(2.49)	(2.32)
$\Delta\overline{E_m^{GB}}(g_{m,q0,3})$		0.16***	0.11*
		(3.24)	(1.68)
rx_m^-	0.019**		0.008
	(2.17)		(1.01)
rx_{m-1}^-	0.027***		0.013**
	(4.60)		(2.11)
#Econ.cond.$_m^-$			
#Econ.cond.$_m^+$			
#Infl.cond.$_m^-$			
#Infl.cond.$_m^+$			
#Uncertain$_m$			
N (meetings)	120	120	120
R^2	0.51	0.61	0.63

Does target respond more to stock market than warranted by Fed's expectations updates?

	(1)	(2)	(3)	(4)	(5)
$\Delta\mathrm{FFR}_{m-1}$	0.25***	0.055	0.034	0.17**	0.14*
	(3.15)	(0.53)	(0.33)	(2.13)	(1.76)
$\Delta\mathrm{FFR}_{m-1}$	0.33***	0.24**	0.25**	0.28**	0.31***
	(3.02)	(2.33)	(2.57)	(2.39)	(2.95)
$E_m^{GB}(g_{m,q0})$		0.093***	0.084***		
		(4.46)	(3.91)		
$E_m^{GB}(\pi_{m,q1})$		0.078***	0.065**		
		(2.88)	(2.20)		
$E_m^{GB}(y_{m,q1})$		0.058**	0.059**		
		(2.49)	(2.32)		
$\Delta\overline{E_m^{GB}}(g_{m,q0,3})$		0.16***	0.11*		
		(3.24)	(1.68)		
rx_m^-	0.019**		0.008		0.014*
	(2.17)		(1.01)		(1.74)
rx_{m-1}^-	0.027***		0.013**		0.018**
	(4.60)		(2.11)		(2.32)
#Econ.cond.$_m^-$				-0.12***	-0.088**
				(-3.70)	(-2.43)
#Econ.cond.$_m^+$				0.051**	0.022
				(2.42)	(1.02)
#Infl.cond.$_m^-$				0.037	0.036*
				(1.58)	(1.79)
#Infl.cond.$_m^+$				-0.001	0.010
				(-0.03)	(0.48)
#Uncertain$_m$					
N (meetings)	120	120	120	120	120
R^2	0.51	0.61	0.63	0.52	0.58

Does target respond more to stock market than warranted by Fed's expectations updates?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ΔFFR_{m-1}	0.25***	0.055	0.034	0.17**	0.14*	0.0064	0.030
	(3.15)	(0.53)	(0.33)	(2.13)	(1.76)	(0.07)	(0.29)
ΔFFR_{m-1}	0.33***	0.24**	0.25**	0.28**	0.31***	0.26***	0.22**
	(3.02)	(2.33)	(2.57)	(2.39)	(2.95)	(2.82)	(2.05)
$E_m^{GB}(g_{m,q0})$		0.093***	0.084***			0.067***	0.079***
		(4.46)	(3.91)			(2.95)	(3.78)
$E_m^{GB}(\pi_{m,q1})$		0.078***	0.065**			0.059*	0.047
		(2.88)	(2.20)			(1.93)	(1.53)
$E_m^{GB}(y_{m,q1})$		0.058**	0.059**			0.085***	0.055**
		(2.49)	(2.32)			(3.21)	(2.28)
$\Delta\overline{E_m^{GB}}(g_{m,q0,3})$		0.16***	0.11*			0.11*	0.11*
		(3.24)	(1.68)			(1.76)	(1.80)
rx_m^-	0.019**		0.008		0.014*	0.005	0.006
	(2.17)		(1.01)		(1.74)	(0.69)	(0.80)
rx_{m-1}^-	0.027***		0.013**		0.018**	0.012*	0.012**
	(4.60)		(2.11)		(2.32)	(1.83)	(2.11)
#Econ.cond.$_m^-$				-0.12***	-0.088**	-0.050	
				(-3.70)	(-2.43)	(-1.25)	
#Econ.cond.$_m^+$				0.051**	0.022	0.0091	
				(2.42)	(1.02)	(0.47)	
#Infl.cond.$_m^-$				0.037	0.036*	0.053***	
				(1.58)	(1.79)	(2.92)	
#Infl.cond.$_m^+$				-0.001	0.010	0.031	
				(-0.03)	(0.48)	(1.63)	
#Uncertain$_m$							-0.048***
							(-2.83)
N (meetings)	120	120	120	120	120	120	120
R^2	0.51	0.61	0.63	0.52	0.58	0.67	0.65

⌢ Econ. cond. textual ⌢ Uncertainty

Does target respond more to stock market than warranted by Fed's expectations updates?

☐ A 10% drop in the stock market leads to a (cumulative) drop in the target of:

- 102 bps in column 1 (no Greenbook controls)
- 29 bps in column 3 (Greenbook controls)
- 23 bps in column 6 (Greenbook and textual analysis economic controls)

☐ The majority but not all of the explanatory power of the stock market put for target changes works via Fed's updating expectations for growth.

Do consumers pay attention to stock market news? (Michigan surv)

☐ Michigan Survey of Consumers (MSC) asks respondents:

– *"During the last few months, have you heard of any favorable or unfavorable changes in business conditions? What did you hear?"*

– (Un)favorable news on: government, employment, elections, consumer demand, prices, <u>stock market</u>, trade deficit, energy

☐ Measure attention of respondents to negative$^-$/positive$^+$ stock market news:

$$\text{MSC stocks news ratio}_t^- = \frac{\#\text{respondents citing neg. stock market news}_t}{\#\text{respondents citing any news}_t}$$

| | Stocks mentions in FOMC minutes | |
	$\#\text{Stocks}_t^+$	$\#\text{Stocks}_t^-$
MSC stocks news ratio$_t^+$	0.44***	
	(5.75)	
MSC stocks news ratio$_t^-$		0.69***
		(10.07)
N (months)	184	184
R^2	0.20	0.46

LHS and RHS are in z-scores.

Do consumers pay attention to stock market news? (Michigan surv)

MSC negative stocks news ratio
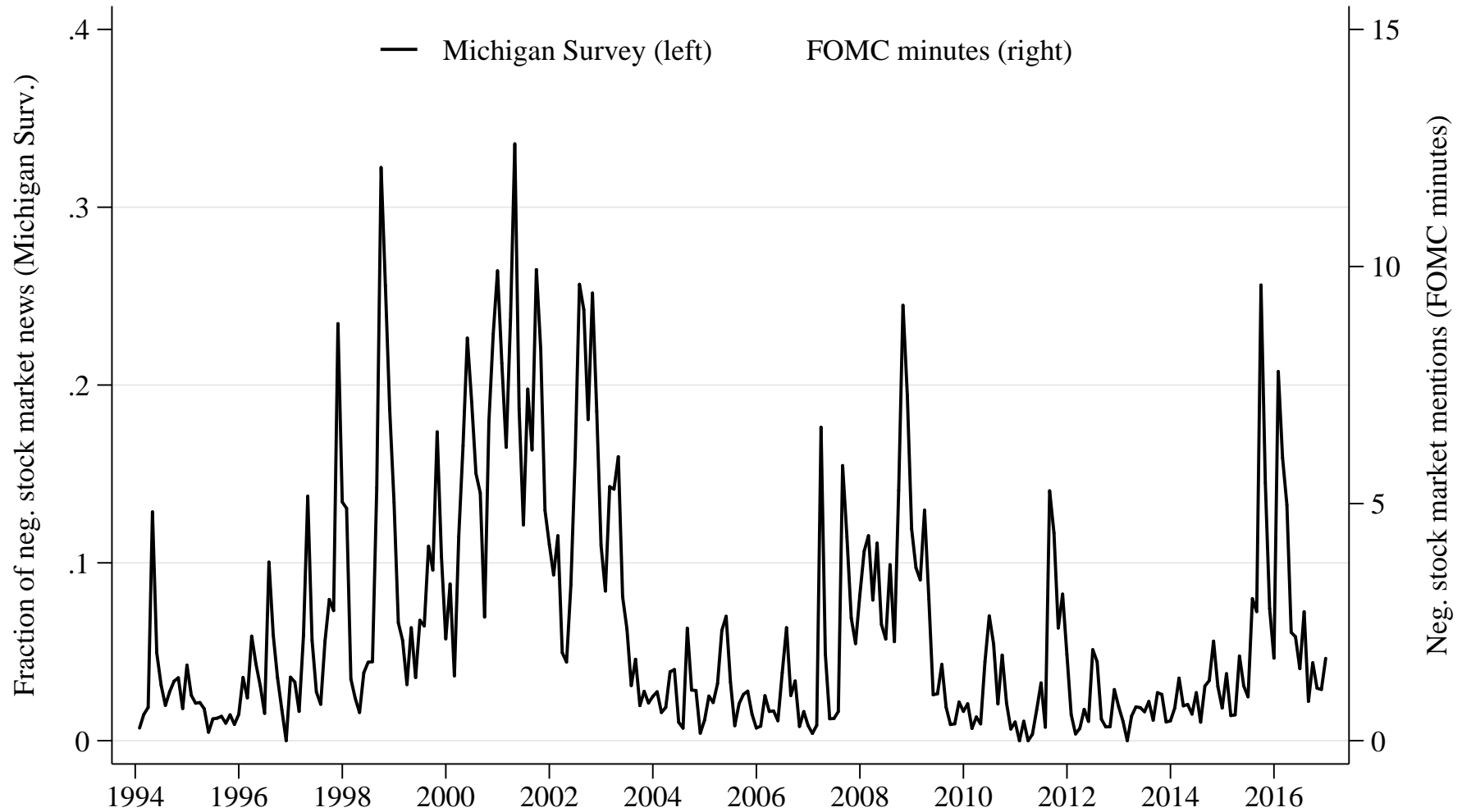
Do consumers pay attention to stock market news? (Michigan surv)

MSC negative stocks news ratio vs. negative stock mentions FOMC minutes
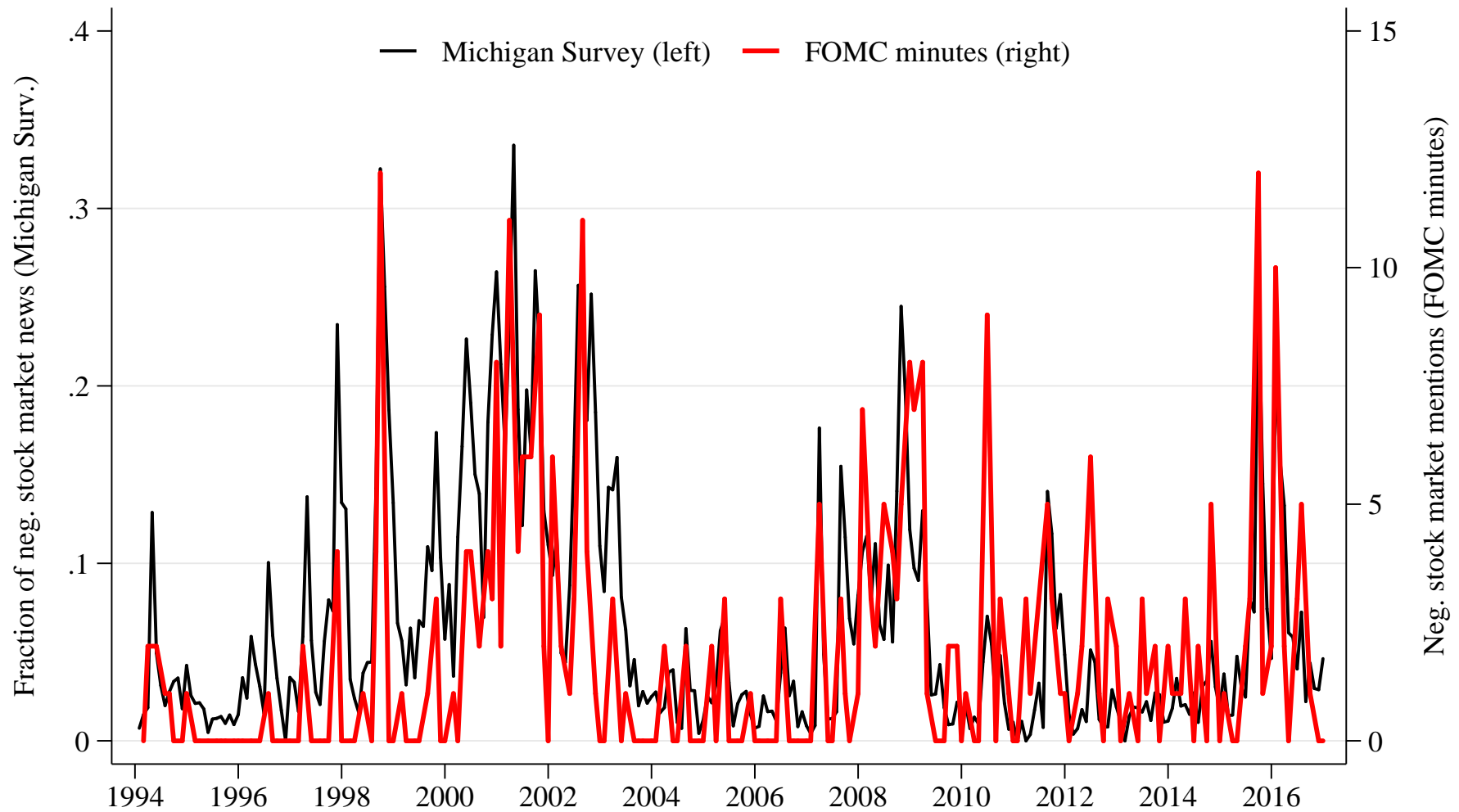
Fed concern about broader financial conditions

- The FOMC minutes often talk about "financial conditions," which (when clarified) refers to the stock market, credit spreads, bank lending standards, the dollar, etc.
- So we also did a textual analysis of whether financial conditions mentions relate to the stock market (Yes) and whether these also predict target changes (They do). Fin.cond.

Negative financial conditions versus stock market phrases in FOMC minutes

— Negative financial conditions phrases (algo) — Negative stock market phrases (manual)
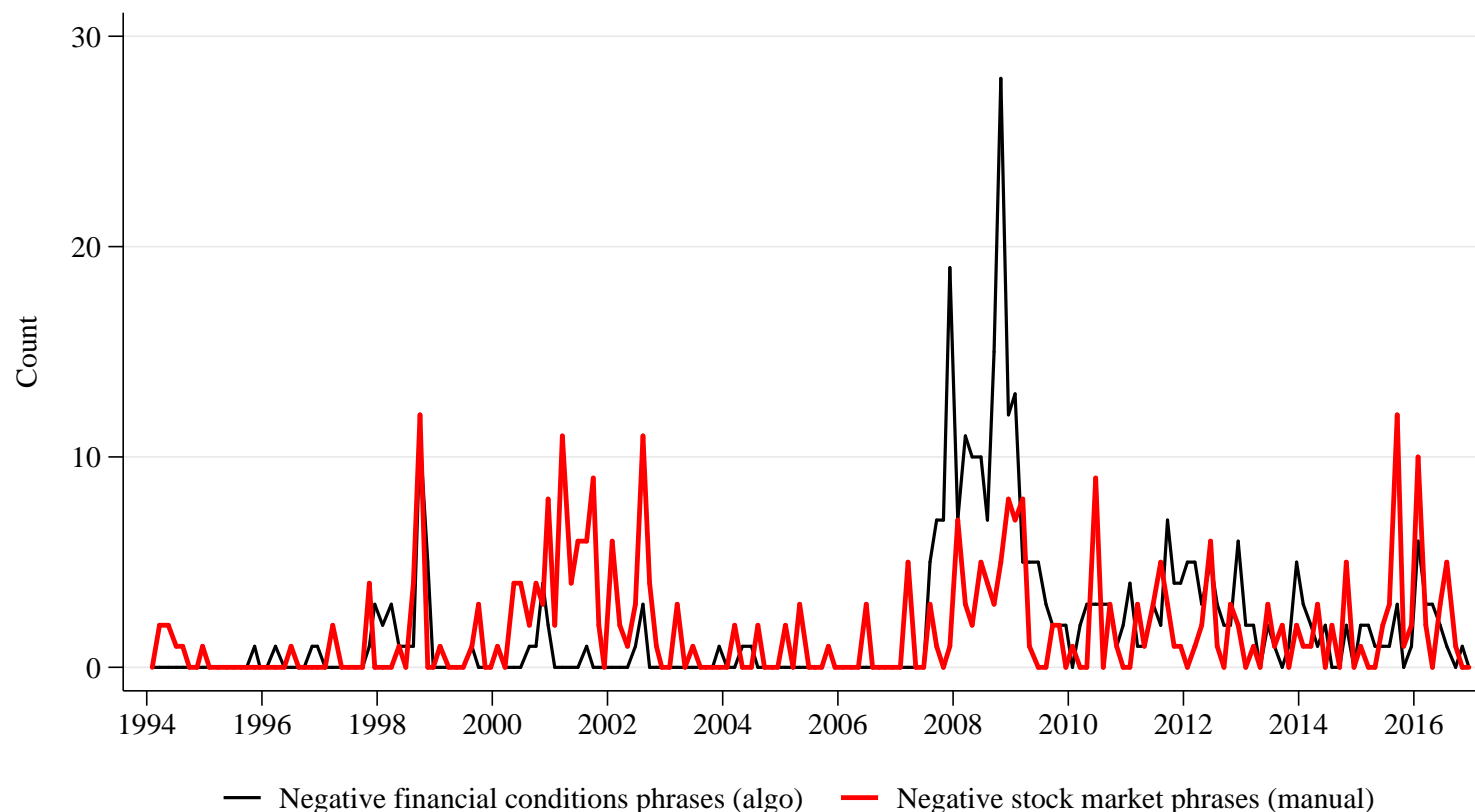
Which other financial conditions does the Fed focus on and why?

"[F]inancial conditions can be broadly summarized by five key measures: short- and long-term Treasury rates, credit spreads, the foreign exchange value of the dollar, and equity prices." – William C. Dudley, NY Fed President

Dudley (2017), https://www.newyorkfed.org/newsevents/speeches/2017/dud170330

— Interest rates:

"A decline in mortgage rates can lift the demand for owner-occupied housing and support construction activity."

— Credit spreads:

"Narrower credit spreads can reduce the cost of capital for business and help support greater business investment."

— The dollar:

"The foreign exchange value of the dollar can affect the relative competitiveness of importers and exporters, which, in turn, influences the countrys trade performance."

— Equity prices:

"A rise in equity prices can boost household wealth, which is one factor that underpins consumer spending."

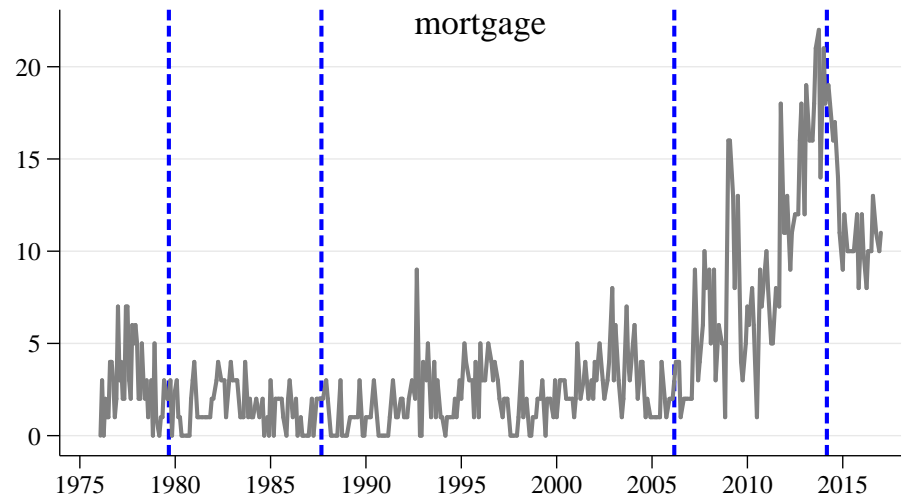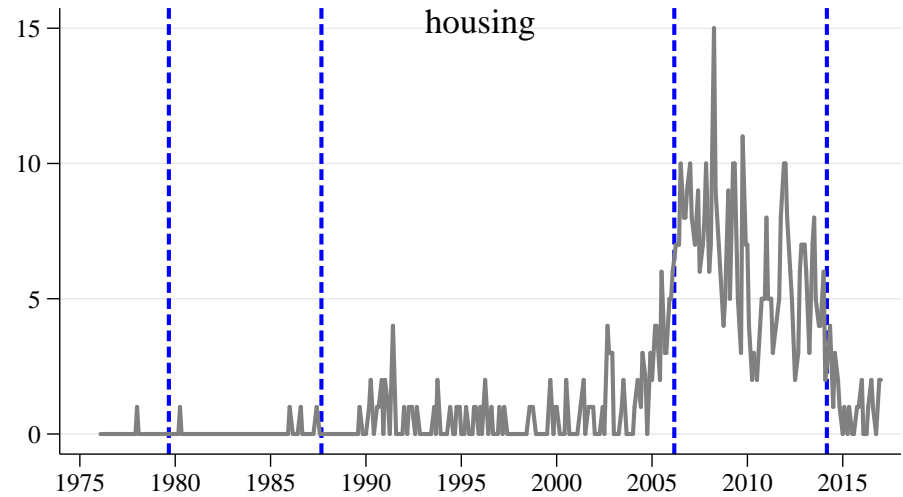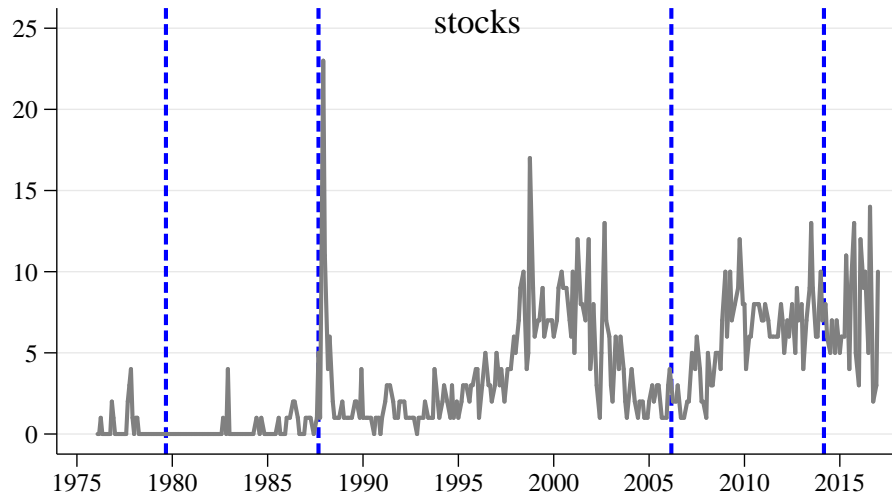# Which other financial conditions does the Fed focus on and why?

Mentions in FOMC minutes (Dashed lines indicate different Fed Chairs)
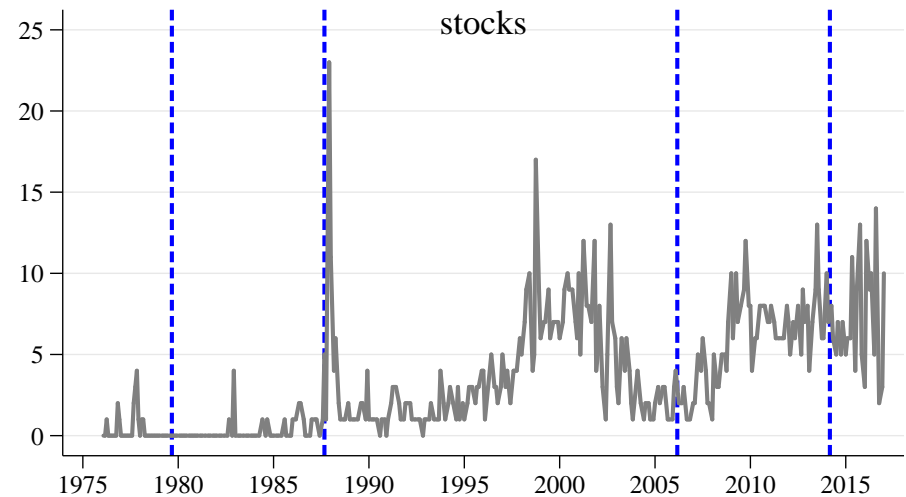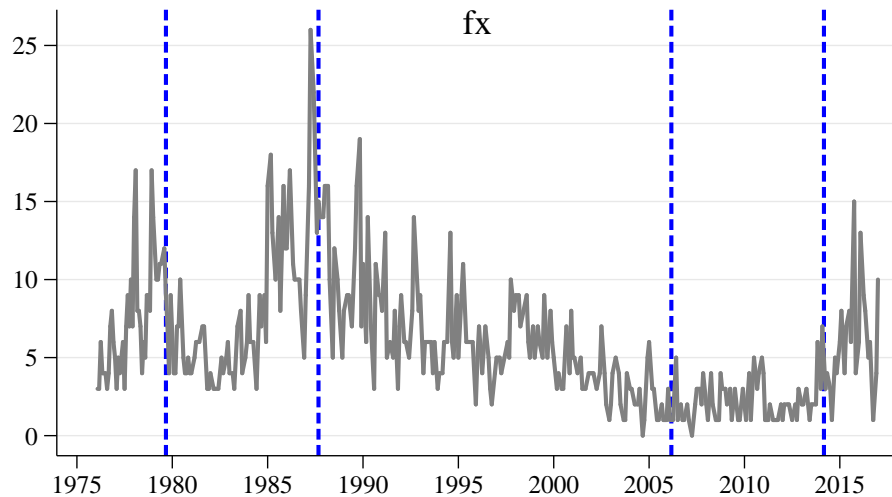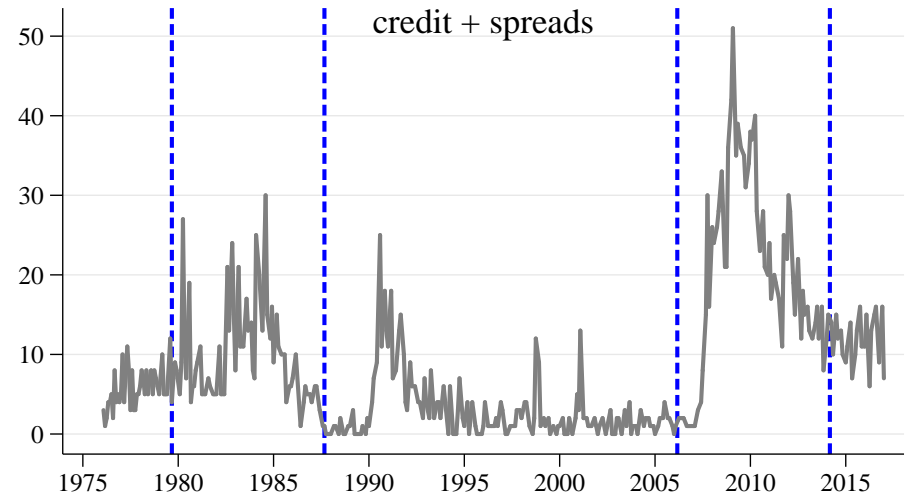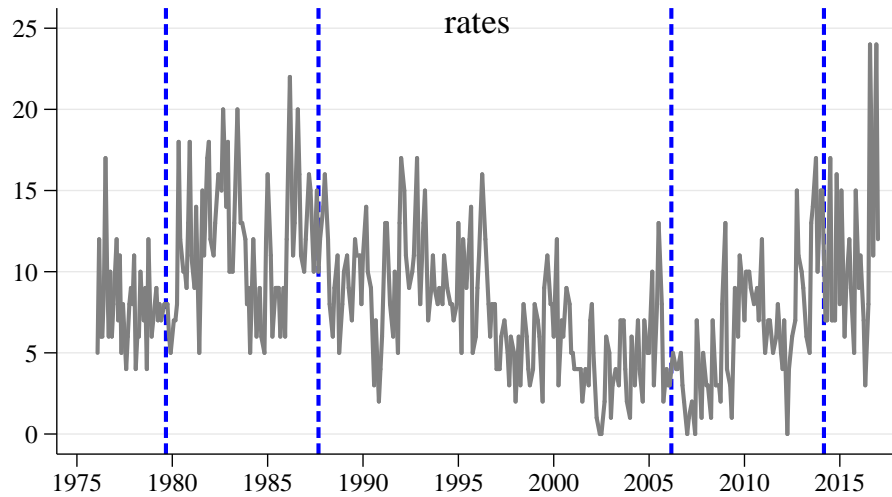
→ Focus on rates, credit and FX is not new. Focus on stocks starts in mid-1990s.

Which other financial conditions does the Fed focus on and why?

Mentions in FOMC minutes (Dashed lines indicate different Fed Chairs)

→ Focus on housing market in both boom and bust consistent with belief in importance of wealth effects.

Conclusions

☐ Since 1994, the Fed eases aggressively following extreme negative stock market returns (a "put" pattern).

☐ The stock market put is a stronger predictor of target changes than commonly followed macro variables.

☐ <u>Causality by textual analysis</u>: The explanatory power of the stock market for the target appears at least in part causal.

☐ <u>Mechanism by textual analysis</u>: The FOMC discusses the stock market often in the context of consumption and, to a lesser extent, investment and broader financial conditions.

    – Less of a role for the stock market predicting (rather than driving) the economy.

☐ Assessing the magnitude of the response:

    – Do the Fed's output and inflation expectations update too much in response to the stock market? No.

    – Does the Fed funds target respond more to the stock market than can be explained by updates to Fed's output and inflation expectations? Output – somewhat. Inflation – yes.

      This could be optimal if the stock market drives the neutral Fed funds rate or the Fed cares about the fiscal costs of bailout following financial crisis.

Appendix

# Literature on Q1: Effect of Fed on stock market, LM (2015)

☐ Pre-FOMC announcement drift: Lucca and Moench (2015, JF) ↰
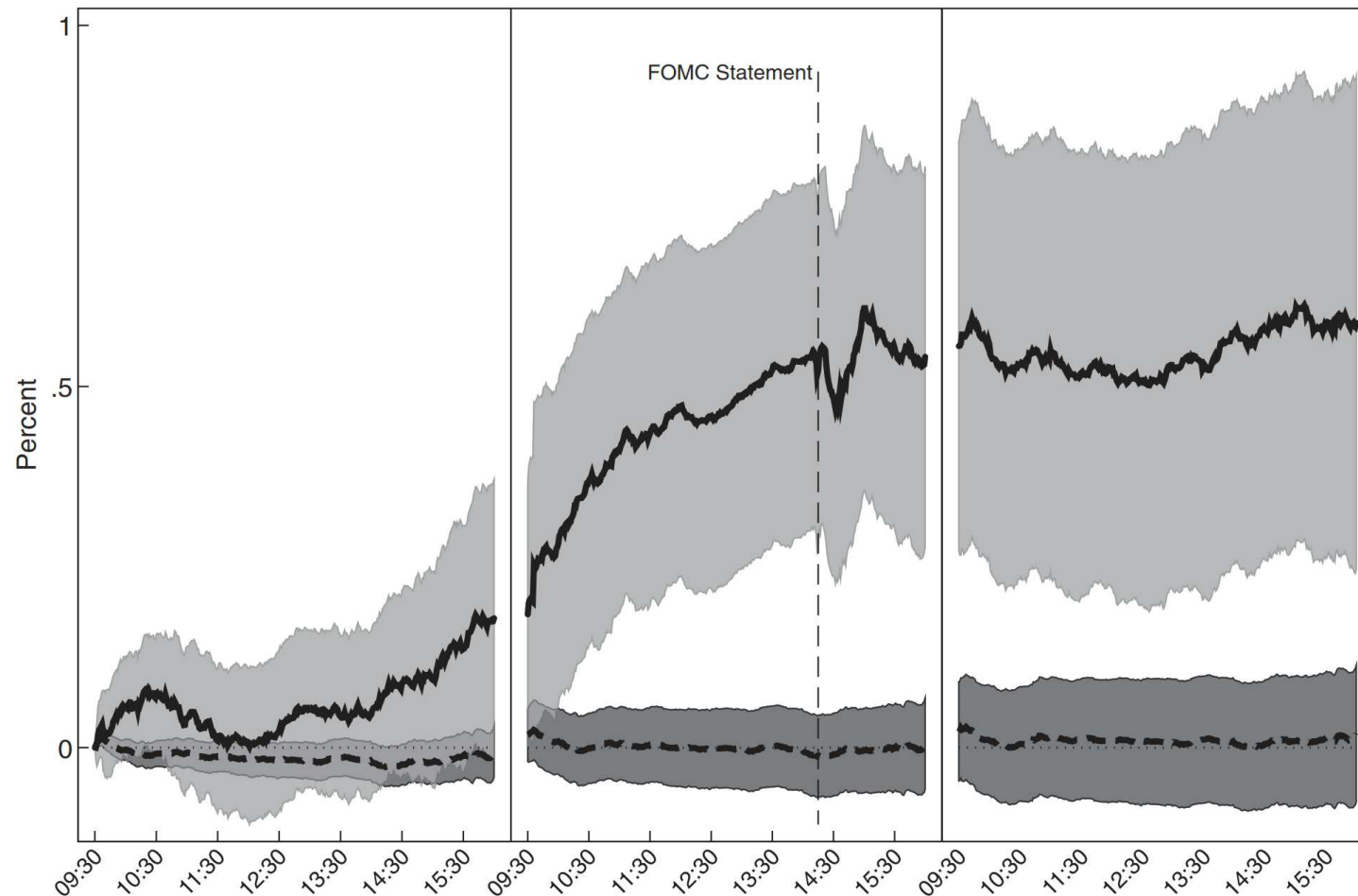
– Post-1994, the stock market has on average earned 49bps during 24 hours (2pm-2pm) <u>before</u> the FOMC announcement.
– Rather than interpreting this as evidence of a large average effect of the Fed on the stock market, they conclude it is a puzzle.

Review of our results in CMVJ (2016)

☐ 1994-2016: The equity premium follows an <u>alternating weekly pattern</u> measured in FOMC cycle time, i.e. time since the last FOMC meeting.

☐ More than the entire equity premium has been earned in weeks 0, 2, 4 and 6 ("<u>even weeks</u>") in FOMC cycle time (equity premium in odd weeks was negative).

Ecn ↷

Stock returns over the FOMC cycle
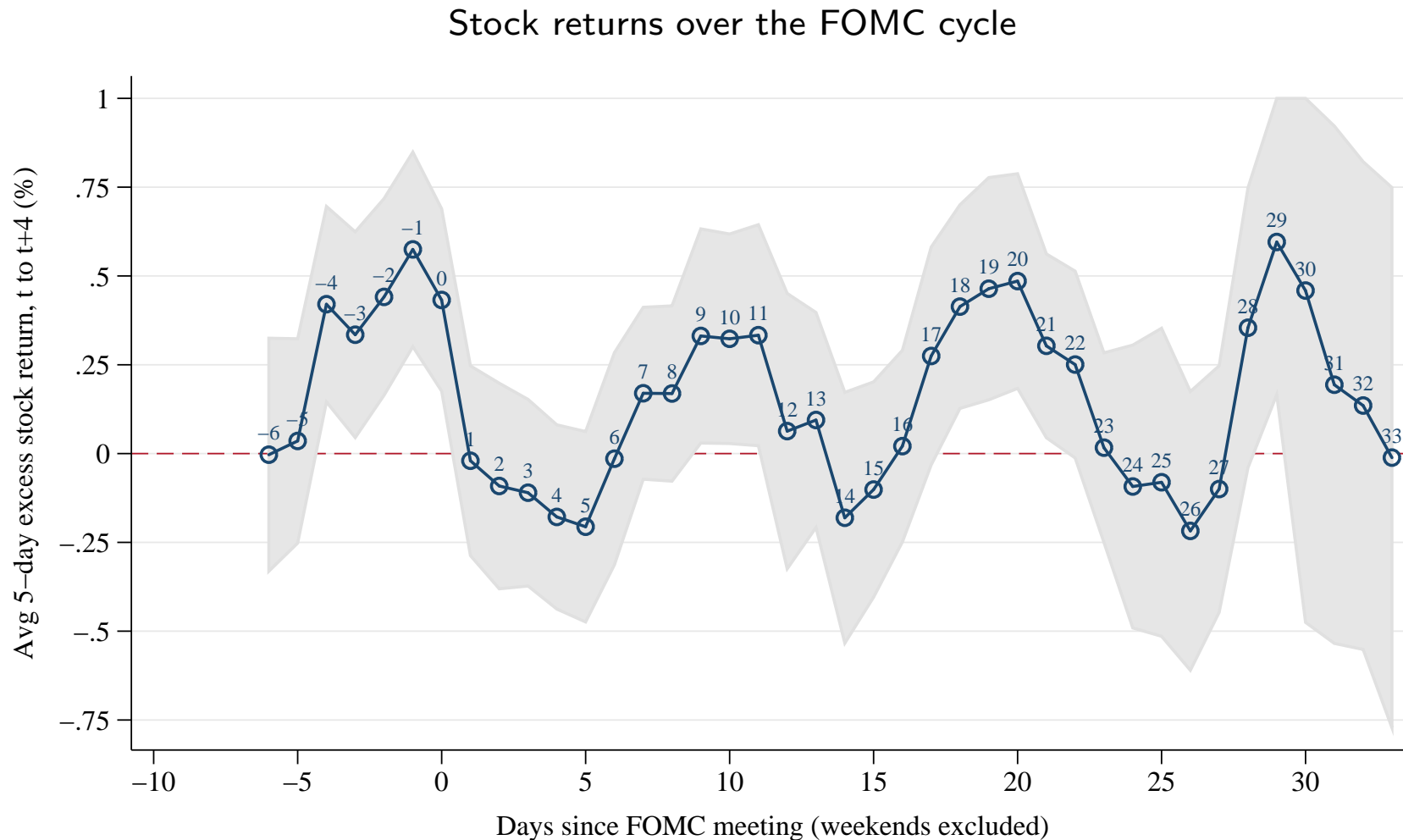
CMVJ (2016)

CMVJ causally related the cycle in stock returns to the Fed:

1. <u>FOMC calendar</u> does not systematically line up with calendars for reserve maintenance periods, macroeconomic data releases, or corporate earnings releases.

2. <u>Decision making/information processing</u> within the Federal Reserve System tends to take place <u>bi-weekly</u> in FOMC cycle time.

   – Intermeeting target changes tend to be in even weeks.
   – High even week returns driven by even weeks with <u>Board of Governors board meetings</u>.

3. The news gets to the market via <u>systematic informal policy communication</u>.

   – Even weeks don't line up with official releases or speeches.
   – Examples of informal communication with private financial sector and media.
   – Motives for use of informal communication: flexibility, learning and disagreement.
   – Tests of informal communication framework.

CMVJ (2016)

Mean-reversion in even weeks following poor stock returns: A "Fed put" in returns
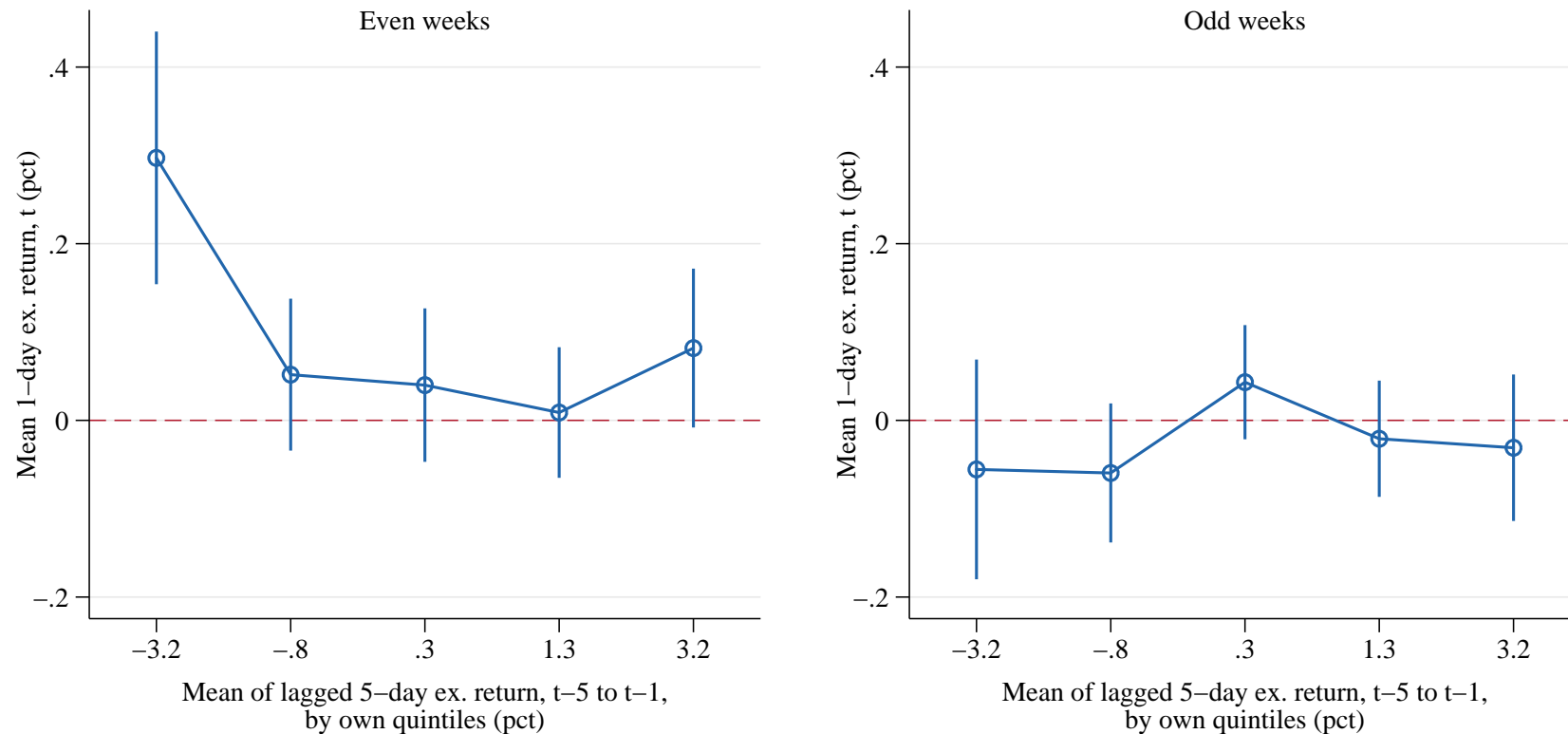
- ☐ Suggests that the FOMC cycle in stock returns works mainly via a trickle of good news (that lowers the risk premium).

- ☐ Indeed, no one seems to have known about the FOMC cycle pattern before our paper, and you don't see high average stock returns around other central bank announcements (Brusa, Savor and Wilson (2016) show no effect for ECB, BoE and BOJ).

Stockmarket returns in America
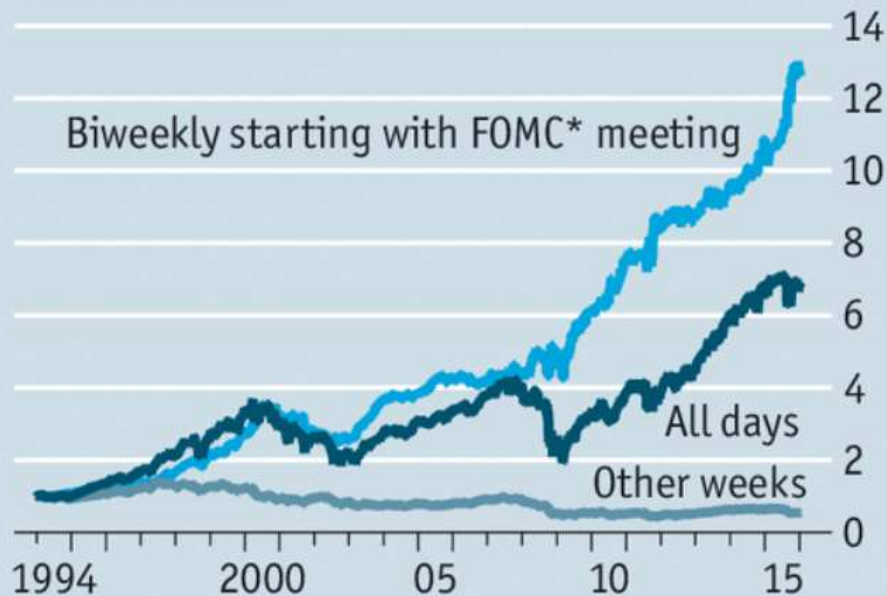
The long arm of the Fed

The Economist

The central bank may exert a strange sway over stockmarket returns

Sep 3rd 2016 | BERKELEY | From the print edition

Market timing

US stock-market returns, value of $1 invested at start of 1994

Biweekly starting with FOMC* meeting

All days

Other weeks

1994   2000   05   10   15

Source: "Stock Returns over the FOMC Cycle", Cieslak, Morse and Vissing-Jorgensen, 2016

*Federal Open Market Committee

Economist.com

1994

- Fed Communication changes:

  - Fed starts making public announcements of policy changes in 1994 (after congressional pressure and 1993 hearings).
  - Transcripts are to be published with a 5 year lag.
  - Minutes take the current format in 1993.

- Greenspan retrospectively refers to a time between 1993 and 1995 as when something fundamentally changed in the economy:

  - Work on the new FRB/US model begins (launched in 1996).
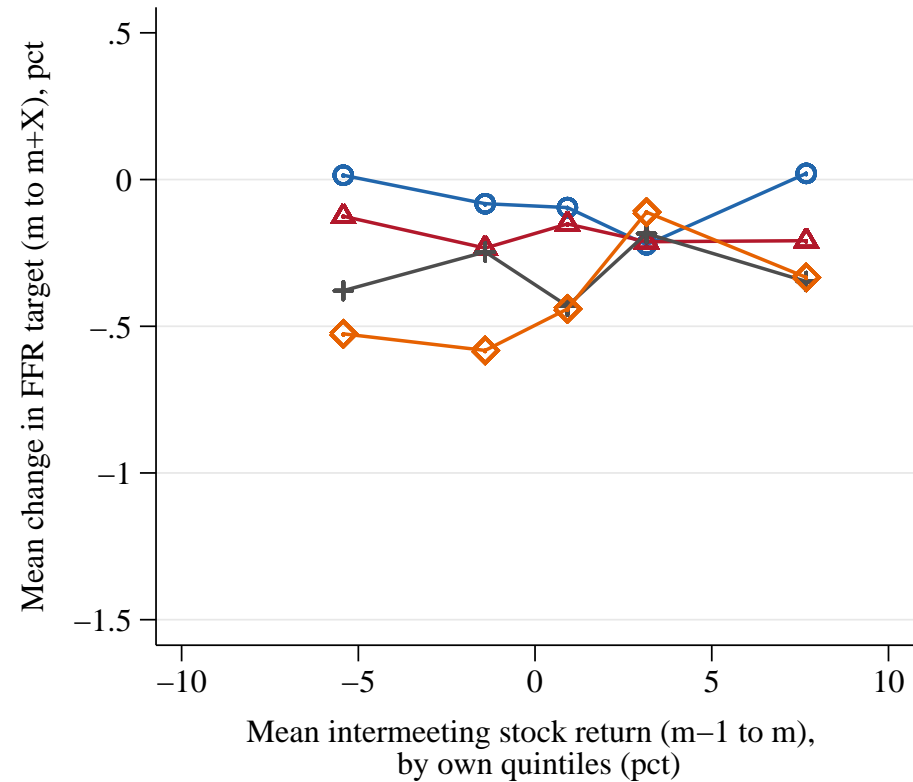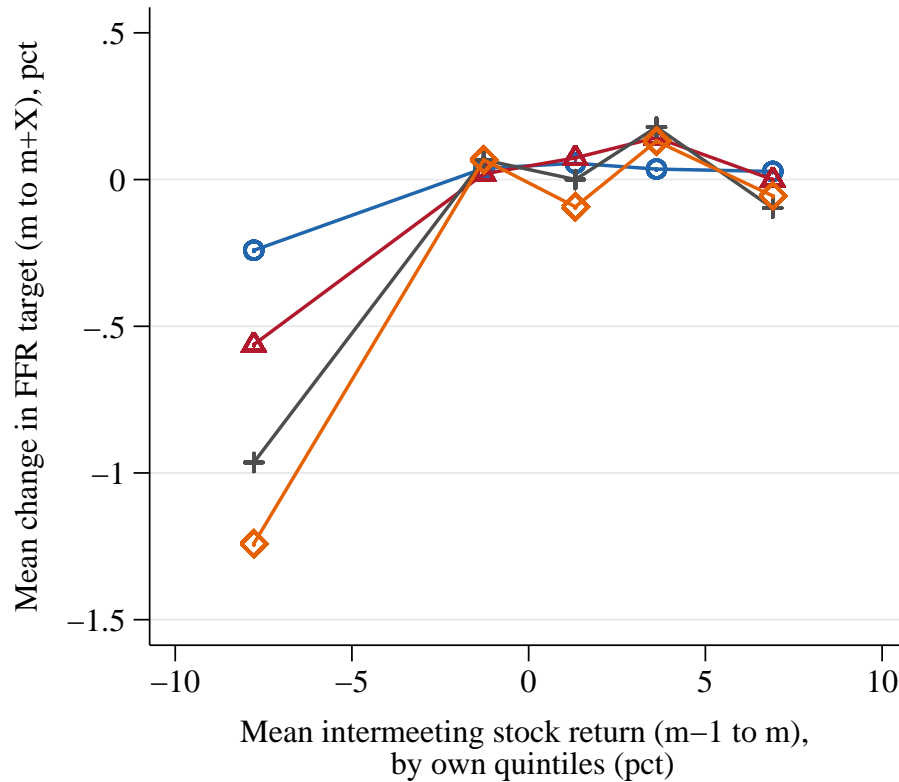 - Irrational exuberance speech in Dec 1996.

FFR target and intermeeting stock returns

Changes in FFR target (m to m+X) conditional on last intermeeting stock returns (m-1 to m)

1994–2008

1982–1993

- ○— change over X=1 FOMC cycle
- +— change over X=6 FOMC cycles
- △— change over X=3 FOMC cycles
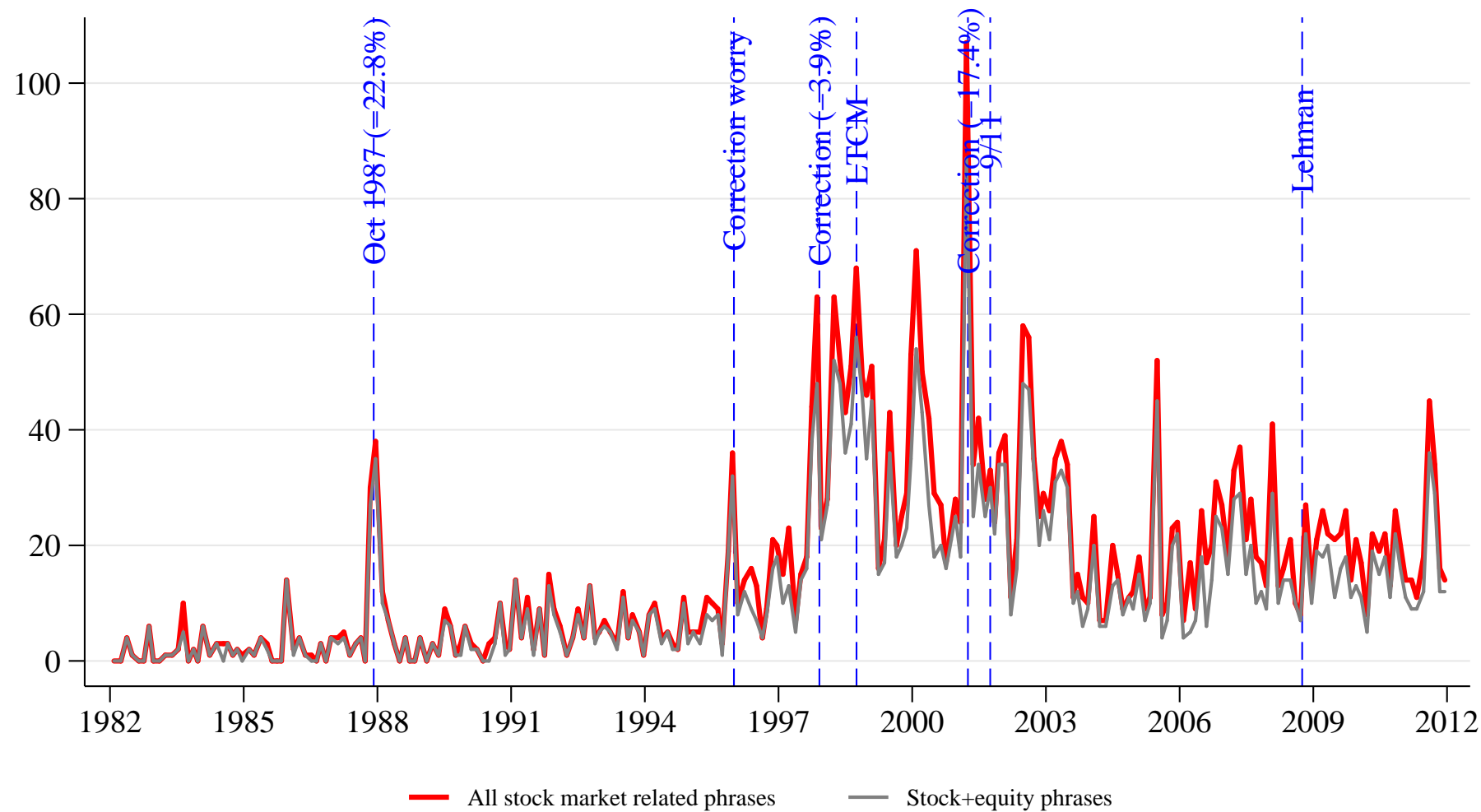- ◇— change over X=8 FOMC cycles

(a) How does the stock market compare to economic indicators as predictor of Fed policy?

Indicator, x_m	Bloomberg ticker	Incremental R^2	p-value
16. Leading Indicators	LEI CHNG Index	0.047	0.030
17. Avg Hourly Earning MOM Prod	USHETOT% Index	0.045	0.034
18. Producer Price Index (MoM)	PPI CHNG Index	0.041	0.047
19. Avg Weekly Hours Production	USWHTOT Index	0.032	0.088
20. Unemployment Rate	USURTOT Index	0.031	0.099
21. Domestic Vehicle Sales	SAARDTOT Index	0.027	0.115
22. GDP QoQ (Annualized)	GDP CQOQ Index	0.027	0.130
23. Initial Jobless Claims	INJCJC Index	0.027	0.137
24. Consumer Price Index (MoM)	CPI CHNG Index	0.022	0.195
25. Personal Income	PITLCHNG Index	0.020	0.229
26. Business Inventories	MTIBCHNG Index	0.015	0.331
27. CPI Ex Food & Energy (MoM)	CPUPXCHG Index	0.014	0.345
28. Personal Spending	PCE CRCH Index	0.012	0.398
29. Current Account Balance	USCABAL Index	0.012	0.417
30. Factory Orders	TMNOCHNG Index	0.008	0.560
31. Nonfarm Productivity	PRODNFR% Index	0.007	0.600
32. Employment Cost Index	ECI SA% Index	0.006	0.660
33. Trade Balance	USTBTOT Index	0.005	0.675
34. Consumer Credit	CICRTOT Index	0.005	0.697
35. Unit Labor Costs	COSTNFR% Index	0.005	0.694
36. Monthly Budget Statement	FDDSSD Index	0.005	0.719
37. Durable Goods Orders	DGNOCHNG Index	0.004	0.752
38. Wholesale Inventories	MWINCHNG Index	0.002	0.850

Bloomberg economic announcements calendar, sample: 1996:10–2008:12

Stock market mentions in FOMC transcripts

Stock market related phrases in FOMC transcripts (1982–2011)

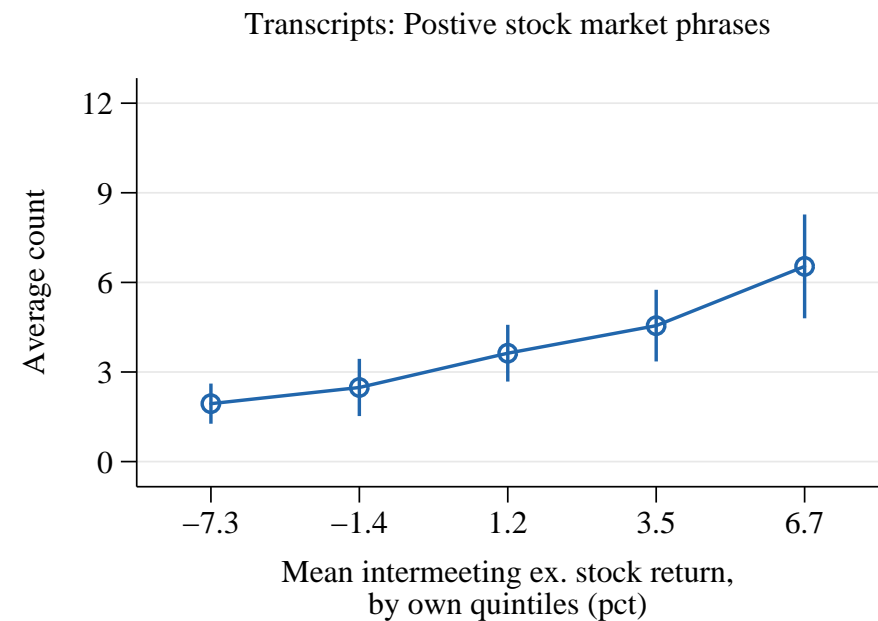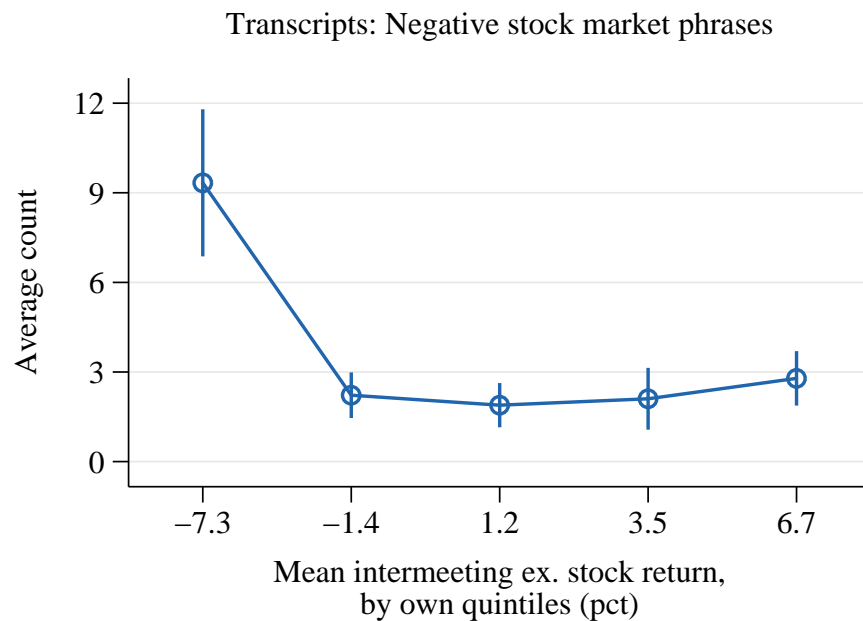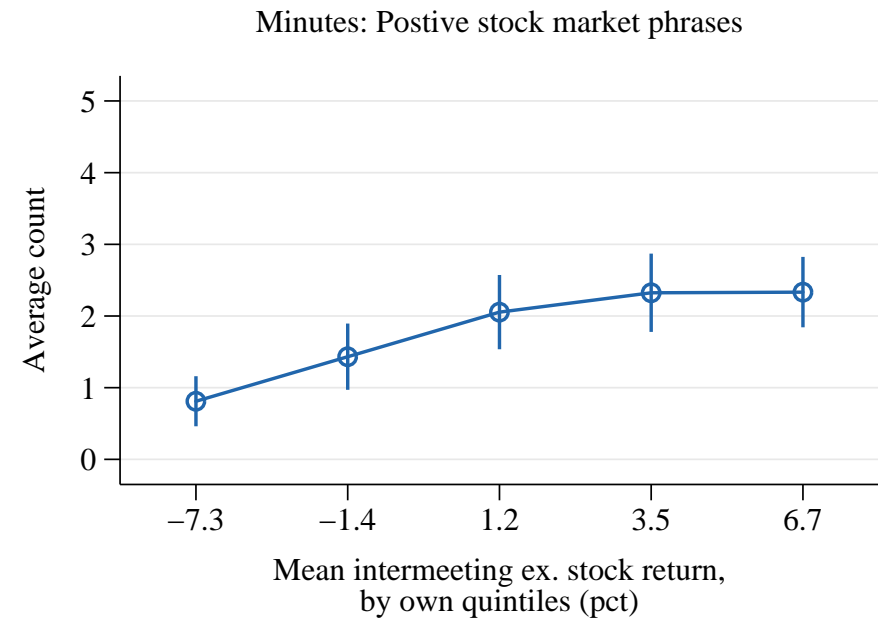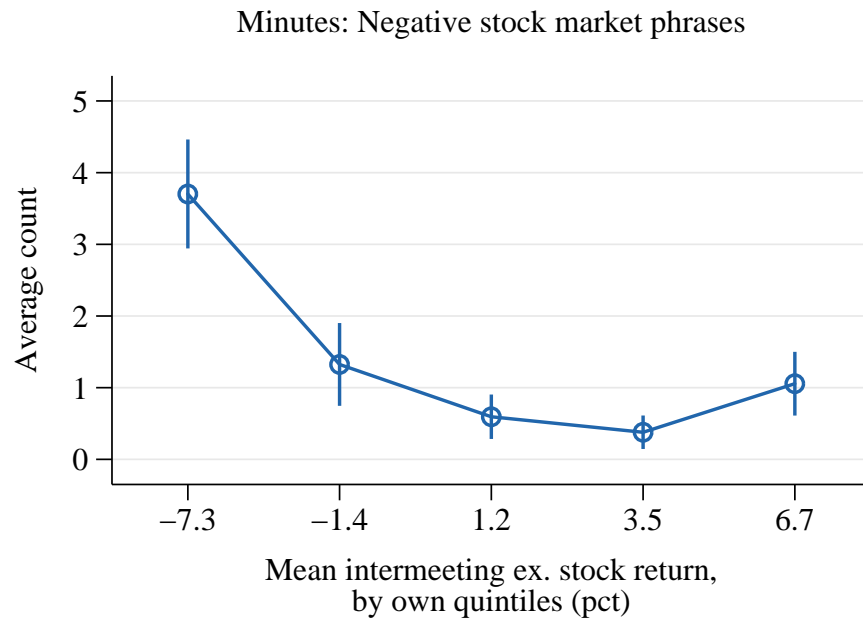Legend: All stock market related phrases — Stock+equity phrases

Robustness: Algorithm-based coding

Phrases		Direction words			
		Negative		Positive	
asset index*	house and equity price*	adjust* downward	mov* downward	acceler*	rise*
asset indic*	household wealth	adverse	mov* lower	adjust* upward	rising
asset market*	household* net worth	burst*	plummet*	advanc*	rose
asset price index*	housing and equity price*	contract*	pressure*	bolster*	run up
asset price indic*	price* of risk* asset*	cool*	pull* back	boost*	runup
asset price*	ratio of wealth to income	deceler*	pullback	edge* up	stop decline
asset valu*	risk* asset price*	declin*	reduc*	elevat*	strength*
equities	s p 500 index	decreas*	revis* down*	encourag*	strong*
equity and home price*	stock index*	deteriorat*	slow*	expand*	tick* up
equity and home valu*	stock indic*	down	slow* down	fast*	up
equity and house price*	stock market index*	downturn	soft*	favor*	upward
equity and housing price*	stock market price*	downward	stagnate*	gain*	upward adjust*
equity index*	stock market wealth	downward adjust*	stall*	go* up	upward movement
equity indic*	stock market*	downward movement	strain*	high*	upward revision
equity market index*	stock price indic*	downward revision	stress*	improv*	went up
equity market indic*	stock price*	drop*	subdu*	increas*	
equity market price*	stock prices index*	eas*	take* toll on	mov* high*	
equity market valu*	stock val*	edge* down	tension*	mov* up	
equity market*	us stock market price*	fall*	tick* down	mov* upward	
equity price index*	wealth effect*	fell	tight*	pick* up	
equity price indic*	wealth to income ratio	go* down	took toll on	rais*	
equity price measure*		limit*	tumbl*	rallied	
equity price*		low*	weak*	rally*	
equity valu*		moderate*	weigh* on	rebound*	
financial wealth		moderati*	went down	recoup*	
home and equity price*		mov* down	worse*	revis* up*	

Robustness: Algorithm-based coding

Minutes: Negative stock market phrases

Minutes: Postive stock market phrases

Transcripts: Negative stock market phrases

Transcripts: Postive stock market phrases

Robustness: Algorithm-based coding

Predicting positive/negative stock market phrases with intermeeting returns: FOMC minutes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Negative stock market phrases				Positive stock market phrases		
Sample:	1994–2016	1994–2016	1994–2008	2009–2016	1994–2016	1994–2016	1994–2008	2009–2016
rx_m	-0.18***				0.11***			
	(-5.78)				(4.59)			
rx_{m-1}	-0.11***				0.063***			
	(-4.77)				(3.05)			
rx_{m-2}	-0.058**				0.020			
	(-2.24)				(1.07)			
rx_m^-		-0.27***	-0.26***	-0.35***		0.035	0.014	0.12***
		(-3.66)	(-3.11)	(-3.21)		(1.34)	(0.53)	(4.05)
rx_{m-1}^-		-0.22***	-0.25***	-0.069		-0.006	-0.027	0.076**
		(-6.73)	(-10.94)	(-0.84)		(-0.35)	(-1.46)	(2.01)
rx_{m-2}^-		-0.067	-0.18**	0.007		0.034	0.065	-0.0097
		(-1.20)	(-2.27)	(0.25)		(1.00)	(1.25)	(-0.29)
rx_m^+		-0.060	-0.13**	0.024		0.20***	0.15***	0.26***
		(-1.28)	(-2.05)	(0.65)		(4.67)	(3.12)	(4.27)
rx_{m-1}^+		0.092*	0.095**	0.007		0.20***	0.21***	0.14**
		(1.81)	(2.08)	(0.08)		(4.25)	(3.08)	(2.15)
rx_{m-2}^+		0.045	0.11	-0.047		0.061	0.079	0.003
		(0.94)	(1.37)	(-0.93)		(1.43)	(1.23)	(0.05)
Constant	1.60***	0.26	-0.099	1.01**	1.69***	0.86***	0.73***	1.43***
	(8.85)	(0.73)	(-0.24)	(2.18)	(10.22)	(3.27)	(2.68)	(5.40)
N (meetings)	184	184	120	64	184	184	120	64
R^2	0.41	0.52	0.65	0.35	0.19	0.26	0.20	0.38

Robustness: Algorithm-based coding

	Predicting FFR target changes: FOMC minutes and transcripts					
	(1)	(2) Minutes	(3)	(4)	(5) Transcripts	(6)
	All	Staff	Partic.	All	Staff	Partic.
ΔFFR_{m-1}	0.22**	0.32***	0.22**	0.26**	0.34***	0.30**
	(2.38)	(3.57)	(2.25)	(2.27)	(2.90)	(2.25)
ΔFFR_{m-2}	0.20	0.23	0.21	0.24*	0.28**	0.21
	(1.44)	(1.52)	(1.59)	(1.94)	(1.96)	(1.48)
$\#\text{Stocks}_m^-$	-0.031	-0.049	-0.050**	-0.0094	-0.061**	-0.0064
	(-1.59)	(-1.20)	(-2.25)	(-1.44)	(-2.24)	(-1.58)
$\#\text{Stocks}_{m-1}^-$	-0.048**	-0.065	-0.071***	-0.019***	-0.0080	-0.025***
	(-2.57)	(-1.61)	(-3.37)	(-3.18)	(-0.74)	(-4.27)
$\#\text{Stocks}_m^+$	-0.021	-0.037	0.0033	-0.00040	0.018	-0.0045
	(-1.15)	(-1.17)	(0.24)	(-0.09)	(1.59)	(-0.63)
$\#\text{Stocks}_{m-1}^+$	0.0067	0.025	-0.0014	0.0068	0.020	-0.00036
	(0.49)	(0.90)	(-0.12)	(1.12)	(1.14)	(-0.04)
Constant	0.11**	0.070	0.057*	0.063	0.013	0.077
	(2.23)	(1.60)	(1.76)	(1.50)	(0.43)	(1.62)
N (meetings)	119	119	119	119	119	119
R^2	0.48	0.43	0.46	0.47	0.46	0.46

Q2c: If Fed does in fact react to stock market, why is it doing that?

Classify economic content of stock market mentions in FOMC minutes by reading the 983 paragraphs:

☐ Descriptive:

Ex.: "Broad U.S. equity price indexes were highly correlated with foreign equity indexes over the intermeeting period and posted net declines. Although concerns about global economic growth likely contributed to the declines in domestic equity prices, investors may also have reassessed valuations and risk in equity markets. Domestic equity indexes were quite volatile in late August and early September, and one-month-ahead option-implied volatility on the S&P 500 index reached levels last seen in 2011. Spreads on 10-year triple-B-rated and speculative-grade corporate bonds over comparable-maturity Treasury securities widened slightly over the intermeeting period."
(Staff Review of the Financial Situation, 9/17/2015)

Economic content of stock-market mentions in FOMC minutes

☐ Various ways in which the stock market *drives* the economy:

– Consumption:

Ex.: "With regard to the outlook for key sectors of the economy, a number of members commented that <u>consumer spending had held up reasonably well in recent months despite a variety of adverse developments including the negative wealth effects of stock market declines,</u> widely publicized job cutbacks, heavy consumer debt loads, and previous overspending by many consumers. A recent survey had indicated that consumer sentiment had firmed a little, but the survey results had yet to be confirmed by additional surveys and the level of consumer confidence was still well below earlier highs. As in the past, <u>consumer spending attitudes likely would depend importantly on trends in employment and income, and further increases in unemployment in the period just ahead along with the negative wealth effects of earlier stock market price declines and the persistence of high energy costs were likely to constrain the growth in consumer expenditures over coming quarters</u>." (Participants' Views on Current Cond. and the Economic Outlook, 5/15/2001)

Economic content of stock-market mentions in FOMC minutes

– Investment:

Ex.: "Another major source of downside risk to the expansion was business fixed investment. Spending for equipment and software declined in the fourth quarter, and the available statistical and anecdotal reports pointed to weakness during the first half of this year, largely reflecting developments in high-tech industries. Substantial downward adjustments to expected near-term business earnings had persisted, suggesting that firms saw investment as much less profitable than they had before and that cash flows would be constrained. <u>Many businesses also were inhibited in their investment activities by less accommodative financial conditions associated with weaker equity markets and tighter credit terms and conditions imposed by banking institutions. As a consequence, a substantial volume of planned investment was being postponed, if not cancelled.</u> ..."
(Participants' Views on Current Cond. and the Economic Outlook, 3/20/2001)

Economic content of stock-market mentions in FOMC minutes

  - Demand:

    Ex.: "Participants discussed whether their current assessments of economic conditions and the medium-term outlook warranted increasing the target range for the federal funds rate at this meeting. Participants agreed that incoming indicators regarding labor market developments continued to be encouraging. They generally concurred that data releases during the intermeeting period on components of private domestic demand had been disappointing, but most participants judged that the slowdown in growth of domestic spending would be temporary, citing possible measurement problems and other transitory factors. <u>Financial market conditions continued to improve, providing support to aggregate demand and suggesting that market participants saw some reduction in downside risks to the outlook: Equity prices rose further, credit spreads declined somewhat, and the dollar depreciated over the intermeeting period.</u> ..."
    (Participants' Views on Current Cond. and the Economic Outlook, 4/27/2016)

Economic content of stock-market mentions in FOMC minutes

- Financial conditions (stock market as part of fin. conditions driving the economy):

  Ex: "Participants noted that <u>financial conditions had worsened significantly over the inter-meeting period</u>. The failure or near failure of a number of major financial institutions had deepened market concerns about counterparty credit risk and liquidity risk. As a result, financial intermediaries had cut back on lending to some counterparties, particularly for terms beyond overnight, and in general were conserving liquidity and capital. <u>Moreover, risk aversion of investors increased, driving credit spreads sharply higher. Survey results and anecdotal information also suggested that credit conditions had tightened significantly further for businesses and households. Equity prices had varied widely and were substantially lower, on net.</u> ..."
  (Participants' Views on Current Cond.'s and the Economic Outlook, 10/29/2008)

- Driver of the economy, no mechanism stated

  "As had been the case in some previous cyclical episodes, a relatively low real federal funds rate now appeared appropriate for a time to <u>counter the factors that were restraining economic growth, including the slide in housing activity and prices, the tightening of credit availability, and the drop in equity prices</u>."
  (Participants Views on Current Conditions and the Economic Outlook, 1/30/2008)

Economic content of stock-market mentions in FOMC minutes

☐ Economic outlook (stock market as *predictor* of the economy)

"Participants noted that financial markets were volatile over the intermeeting period, as investors responded to news on the European fiscal situation and the negotiations regarding the debt ceiling in the United States. However, the broad declines in stock prices and interest rates over the intermeeting period were seen as mostly reflecting the incoming data pointing to a weaker outlook for growth both in the United States and globally as well as a reduced willingness of investors to bear risk in light of the greater uncertainty about the outlook. While conditions in funding markets had tightened, it was noted that the condition of U.S. banks had strengthened in recent quarters and that the credit quality of both businesses and households had continued to improve."
(Participants' Views on Current Cond.'s and the Economic Outlook, 8/9/2011)

☐ Financial stability
☐ Other

Financial conditions and intermeeting stocks returns in FOMC minutes

Predicting positive/negative financial conditions phrases with intermeeting returns: FOMC minutes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Negative fin. cond. phrases				Positive fin. cond. phrases		
Sample:	1994-2016	1994-2016	1994-2008	2009-2016	1994-2016	1994-2016	1994-2008	2009-2016
rx_m	-0.24*				0.043			
	(-1.88)				(1.10)			
rx_{m-1}	-0.16***				0.032			
	(-3.24)				(1.13)			
rx_{m-2}	-0.13**				-0.073*			
	(-2.11)				(-1.76)			
rx_m^-		-0.45**	-0.47**	-0.23**		-0.080*	-0.062	-0.059
		(-2.35)	(-2.11)	(-2.40)		(-1.69)	(-1.27)	(-1.01)
rx_{m-1}^-		-0.18***	-0.19***	-0.13*		-0.042	-0.021	-0.10
		(-2.72)	(-2.59)	(-1.81)		(-0.99)	(-0.66)	(-1.30)
rx_{m-2}^-		-0.18**	-0.092	-0.29***		-0.11**	-0.024	-0.19***
		(-2.48)	(-0.73)	(-8.46)		(-2.01)	(-0.40)	(-3.77)
rx_m^+		0.063	-0.064	0.10*		0.22***	0.035	0.35***
		(0.69)	(-0.45)	(1.71)		(3.16)	(0.90)	(4.56)
rx_{m-1}^+		-0.029	-0.16	0.043		0.20**	0.025	0.36***
		(-0.30)	(-1.12)	(0.61)		(2.48)	(0.38)	(4.43)
rx_{m-2}^+		0.036	-0.11	0.15**		0.071	-0.039	0.081
		(0.41)	(-0.86)	(2.45)		(1.46)	(-1.00)	(0.93)
Constant	2.17***	0.35	0.81	0.78*	1.26***	-0.23	0.40	-0.22
	(3.79)	(0.39)	(0.63)	(1.80)	(4.73)	(-0.49)	(1.06)	(-0.48)
N (meetings)	184	184	120	64	184	184	120	64
R^2	0.24	0.31	0.34	0.55	0.060	0.19	0.070	0.44

Predicting FFR target changes with financial conditions and stock market phrases

	(1)	(2)	(3) Algo for #Stocks	(4)	(5) Manual for #Stocks	(6)
	1994–2008	1994–2007	1994–2008	1994–2007	1994–2008	1994–2007
ΔFFR_{m-1}	0.25***	0.24**	0.16*	0.15*	0.17*	0.15
	(2.63)	(2.20)	(1.87)	(1.68)	(1.84)	(1.53)
ΔFFR_{m-2}	0.34***	0.44***	0.24*	0.31**	0.29**	0.37***
	(2.67)	(3.68)	(1.81)	(2.04)	(2.47)	(2.94)
$\#\text{Fin.cond.}_m^-$	-0.011*	-0.005	-0.007	-0.005	-0.009	-0.007
	(-1.67)	(-0.54)	(-1.07)	(-0.61)	(-1.29)	(-0.80)
$\#\text{Fin.cond.}_{m-1}^-$	-0.038***	-0.035***	-0.029**	-0.018	-0.029**	-0.011
	(-3.87)	(-2.92)	(-2.43)	(-1.27)	(-2.52)	(-0.84)
$\#\text{Fin.cond.}_m^+$	0.052*	0.019	0.027	-0.0037	0.030	-0.006
	(1.74)	(0.96)	(0.93)	(-0.24)	(1.06)	(-0.36)
$\#\text{Fin.cond.}_{m-1}^+$	0.050**	0.044**	0.026	0.012	0.032	0.019
	(2.57)	(2.40)	(1.16)	(0.64)	(1.49)	(1.01)
$\#\text{Stocks}_m^-$			-0.014	-0.002	-0.013	-0.010
			(-1.21)	(-0.20)	(-1.53)	(-0.97)
$\#\text{Stocks}_{m-1}^-$			-0.040*	-0.057***	-0.031**	-0.040***
			(-1.79)	(-4.05)	(-2.24)	(-3.62)
$\#\text{Stocks}_m^+$			-0.016	-0.012	-0.015	-0.015
			(-1.00)	(-0.86)	(-1.26)	(-1.41)
$\#\text{Stocks}_{m-1}^+$			0.002	-0.003	-0.007	-0.007
			(0.18)	(-0.30)	(-0.51)	(-0.50)
Constant	-0.008	-0.003	0.093*	0.11**	0.11**	0.12**
	(-0.27)	(-0.11)	(1.87)	(2.35)	(2.12)	(2.41)
N (meetings)	119	111	119	111	119	111
R^2	0.51	0.43	0.56	0.54	0.56	0.53

#Fin.cond. are based on algorithm-based coding. ↶

Methodology for textual measures of Fed concerns about growth and inflation

☐ Similar to stock market phrases, we develop an algorithm for measuring Fed's concern about economic conditions, and implement it on FOMC minutes and transcripts.

☐ Two broad categories: (1) economic growth and (2) inflation and wages:

Category	# Phrases	# Direction words	
		Negative	Positive
Economic growth	58	52	42
Inflation and wages	36	37	38

☐ Number of matches:

	# Matches	# Neg matches	# Pos matches
	(Match = Phrase + direction word)		
Minutes			
Economic growth	3,763	1,282	2,481
Inflation and wages	2,663	1,656	1,007
Transcripts			
Economic growth	8,454	3,581	4,873
Inflation and wages	8,620	5,068	3,552

Impact of stock market on the tone of Fed deliberations about economic growth and inflation (FOMC minutes)

	Negative phrases			Positive phrases		
	All	Staff	Particip.	All	Staff	Particip.
Economic activity conditions						
rx_m^-	-0.15	-0.13**	-0.034	0.28***	0.13***	0.20**
	(-1.45)	(-2.42)	(-0.49)	(3.33)	(3.14)	(2.18)
rx_{m-1}^-	-0.47***	-0.29***	-0.19***	0.081	0.11**	0.039
	(-3.97)	(-3.01)	(-3.97)	(1.14)	(2.19)	(0.67)
rx_m^+	0.048	0.024	0.014	0.12	-0.018	0.093
	(0.33)	(0.28)	(0.19)	(0.87)	(-0.29)	(0.85)
rx_{m-1}^+	0.19	0.12	0.066	0.062	-0.052	0.078
	(1.10)	(1.29)	(0.62)	(0.40)	(-0.84)	(0.56)
Lag of dept. var.	Y	Y	Y	Y	Y	Y
Constant	3.04***	1.23***	1.67***	3.25***	3.68***	1.93**
	(4.89)	(2.95)	(4.14)	(3.68)	(6.95)	(2.41)
N (meetings)	183	183	183	183	183	183
R^2	0.29	0.30	0.23	0.66	0.21	0.65
Inflationary conditions						
rx_m^-	0.37***	0.11***	0.21***	0.029	0.039	-0.026
	(4.35)	(2.81)	(3.26)	(0.35)	(1.60)	(-0.37)
rx_{m-1}^-	0.032	0.0054	0.055	-0.16	-0.19**	0.024
	(0.36)	(0.20)	(0.62)	(-1.29)	(-2.23)	(0.44)
rx_m^+	-0.16	-0.082*	-0.090	-0.023	0.021	-0.022
	(-1.13)	(-1.71)	(-0.70)	(-0.18)	(0.37)	(-0.21)
rx_{m-1}^+	-0.32***	-0.12*	-0.23**	-0.012	0.0013	0.022
	(-2.92)	(-1.88)	(-2.34)	(-0.09)	(0.02)	(0.21)
Lag of dept. var.	Y	Y	Y	Y	Y	Y
Constant	5.61***	2.39***	4.50***	2.29***	1.18***	1.39***
	(6.36)	(6.57)	(5.64)	(4.01)	(4.92)	(2.59)
N (meetings)	183	183	183	183	183	183
R^2	0.35	0.14	0.25	0.33	0.20	0.39
Lag of dept. var.	Y	Y	Y	Y	Y	Y
N (meetings)	183	183	183	183	183	183

Components of GDP: Comparing impact of stock market on Greenbook, SPF, and realized values

Growth rate forecast update, 1994–2010, q0+q1+q2+q3

	Federal Reserve, Greenbook				Private sector, SPF			
	(1) Y	(2) C	(3) I$_{bus.fixed}$	(4) I$_{res}$	(5) Y	(6) C	(7) I$_{bus.fixed}$	(8) I$_{res}$
rx_t^-	5.06***	2.72***	23.77***	16.26	4.56***	2.53***	21.18***	6.67
	(2.98)	(3.20)	(3.24)	(1.46)	(3.13)	(2.73)	(4.60)	(0.79)
rx_{t-1}^-	4.61***	2.55**	12.97***	-6.33	4.68***	3.31***	7.45*	11.53***
	(3.94)	(2.22)	(2.70)	(-0.87)	(5.15)	(4.15)	(1.80)	(3.34)
rx_t^+	1.95	1.53	0.95	7.31	1.63	1.57*	-1.74	8.47
	(1.28)	(1.26)	(0.14)	(0.66)	(1.61)	(1.88)	(-0.49)	(1.66)
rx_{t-1}^+	2.01	2.30**	0.71	16.18	0.14	-0.37	3.01	-6.33
	(1.50)	(2.41)	(0.11)	(1.27)	(0.17)	(-0.47)	(0.91)	(-1.36)
Lag of dept. var.	-0.105	-0.098	0.043	0.013	0.08	0.11	0.29*	0.51***
	(-1.12)	(-0.73)	(0.42)	(0.11)	(0.72)	(0.94)	(1.97)	(5.73)
Constant	0.03	0.02	0.52	-0.76	0.00	0.03	0.44	-0.05
	(0.38)	(0.51)	(1.48)	(-1.29)	(-0.02)	(0.45)	(1.40)	(-0.10)
N (meetings)	136	136	136	136	93	93	93	93
R^2	0.38	0.21	0.31	0.07	0.54	0.40	0.54	0.46

☐ Across all three data sets, consumption is less sensitive to the stock market than business investment (as you'd expect since investment is known to be more cyclical).

☐ No evidence that Fed expectations for consumption or investments are substantially more sensitive to the stock market than SPF expectations or predictability in actual data.

☐ But surveys suggest a more asymmetric response than actual realized data.

Components of GDP: Comparing impact of stock market on Greenbook, SPF, and realized values

Realized growth rates (NIPA data), q0+q1+q2+q3

	Y	C	I$_{total}$	I$_{bus.fixed}$	I$_{res}$
1994–2016					
rx_t^-	10.11**	1.324	52.73**	42.09***	-5.32
	(2.54)	(0.53)	(2.32)	(2.87)	(-0.27)
rx_t^+	5.55**	7.96***	27.66*	10.98	46.07**
	(1.97)	(3.02)	(1.86)	(1.10)	(2.27)
Lag of q0-value of dept. var.	1.04***	2.08***	0.53*	1.56***	1.79***
	(3.78)	(7.33)	(1.74)	(6.04)	(5.34)
Constant	1.79***	1.01***	3.28**	3.08***	-1.39
	(5.20)	(2.97)	(2.04)	(2.88)	(-0.85)
N (quarters)	89	89	89	89	89
R^2	0.32	0.47	0.24	0.42	0.37
1947–2016					
rx_t^-	13.00***	7.33***	58.06***	49.17***	15.03
	(3.66)	(2.68)	(3.17)	(5.10)	(0.80)
rx_t^+	8.06***	6.62**	35.14**	-5.22	88.20***
	(2.60)	(2.10)	(2.24)	(-0.63)	(3.76)
Lag of q0-value	0.54***	0.48*	0.02	0.70***	0.76***
	(2.84)	(1.77)	(0.12)	(3.30)	(3.59)
Constant	2.76***	2.85***	5.45***	5.19***	-0.20
	(8.17)	(7.81)	(3.94)	(6.09)	(-0.12)
N (quarters)	275	275	275	275	275
R^2	0.15	0.11	0.10	0.18	0.17

VAR: Effect of Fed's stock market attention shock on FFR
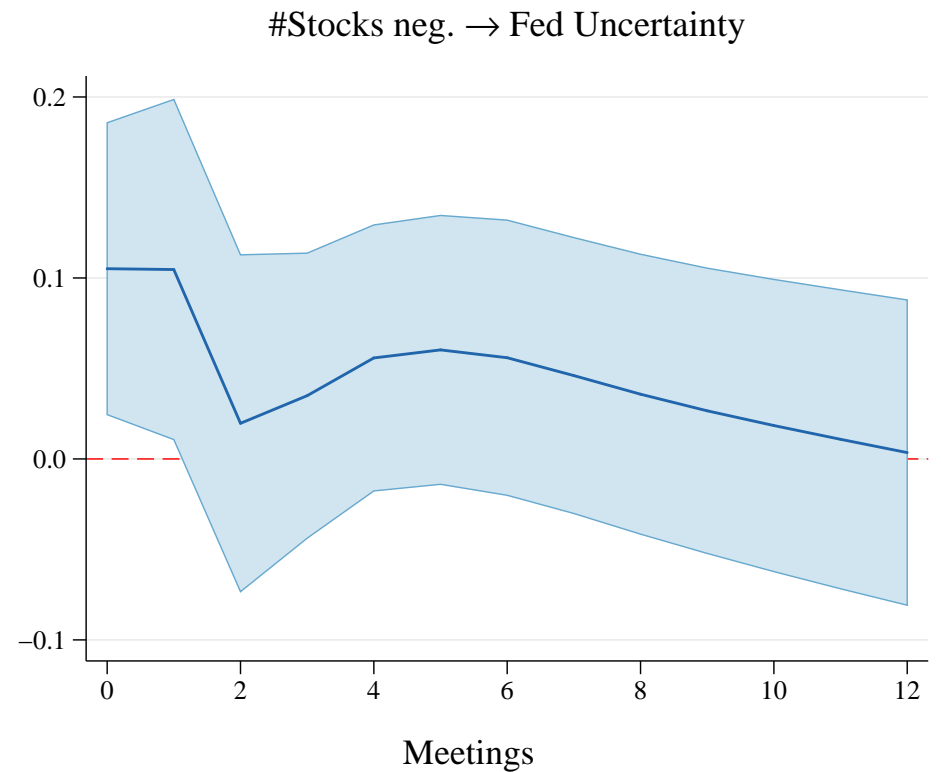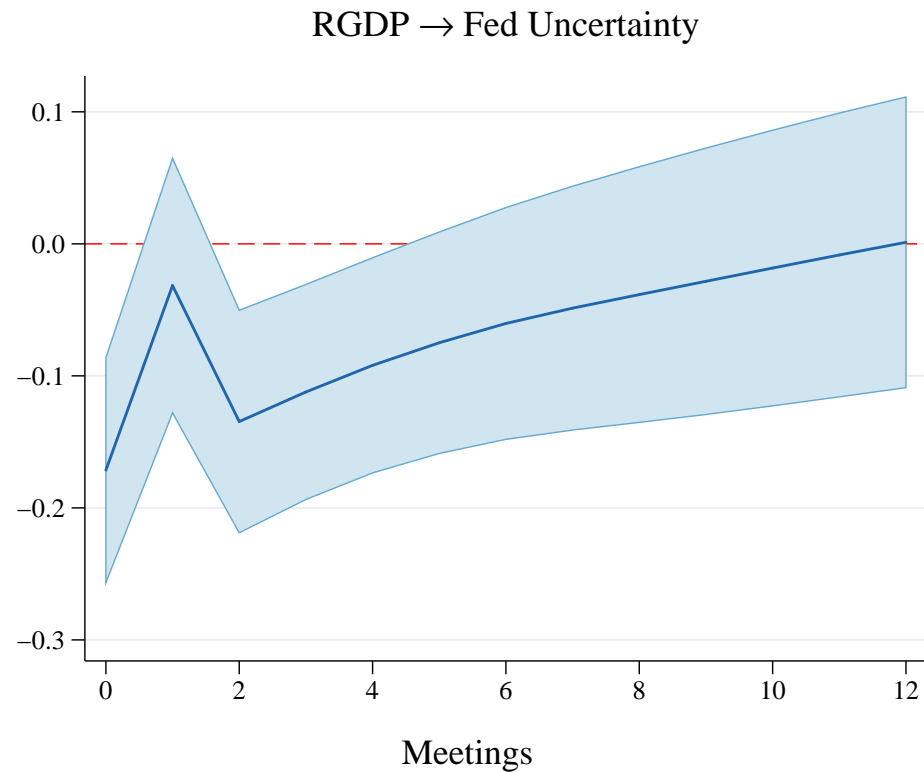
- □ VAR(2) with Greenbook forecasts for real GDP, inflation, employment, negative/positive stock market mentions, uncertainty and FFR target (in this order)
- □ Effect of 1σ shock to real GDP and #Stocks$^-$ onto a measure of Fed uncertainty (y-axis in units of standard deviation)
- □ Other IRFs are not significant