

THE VOICE OF MONETARY POLICY

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EVOLUTION OF POLICY COMMUNICATION

A. Greenspan, September 22, 1987

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J. Powell, June 13, 2018

“[B]ecause monetary policy affects everyone, I want to start with a plain-English summary of how the economy is doing, what my colleagues and I at the Federal Reserve are trying to do, and why.”

“As Chairman, I hope to foster a public conversation about what the Fed is doing to support a strong and resilient economy. **And one practical step in doing so is to have a press conference like this after every one of our scheduled FOMC meetings.** And we're going to do that beginning in January. **That will give us more opportunities to explain our actions and to answer your questions.** I want to point out that having twice as many press conferences does not signal anything about the timing or pace of future interest rate changes. This change is only about improving communications.”

WHAT IS COMMUNICATION?

Mehrabian (1971) posited a 7-55-38 rule of communication:

- the words convey 7 percent of a message,
- the body language (gestures, facial expressions, etc.) accounts for 55 percent
- the tone delivers 38 percent

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- the tone delivers 38 percent
 - this paper

WHAT ARE TRADERS LOOKING FOR?

“FELICIA TAYLOR, CNN FINANCIAL CORRESPONDENT: The press conference, though, that is coming up in just a few minutes is where traders are really going to be looking for every little nuance. **They want to see how he is going to read into everything. The tone of his voice, his body language, his inflection, for any clue about the direction the markets are still looking for.** And that is something that is not out there yet. Growth is going to be less than we expected. That is good. He acknowledged it. The marketplace wanted to hear that.”

(CNN International QUEST MEANS BUSINESS; June 22, 2011)

PREVIEW

Methodological approach:

- Use press-conference after FOMC meetings
- Train a machine learning algorithm to identify emotions in the voice tone
- Construct the “tone” of voice communication
- Study responses of financial variables to the “tone”

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Main results:

- The tone moves the stock market, uncertainty, inflation expectations and exchange rate
- **HOW** policy is communicated matters and voice could be a separate channel

SOURCES OF COMMUNICATION DATA

- Press conferences, particularly the Q&A sessions, play an important role in clarifying market views about the future outlook (especially in periods of high uncertainty)
- **Unscripted nature of the answers**
- Audios of press conferences of the Fed available in its Youtube channels:
 - FED: 37 FOMC press conferences (2011-2019)
 - Only answers of the Chair during the Q&A session
- 692 answers of 3 speakers: Bernanke, Powell, Yellen

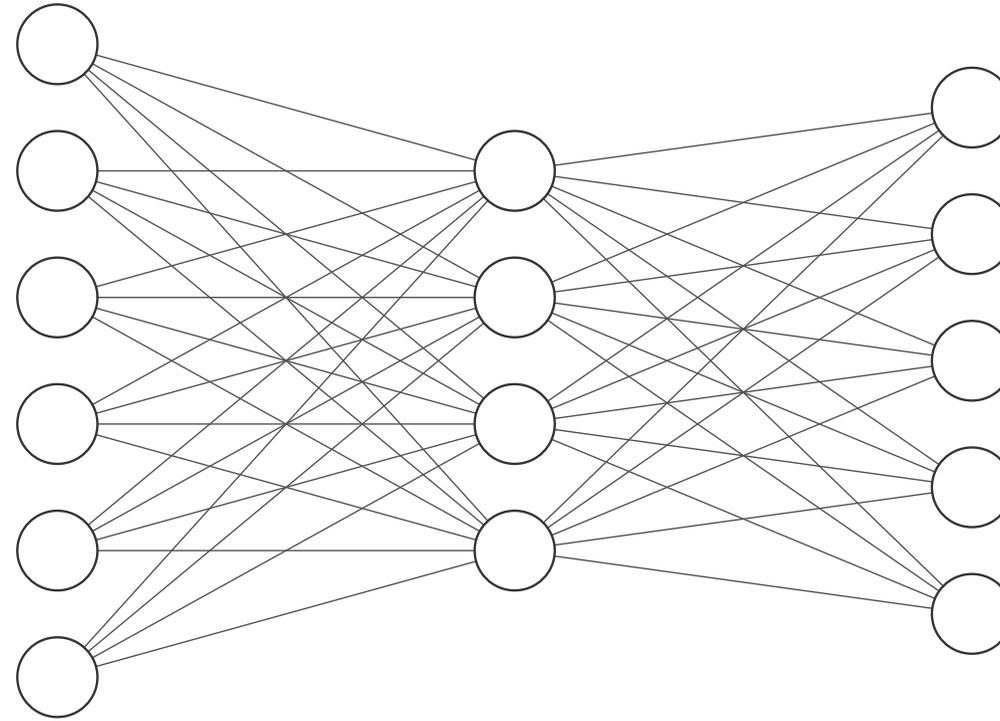
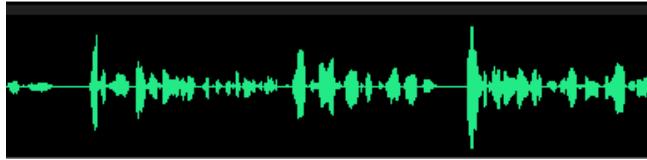
INTERPRETING VOICE TONE

Need to convert



into emotions

INTERPRETING VOICE TONE



Input Layer $\in \mathbb{R}^6$

Hidden Layer $\in \mathbb{R}^4$

Output Layer $\in \mathbb{R}^5$

Emotions

INTERPRETING VOICE TONE

Training data:

- Ryson Audio-Visual Database of Emotional Speech and Song (RAVDESS):
 - 24 actors (12 male, 12 female) speaking identical statements in the neutral North American accent with different emotions.
 - 8 emotions (calm, happy, sad, angry, fearful, surprised, disgust, neutral)
 - 3 sentences
- Toronto Emotional Speech Set (TESS):
 - a set of 200 target words were spoken in the carrier phrase "Say the word...'
 - two actresses

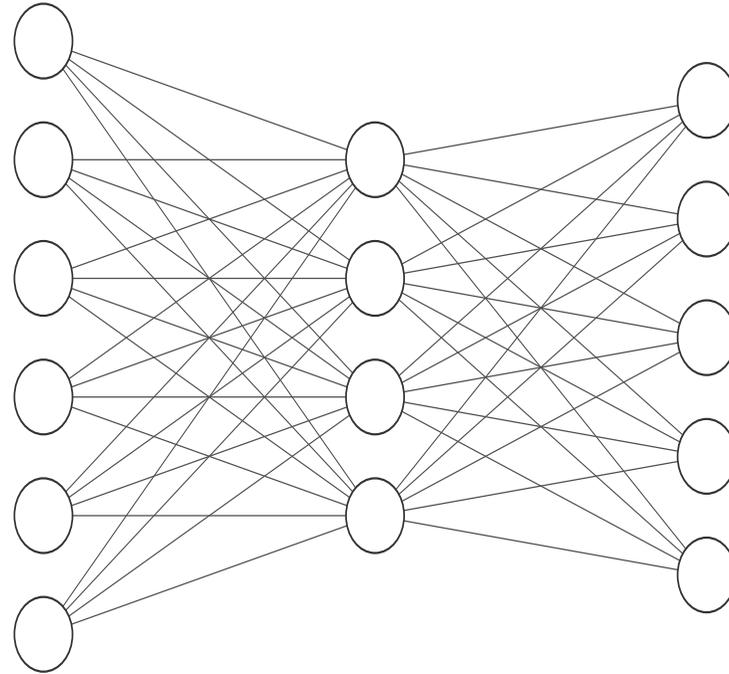
We only use audios of 5 emotions, i.e., happy, (pleasant) surprised, neutral, sad, and angry

INTERPRETING VOICE TONE



Audio inputs:

- Mel-frequency cepstral coefficients,
- Chromagram,
- Mel-scaled spectrogram



Input Layer $\in \mathbb{R}^6$

Hidden Layer $\in \mathbb{R}^4$

Output Layer $\in \mathbb{R}^5$

Emotions:

- happy,
- (pleasant) surprised,
- neutral,
- sad,
- angry

Accuracy score = 84.1%

INTERPRETING VOICE TONE

After training data:

- We applied our model to each answer during a press-conference
- Aggregate over each FOMC press conference

$$\text{VoiceTone} = \frac{\text{Positive answers} - \text{Negative answers}}{\text{Positive answers} + \text{Negative answers}}$$

- Positive answers are the answers which have either “happy” or “surprised” emotion
- Negative answers include the answers which have either “sad” or “angry” emotion

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- The VoiceTone indicator is in the [-1;1] range

RESULTS

Voice tone	All	Bernanke	Yellen	Powell
	(1)	(2)	(3)	(4)
mean	0.09	0.64	-0.13	-0.30
standard deviation	0.75	0.58	0.61	0.82

TEXT SENTIMENT

- Search and count: $TextSentiment = \frac{Dovish\ phrases - Hawkish\ phrases}{Dovish\ phrases + Hawkish\ phrases}$
- Simple, easy to use, but might not capture the text sentiment in the most accurate way (e.g., we might miss out important information if the keyword list is not comprehensive enough)
- State-of-the-art NLP tool: Google's **Bidirectional Encoder Representations from Transformers** (BERT): Understand the meaning of a word (text representation) by accounting for both left and right context surrounding the word
 - We sat on the **river bank** and had a **picnic**
 - **Bank** of England decided to maintain the **bank rate** at 0.1%

TEXT SENTIMENT

- BERT models for text classification:
 - Sentiment classes are **negative, neutral, and positive** (i.e., not central bank specific)
 - Also use FinBERT (BERT embedding and text classification tailored for financial text)
- Transfer learning:
 - Create a unique training data where text of the FOMC statements (full statement + each sentence) published during the 1997-2010 period is manually labelled from -10 (very **hawkish**) to 10 (very **dovish**). These labels are then grouped into hawkish, neutral, and dovish
 - Use BERT to extract the word embeddings → inputs of a neural network model for (central bank communication) sentiment classification (87% accuracy)

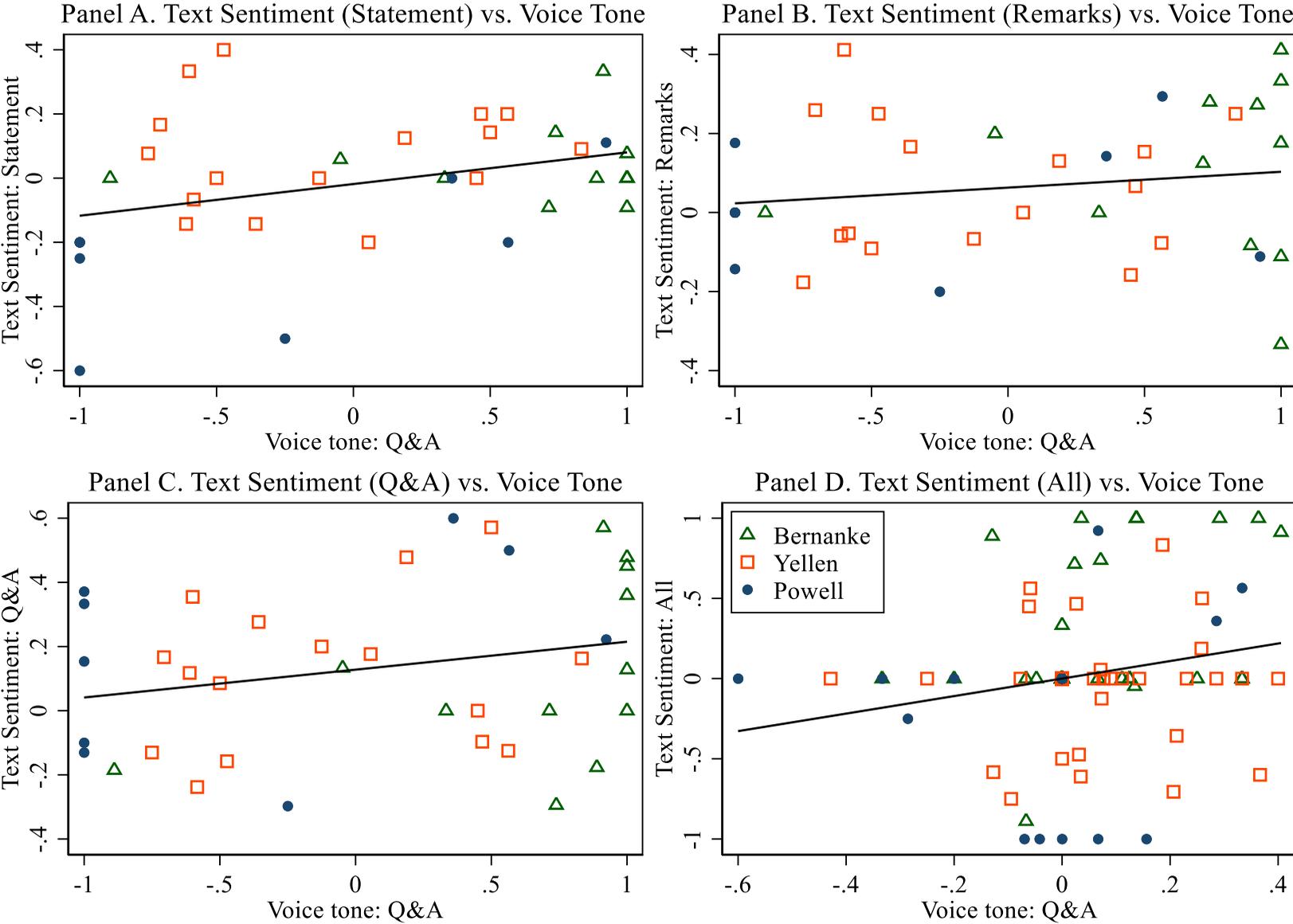
OTHER CONTROLS

- Policy shocks (Swanson, JME 2020), normalized to have unit variance
 - FFR shock
 - Asset Purchases (AP) shock
 - Forward Guidance (FG) shock

OTHER CONTROLS

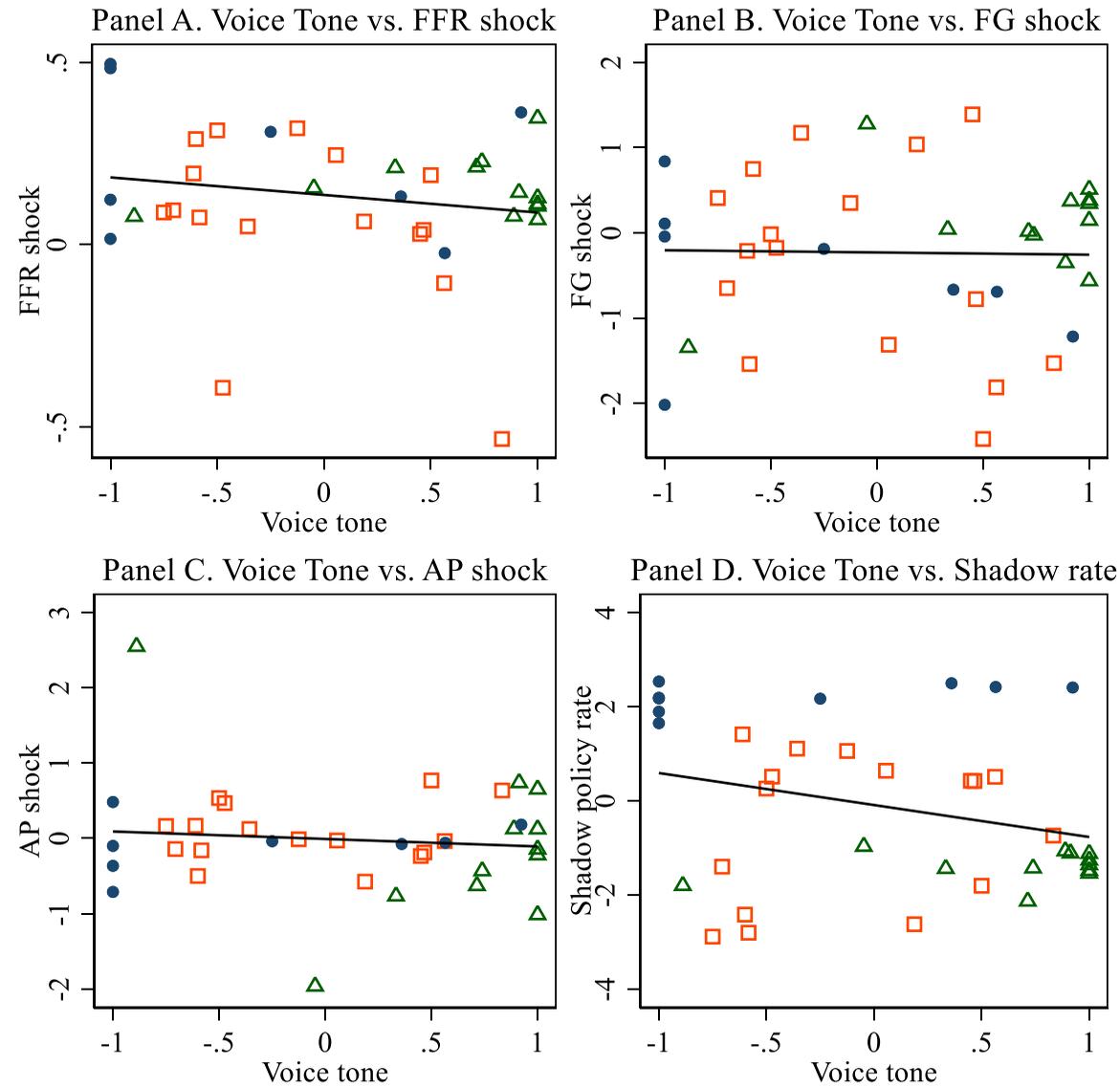
- Policy shocks (Swanson, JME 2020), normalized to have unit variance
 - FFR shock
 - Asset Purchases (AP) shock
 - Forward Guidance (FG) shock
- General stance of monetary policy: shadow policy rate (Wu and Xia, JMCB 2016)

CORRELATIONS: VOICE TONE VS. TEXT SENTIMENT



Voice tone appears to have independent variation

CORRELATIONS: VOICE TONE VS. POLICY ACTIONS



Voice tone appears to have independent variation

ECONOMETRIC SPECIFICATION

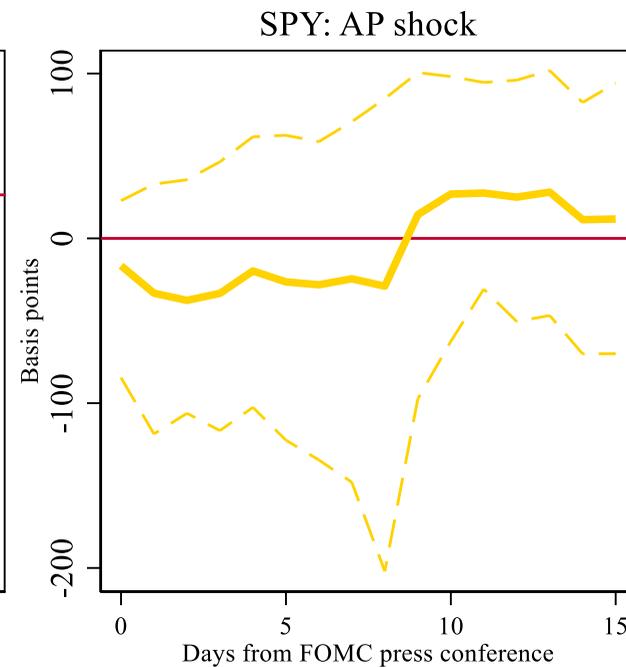
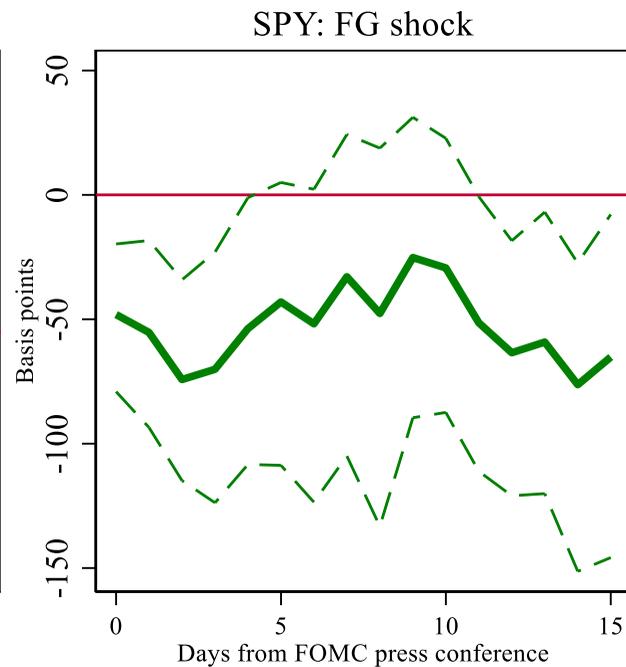
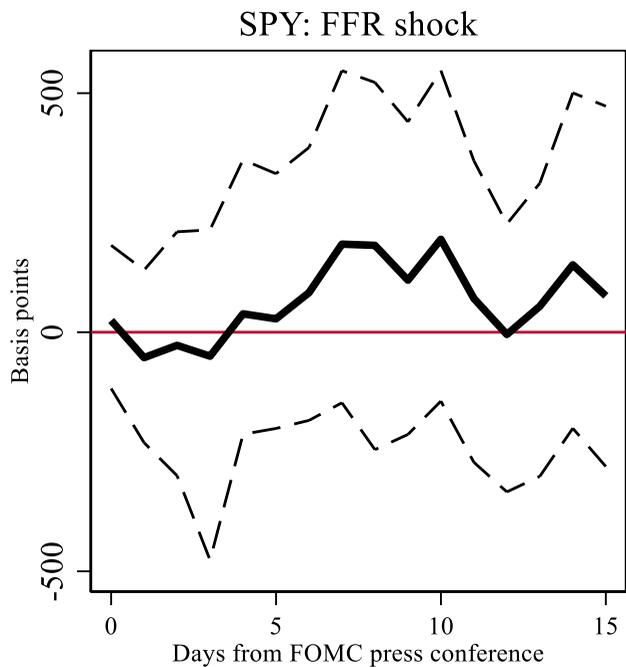
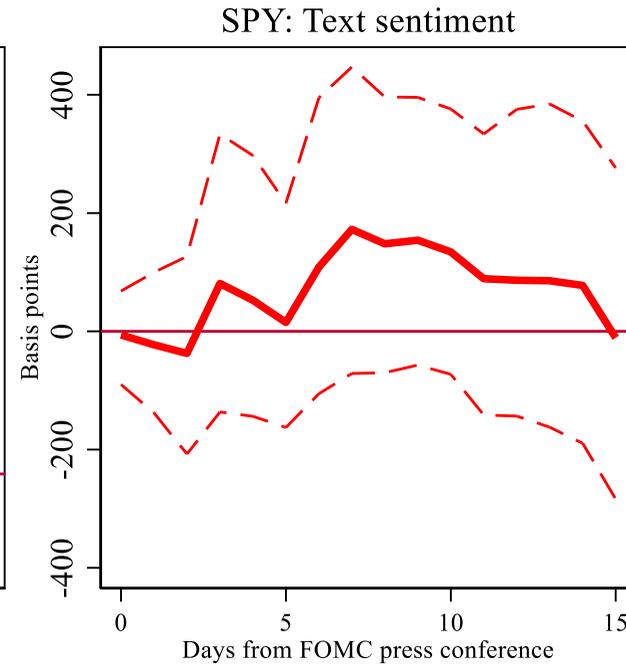
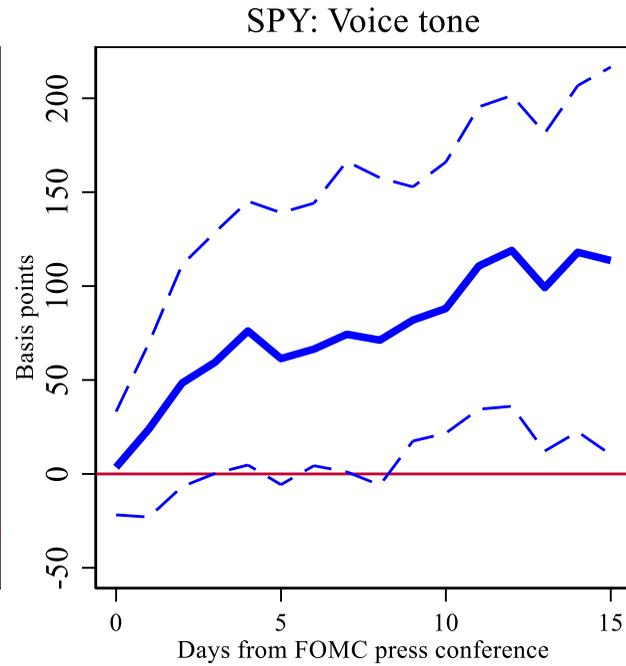
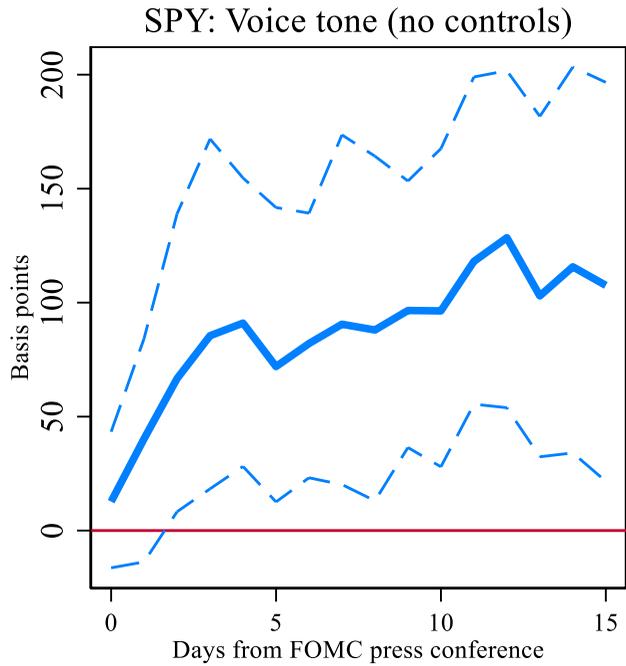
$$\begin{aligned} Outcome_{t,t+h} = & b_0^{(h)} + b_1^{(h)} VoiceTone_t + b_2^{(h)} TextSentiment_t \\ & + b_3^{(h)} FFRShock_t + b_4^{(h)} FGShock_t + b_5^{(h)} APShock_t \\ & + b_6^{(h)} ShadowRate_t + error_t^{(h)} \end{aligned}$$

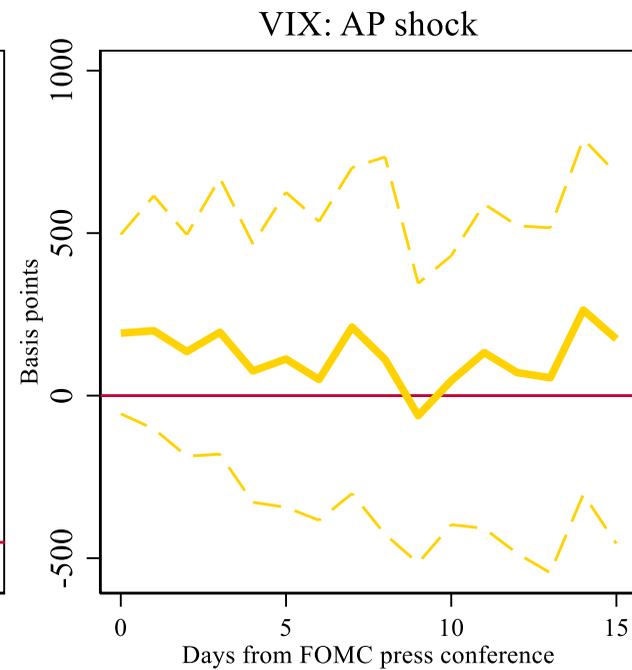
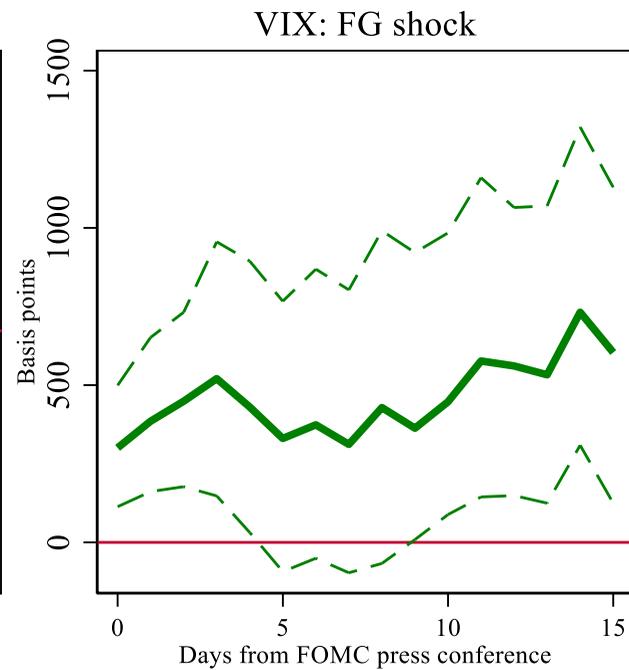
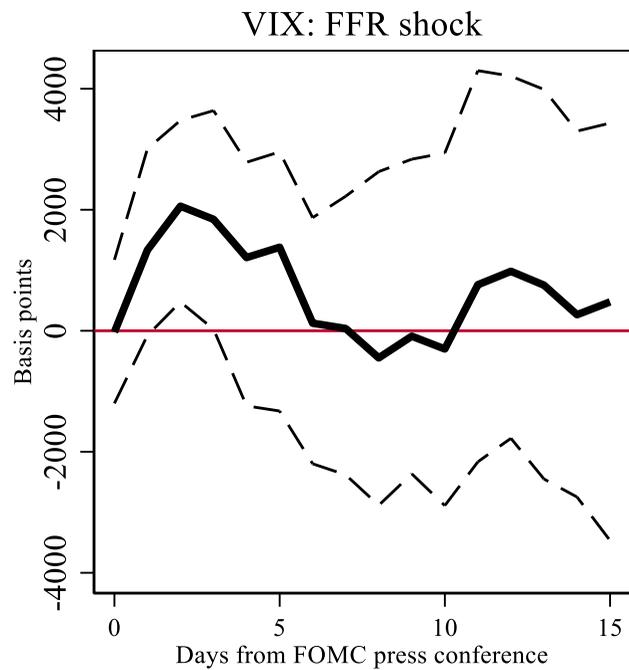
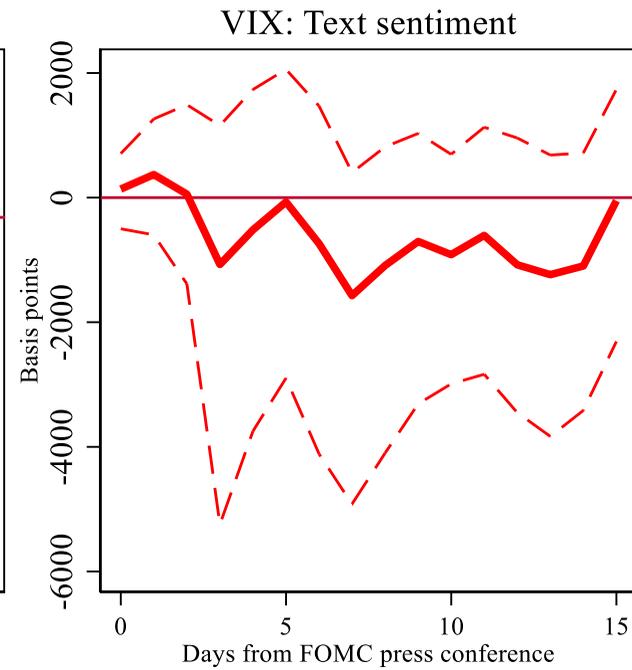
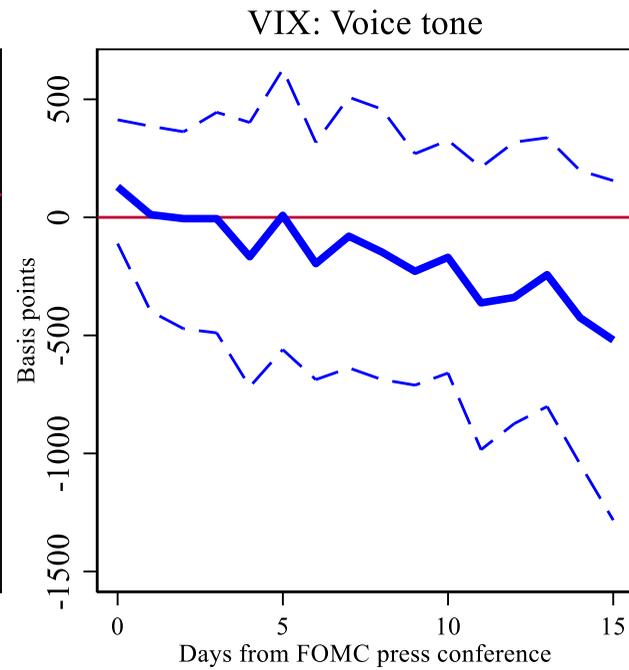
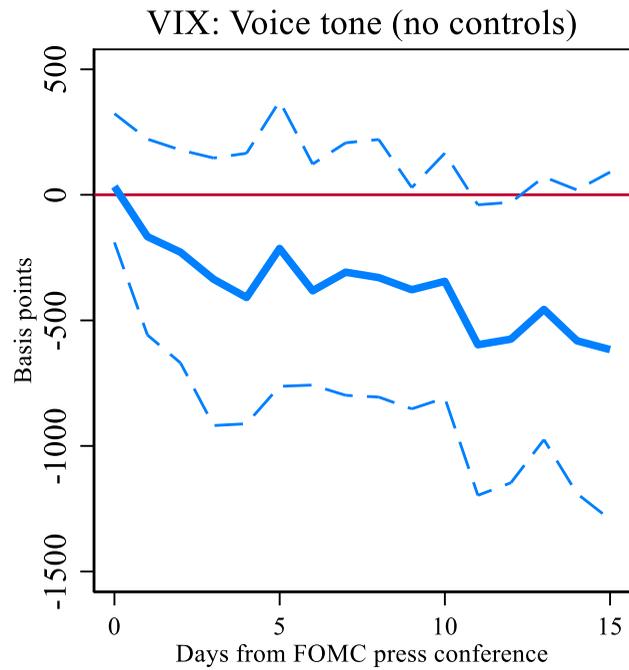
Time t is in days around press-conferences; unit of analysis is a press-conference; Bootstrap

Outcomes:

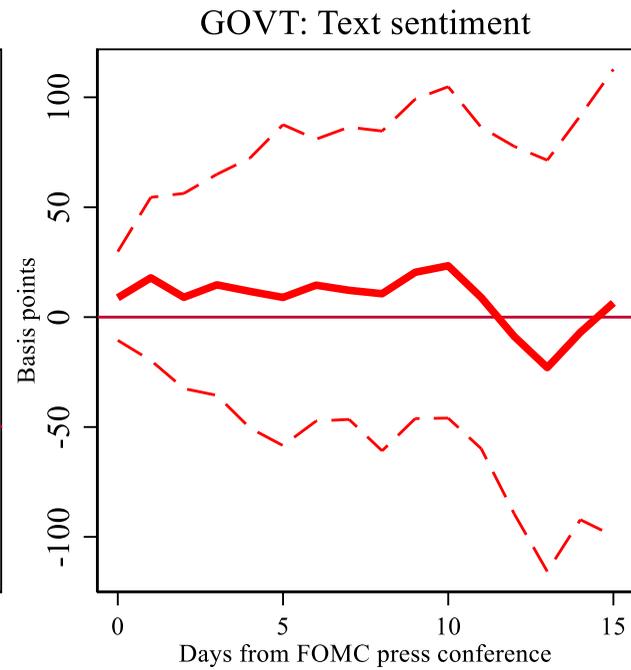
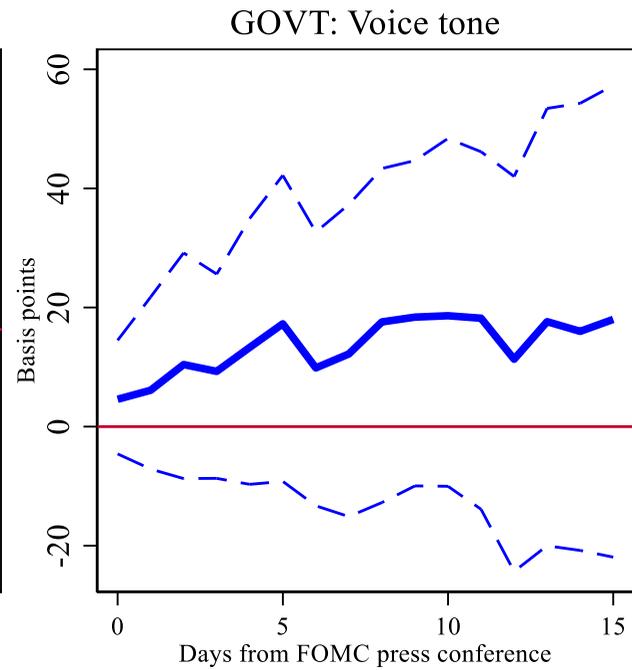
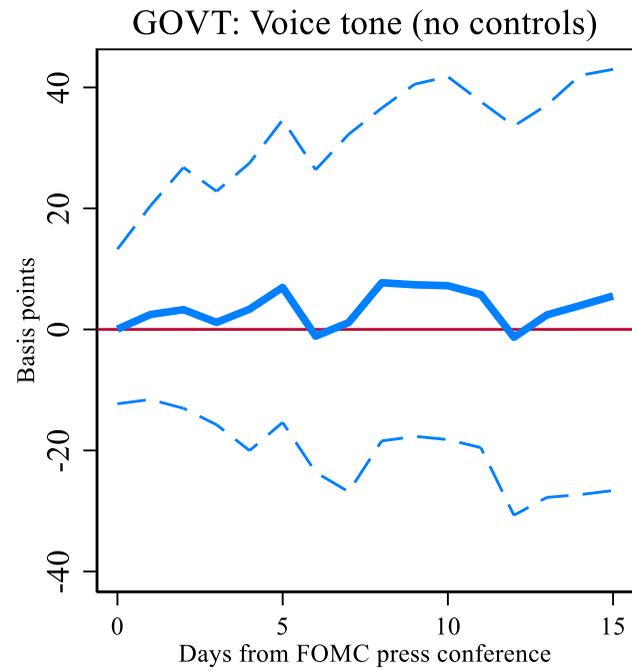
- Daily financial indicators collected from Thomson Reuters, Yahoo Finance, and Tiingo
- Prices of exchange-traded funds (ETFs) that track popular indices: e.g., SPY (an ETF fund that tracks the S&P 500 index)
- $Return_{t,t+h}^i = \log(close_{t+h}^i) - \log(open_t^i)$

SPY (S&P 500)

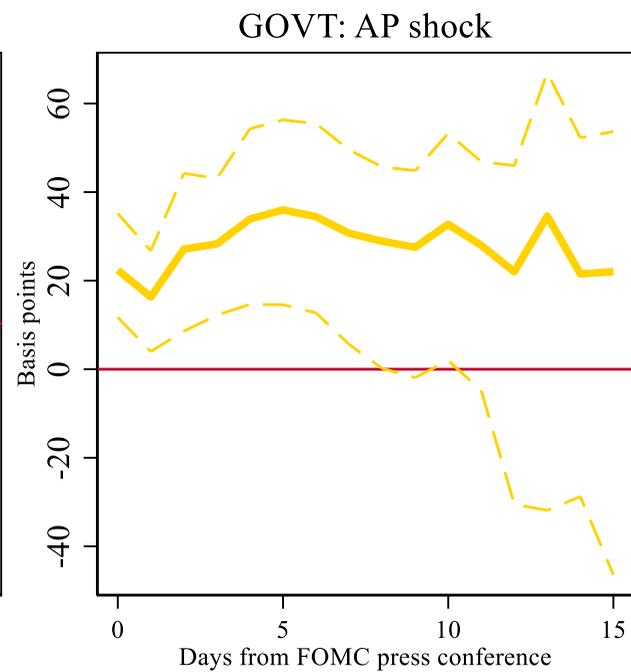
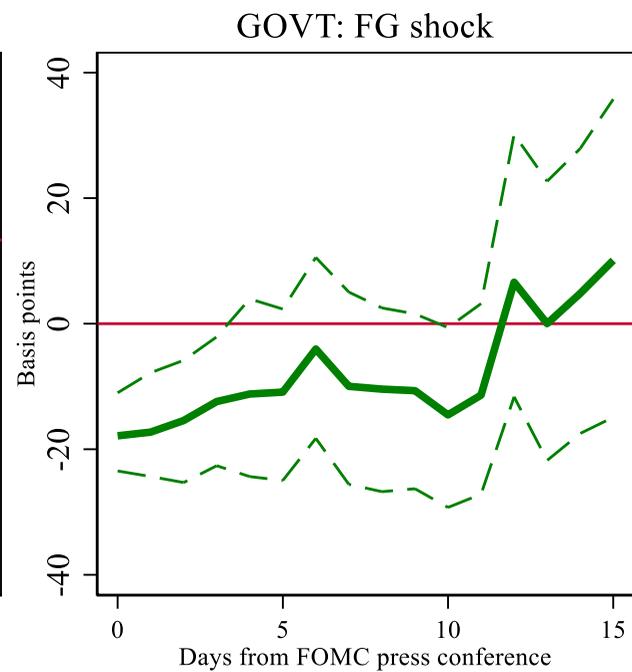
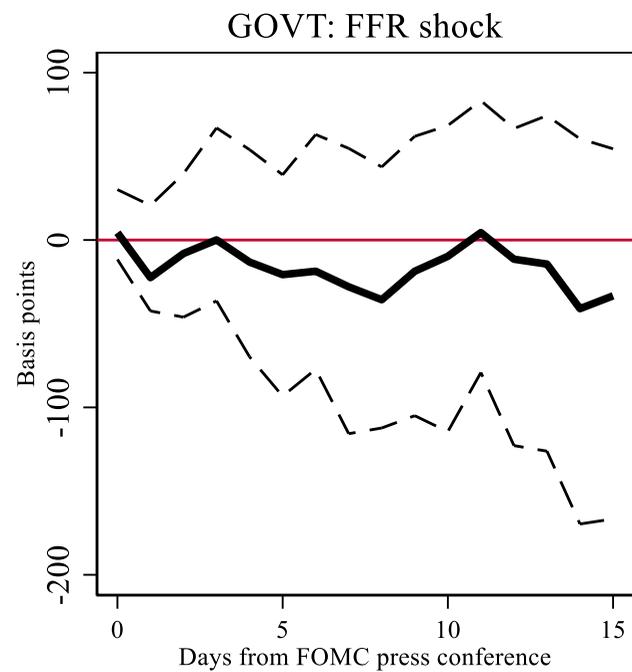


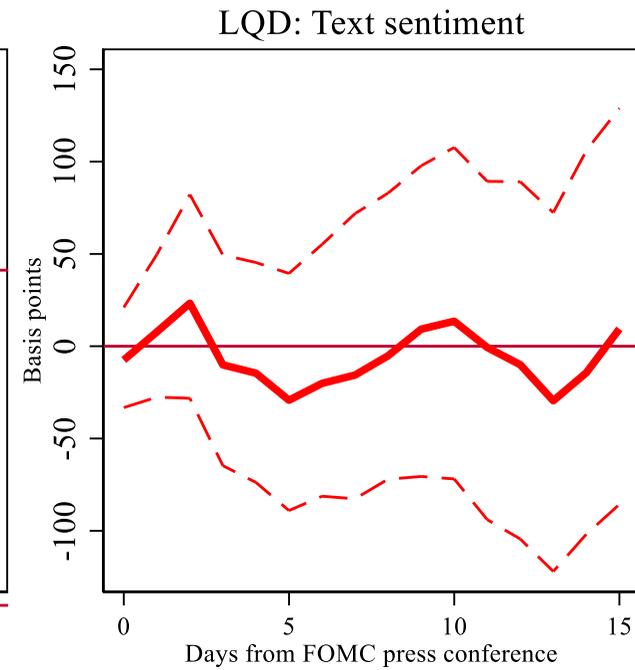
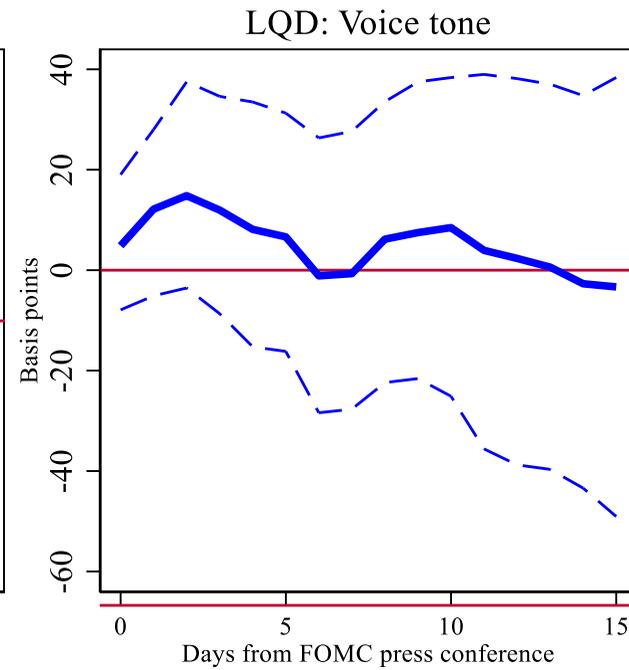
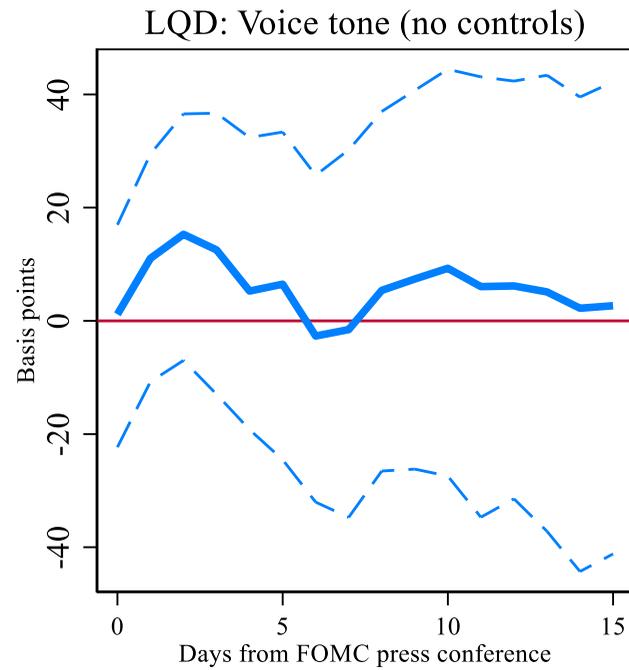


VIX
(Volatility)

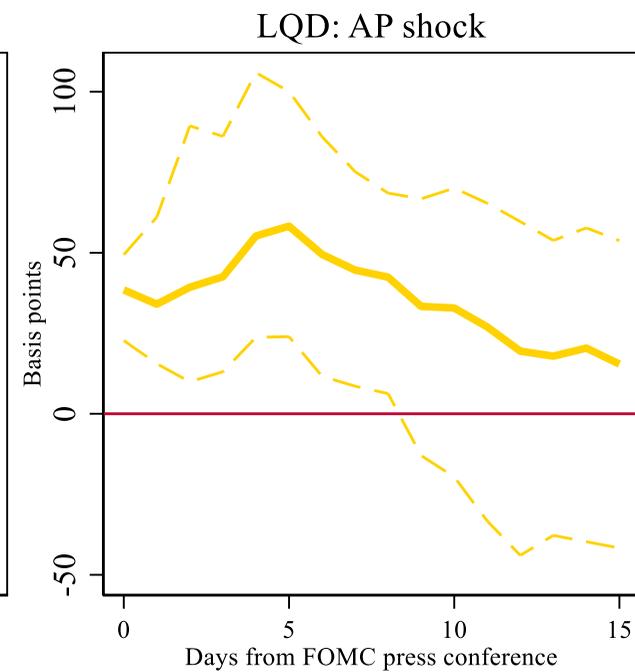
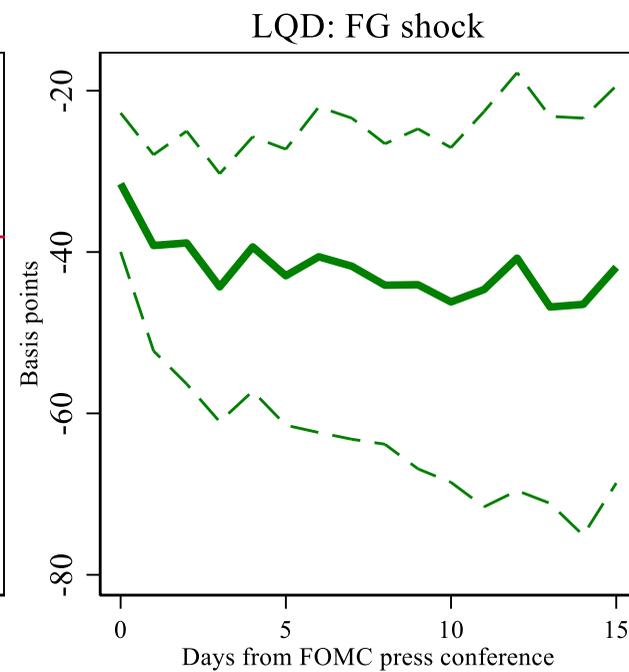
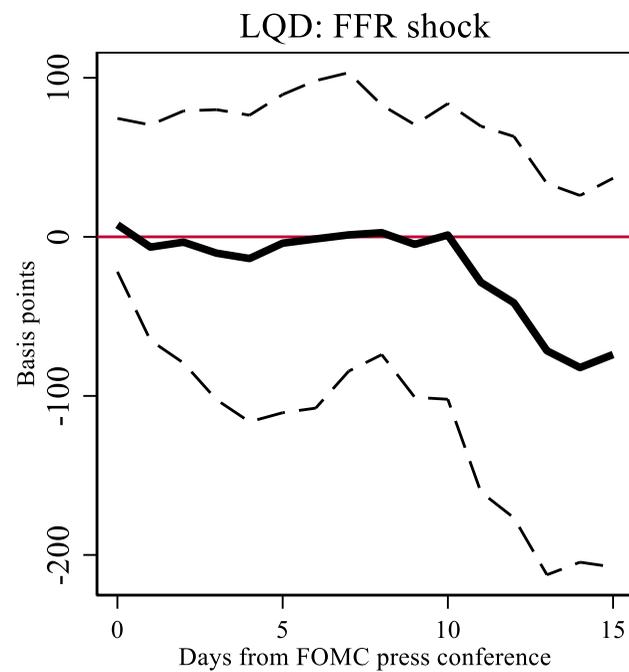


GOVT ETF
(U.S. government debt)





LQD ETF
(corporate debt)



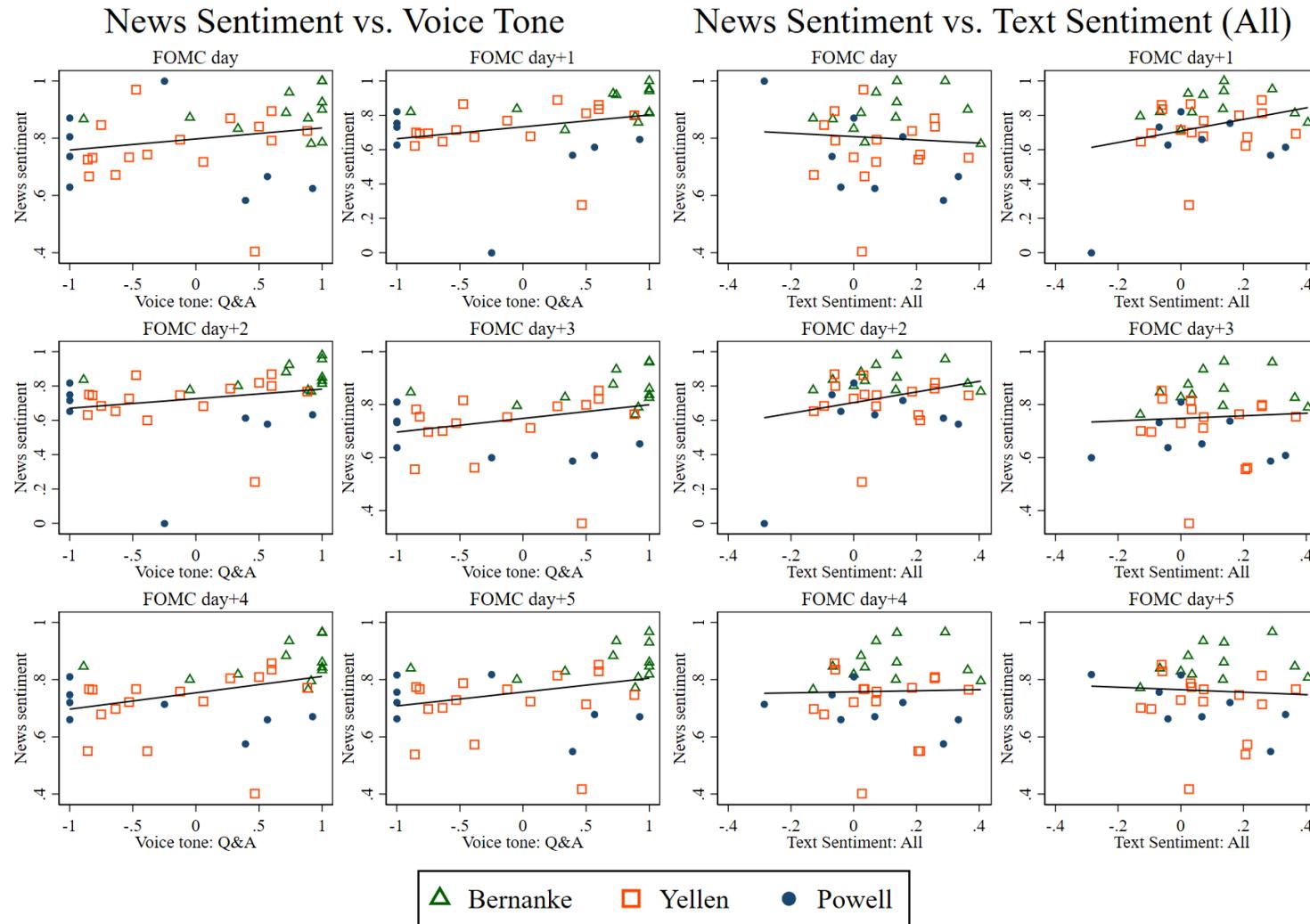
OTHER RESULTS

- Similar to FG shock, a more positive tone leads to:
 - A reduction in expectations about interest rate risk
 - Lower inflation expectation
- Mixed reactions across currencies (Yen/Dollar; Euro/Dollar)
- Results are consistent if we use text sentiment obtained from BERT or fine-tuned BERT

RESPONSES TO VOICE TONE

- Responses to voice tone appear to gradually build up over time with weak contemporaneous reactions
- Why?
 - The tone may be a leading indicator for subsequent policy communication
 - Informed, or high ability, traders are better at reading—perhaps subconsciously—non-verbal communication at press conferences. They move first and then the initial momentum is amplified by less informed/lower ability investors
 - Media coverage

RESPONSES TO VOICE TONE



CONCLUDING REMARKS

- Communication revolution in central banking from Greenspan to Powell
- Is communication fully utilized/understood? (7-55-38 rule of communication)
- Voice tone appears to move (some) financial variables
 - Mechanism: Voice tone can convey “soft” information about the state of the economy or policy outlook
- Ronald Reagan (1980): “How can a president not be an actor?”
“How can a Fed chair not be an actor?”