

Real-time price discovery via verbal communication: Method and application to Fedspeak

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Motivation

- Ignoring investors expectations in policy analysis can mislead conclusions.
 - Central bankers prioritize market communication to manage expectations.
 - FOMC press conference from 2011.8
- Little is known about how investors form expectations from such communications.
- → Tracing investors' reaction to a specific sentence communicated by the central bank

Question

- Q1: Is there any relation between prices changes around statement release and in press conference?
 - Yes, positive and significant
- Q2: Which moments the autocorrelation of price changes described above are realized in?
 - The minutes in which the Fed chairman discusses the statement news lie behind such positive autocorrelation.
- Q3: How to explain such autocorrelation?
 - Difference-of-opinion models

Contribution

- Economics literature that uses textual analysis methods.
 - Ext: Examine when each word is pronounced, clarifying which news or word the market responds to.
- Literature at the intersection of monetary policy, info transmission & asset pricing.
 - Ext: Support theories suggesting investors interpret Fed signals differently.
- Literature on the signaling effects of monetary policy.
 - Ext: Show how communications during press conference help form investors' expectations

Data: Post-meeting press conferences

- FOMC: 2011.8-2020.1, 41 press conferences
- Convert press conference audio into text and time-stamp
 - ① Split the audio into smaller frames of around three seconds
 - ② Convert the three-second audio frames into an interpretable text
 - ③ Time-stamp the text of each three-second audio frame
 - ④ Create matrix W_j for the press conference on date j
 - Columns: words contained in the text of the press conference
 - Rows: three-second time windows
 - $element_{mn}$ equals to 1 if word n is mentioned in window m

Data:Identify FOMC statement news

Information received since the Federal Open Market Committee met in December November indicates that the labor market has continued to strengthen and that economic activity has been rising at a solid strong rate. Job gains have been strong, on average, in recent months, and the unemployment rate has remained low. Household spending has continued to grow strongly, while growth of business fixed investment has moderated from its rapid pace earlier last in the year. On a 12-month basis, both overall inflation and inflation for items other than food and energy remain near 2 percent. Although market-based measures of inflation compensation have moved lower in recent months, survey-based measures Indicators of longer-term inflation expectations are little changed, on balance. Consistent with its statutory mandate, the Com-

Information received since the Federal Open Market Committee met in December October indicates that the labor market remains strong and that economic activity has been rising at a moderate rate. Job gains have been solid, on average, in recent months, and the unemployment rate has remained low. Although household spending has been rising at a moderate strong pace, business fixed investment and exports remain weak. On a 12-month basis, overall inflation and inflation for items other than food and energy are running below 2 percent. Market-based measures of inflation compensation remain low; survey-based measures of longer-term inflation expectations are little changed. Consistent with its statutory mandate, the Committee seeks to foster maximum employment and price stability. The Committee decided to maintain the target

- s_j : Words changed (added or removed) vector for press conference j

Data: Link statements news with press conference news

- Steps:
 - ① Aggregate the three-second-level text in W_j to a one-minute frequency
 - ② Run a part-of-speech analysis of the sentences identified in s_j : n,v,adj...
 - ③ Within press conference text, search for combinations include n and v from s_j .
 - ④ Create D_t : equal to 1 when a given minute is statement-related minutes
- →: Get a series of minute-level dummy D_t for each post-meeting press conference

Data:Asset prices

- Assets
 - Futures: best of book (BBO) trade and quote data from the CBOT and the CME
 - Stock: Intraday behavior of S&P 500 index and its constituents from TQA
 - Forex: spot exchange rate quotes on seven currencies against the U.S. dollar from Dukascopy
- Frequency: minutes

Q1:Design & Result

- Relation between price changes around press conference and statement

$$\Delta p_{it,PC} = a_k + b_k \Delta p_{it,ST} + \epsilon_{it}$$

- $\Delta p_{it,PC}$: change in asset i 's price during date- t press conference
- $\Delta p_{it,ST}$: change in asset i 's price around the date- t FOMC statement release

| | Fed funds futures | | Eurodollar futures | | Stocks | Forex |
|-------|-------------------|------------------|--------------------|------------------|------------------|------------------|
| | 1m-6m | 9m-15m | 6m-12m | 24m-70m | | |
| a | 0.05 [0.41] | -0.16 [-0.54] | 0.03 [0.11] | -0.14 [-0.28] | -4.30 [-0.51] | -5.18 [-1.51] |
| b | 0.17 [1.99] | 0.17 [1.47] | 0.19 [3.87] | 0.33 [2.77] | 0.41 [2.59] | 0.25 [3.10] |
| R^2 | 8.53 | 5.50 | 8.43 | 20.21 | 14.10 | 11.20 |

- There is a positive autocorrelation of different price changes

Q2: Design

- How the chairman's message induces variation in investors' beliefs?

$$\frac{\frac{|r_{it}|}{Vol_{ijt}}}{\sum_{t \in T_j} Vol_{ijt}} = a_k + b_k D_{t-1} + \epsilon_{it}, \quad r_{it} = \begin{cases} a_k^- + b_k^- D_{t-1} & \text{if } \Delta p_{ij,st} < 0 \\ a_k^+ + b_k^+ D_{t-1} & \text{if } \Delta p_{ij,st} > 0 \end{cases}$$

- $r_{i,t}$: financial returns of asset i between minutes $t-1$ and t
- Vol_{ijt} : trading volume of asset i on day j between minutes $t-1$ and t
- T_j : the set of minutes on day j
- D_{t-1} : statement-related dummy variable
- $\Delta p_{ij,st}$: price shock around the statement release on date j

Q2:Result

| | Fed funds futures | | Eurodollar futures | | Stocks | Forex |
|---|-------------------|------------------|--------------------|------------------|------------------|------------------|
| | 1m-6m | 9m-15m | 6m-12m | 24m-70m | | |
| <i>Days when statement shock was negative</i> | | | | | | |
| a^- | -0.01 [-2.24] | -0.01 [-0.98] | -0.01 [-1.37] | -0.02 [-2.52] | -0.27 [-1.54] | -0.17 [-1.89] |
| b^- | 0.00 [0.22] | -0.03 [-1.31] | -0.02 [-0.52] | -0.08 [-2.17] | -1.82 [-2.80] | -0.55 [-1.86] |
| <i>Days when statement shock was positive</i> | | | | | | |
| a^+ | 0.00 [0.43] | 0.00 [0.80] | 0.00 [0.15] | 0.02 [1.84] | 0.27 [3.31] | 0.08 [0.94] |
| b^+ | -0.00 [-0.12] | 0.01 [0.53] | 0.05 [2.26] | 0.04 [1.04] | 0.58 [1.92] | 0.22 [0.56] |

- Statement-related minutes are more relevant to forming investors' expectations.
- Investors update their beliefs in statement-related minutes mostly for the **longer-term horizon**.

Q3: Design & Result

- Difference-of-opinion models:

$$\Delta p_{it,PC} = a_k + b_k \Delta p_{it,ST} + c_k \Delta p_{it,ST} I_t + \epsilon_{it}$$

- I_t : 1 if interest rate uncertainty 2 hours pre-statement > median

| | Fed funds futures | | Eurodollar futures | | Stocks | Forex |
|-------|-------------------|------------------|--------------------|----------------|------------------|------------------|
| | 1m-6m | 9m-15m | 6m-12m | 24m-70m | | |
| a | 0.02 [0.22] | 0.20 [0.90] | 0.12 [0.40] | 0.22 [0.71] | -2.42 [-0.55] | -5.31 [-1.87] |
| b | -0.29 [-1.28] | -0.25 [-1.63] | -0.14 [-2.69] | 0.17 [1.33] | 0.17 [6.52] | 0.04 [0.51] |
| c | 0.69 [2.14] | 0.73 [3.57] | 0.56 [12.62] | 0.35 [4.71] | 0.45 [2.15] | 0.36 [3.60] |
| R^2 | 32.63 | 30.70 | 26.20 | 25.60 | 18.37 | 16.83 |

- The positive relation we document is concentrated in periods of high uncertainty

Conclusion

- Price movements around the statement release can predict price movements around the subsequent press conference
- The minutes in which the Fed chairman discusses the statement news lie behind such positive autocorrelation.
- Our results are consistent with Difference-of-opinion models.