

Words Speak as Loudly as Actions: Central Bank Communication and the Response of Equity Prices to Macroeconomic Announcements

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1. Introduction

Background & Motivation

- There is an extensive literature on the response of equity prices to macroeconomic news announcements, and how this response depends on the state of the economy.
- Two forces: cash flows and discount rate.
- The former effect can potentially be offset by the latter resulting in a lower, or even negative, overall response of equity prices to good news during good times.
- In this paper, we further explore this question by introducing a novel FOMC sentiment index.

1. Introduction

Question

- How does macroeconomic news affect equity prices?
 - cash flows effect or discount rate effect?
- What can explain the response of equity prices to macroeconomic announcements
- Can the FOMC sentiment help explain FOMC decisions?
- Can the FOMC sentiment help predict future economic activity?

1. Introduction

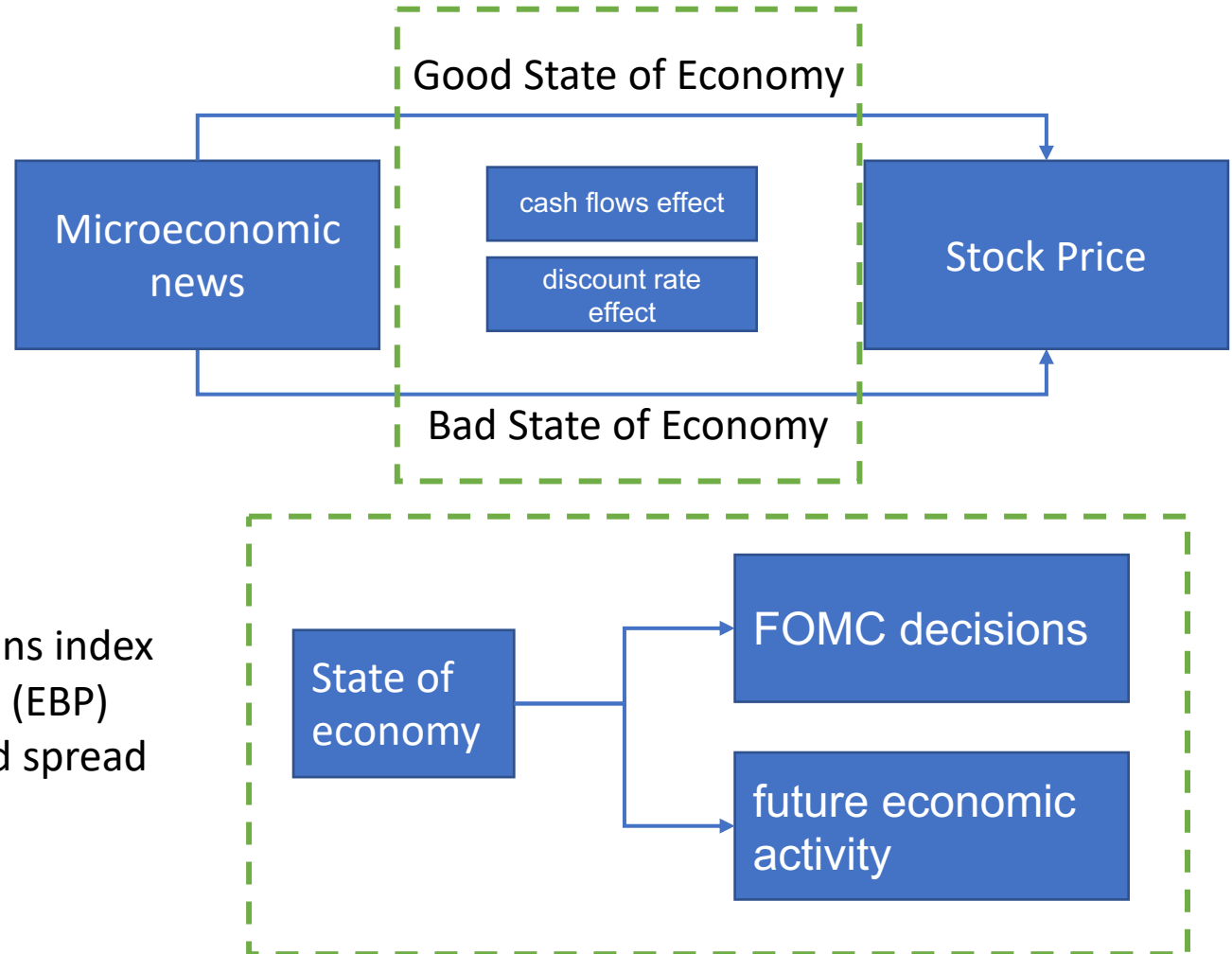
Research contents

- We use textual analysis techniques to extract our novel FOMC sentiment index.
- We prove that FOMC sentiment index is one of the best predictors of the sensitivity of equity prices to macroeconomic news.
- To understand the properties of the FOMC sentiment index, we test its ability to forecast monetary policy decisions and macroeconomic outcomes.

1. Introduction

1) nonfarm payroll;
2) initial claims;
3) ISM manufacturing and Conference Board consumer confidence index

1) FOMC index;
2) ADS business conditions index
3) excess bond premium (EBP)
4) the near-term forward spread
.....



1.Introduction

Related researches

- Literature that studies time-variation in the response of equity prices to macroeconomic news (McQueen and Roley, 1993; Boyd et al., 2005; Andersen et al., 2007; Law et al., 2019)
- Literature that uses textual analysis techniques to extract useful variables that have predictive power.
- news search (Baker et al., 2016; Demiralp et al., 2019; Caldara and Iacoviello, 2017), Latent Dirichlet Allocation (Hansen and McMahon, 2016; Hansen et al., 2017) and dictionary methods (Loughran and McDonald, 2011; Sharpe et al., 2017; Banerjee et al., 2019)

1.Introduction

Contribution

- Our study provides further support to the explanation that equity prices are less sensitive to good news during good times because the FOMC is more likely to increase interest rates during good times.
- Developing a Federal Reserve specific dictionary to sign FOMC statements and demonstrating that it works better than using the general dictionary of financial market positive and negative words of Loughran and McDonald (2011).

2. Methodology

1) FOMC Sentiment Index

- We construct the FOMC sentiment index using a user-defined dictionary of topic-keywords, modifier-keywords and phrases.
- We separate topic-keywords and phrases into five topics: **labor, output, inflation, financial conditions, and future monetary policy**. (based on our reading of the 162 FOMC statements over the 2000-2019 period)

Step 1: Dictionary of topic-keywords

- Words or phrases are added to each topic-keyword dictionary based on their relative frequency in a list of most frequently used words that appear in FOMC statements after dropping common stop words such as “a,” “the,” etc.

2. Methodology

1) FOMC Sentiment Index

Step 2: Dictionary of modifier-keywords

- We pair a topic-keyword with the closest modifier-keyword within a sentence to get the topic-modifier pair.
- Distance is measured by the number of words from the beginning of a topic-keyword to the beginning of a modifier-keyword

Step 3: phrases

- Because the FOMC committee is predictable in its speech pattern, we use different rules to uniquely identify and score actions throughout the entire period.

Table A1: List of Keywords and Their Scores

keyword	score	category
inflation	1	inflation
price	1	inflation
cost	1	inflation
employers	1	labor
employment	1	labor
job gains	1	labor
job losses	-1	labor
labor	1	labor
hiring	1	labor
underutilization of labor resources	-1	labor
unemployment	-1	labor
utilization of the pool of available workers	1	labor

Table A2: List of Modifiers and Their Scores

modifier	score	category	modifier	score	category
declin	-1	labor	below	-1	inflation
deteriorat	-1	labor	damp	-1	inflation
diminish	-1	labor	ease (space)	-1	inflation
disappoint	-1	labor	easing	-1	inflation
inhibit	-1	labor	declin	-1	inflation
losses	-1	labor	diminish	-1	inflation
low	-1	labor	down	-1	inflation
modest	-1	labor	low	-1	inflation
moderated	-1	labor	modest	-1	inflation
reluctant to add	-1	labor	moderated	-1	inflation

Due to the predictable pattern of FOMC communication, we were able to generate a representative set of **topic-keywords** (seven for labor, eighteen for output, three for inflation, and three for financial conditions) and **phrases** (twenty four for future monetary policy).

We have separated modifiers depending on the topic, because certain modifiers are more likely to be used with certain topics, but our results are robust to using a “global” modifier dictionary.

2. Methodology

1) FOMC Sentiment Index

Step 4: uninformative sentences and sentiment index

- The sentiment index for each topic is the sum of each topic sentiment divided by the square root of the number of words in the statement after having deleted **uninformative sentences**.
- To systematically identify and remove uninformative sentences, we used combinations of words and phrases that are commonly found within these types of sentences.
- The uninformative label was used to remove a sentence from the scoring algorithm for the output, labor, inflation, and financial markets sub-components.

Table A6: Rules for Scoring Futute Monetary Policy Actions

pattern	score
(policy accommodation) (maintained)	-1
(low levels) (warrant)	-1
(maintain) (highly accommodative stance)	-1
(below levels) (longer run)	-1
(accommodative stance) (monetary policy)	-1
(substantial easing) (monetary policy)	-1
continue its purchases	-1
(ready to expand) (purchase)	-1
(await more evidence) (pace of its purchases)	-1
(will act) (as needed)	-1
be patient	0
appropriate	0
(anticipate) (rais.* the target)	1
(believe) (policy accommodation) (removed)	1
(firming) (need)	1
(expects) (increases in the target range)	1
(judges) (increases in the target range)	1
(appropriate) (raise the target range)	1
(warrant) (gradual increases)	1
balance sheet normalization	1
(purchase) (improvement)	1
(reduce) (purchase)	1
(complete moderate) (purchase) (improvement)	1
(decides to) (remove policy accommodation)	1

Table A5: Rules for Identifying Uninformative Sentences

pattern
(will) (assess) (as needed)
(will) (monitor) (as needed)
(promote a stronger) (as announced)
(review) (size) (composition)
(promote a stronger) (dual mandate)
(sizable) (still increasing holdings)
(recognize) (below its 2 percent objective)
(expect) (gradual adjustments) (will .*? strengthen remain strong)
(appropriate policy accommodation) (dual mandate)
(dual mandate) (purchasing additional) (agency mortgage backed securities)
(long term prospects) (unusual forces) (demand abate)
(sustain.*? expansion) (symmetric 2 percent objective)
(federal reserve) (employ all available tools using its balance sheet)
(today's .*? action) (help)

3. Data & Variable

1. FOMC Sentiment Index

- January 2000 and ends in April 2019

2. Equity Prices

- we use intraday data on the E-mini S&P 500 futures contract bid and ask quotes from Thomson Reuters Tick History.
- In our tests, we use the front-month futures contract, so that our results carry over to the spot S&P 500 index.
- We consider futures contracts for the asset prices in our analysis because futures contracts allow us to capture the effect of announcements that take place at 8:30 am Eastern time before equity market opens.

3. Data & Variable

$$Surprise_{it} = \frac{A_{it} - E_{it}}{\hat{\sigma}_i},$$

3. Macroeconomic News Announcements

- Law et al. (2019): (1) Nonfarm payroll, (2) Initial claims, (3) ISM manufacturing and the Conference Board consumer confidence index.
- We define announcement surprises as the difference between announcement realizations and their corresponding expectations.

4. Different Measures of the State of the Economy

- Indicate the current state of the economy: ADS business conditions index (Aruoba et al. (2009)), recessions indicator variable.
- Predict the future state of the economy: excess bond premium (Gilchrist and Zakrajšek (2012)), the near-term forward spread (Engstrom and Sharpe (2018))

3. Data & Variable

5. Monetary Policy and Other Variables

- We consider a number of other variables in our analysis, as they could affect the response of equity prices to macroeconomic news announcements:
 - Level of the federal funds target rate (FFTR)(Goldberg and Grisse (2013)).
 - Policy stance indicator: that takes the values = 1, 0, or -1 according to whether the FOMC decreases, leaves unchanged or increases the FFTR and to whether it announces other unconventional policies that are tightening, neutral or accommodative.
- We also evaluate which variables best predict FOMC decisions:
 - Law et al. (2019): employment gap, inflation level, 5-year bond yield level and changes, the price-to-dividend ratio, and the VIX index as a proxy for uncertainty.

3. Empirical results

1. What Can Explain the Time-Varying Response of Equity Prices to Macroeconomic Announcements?

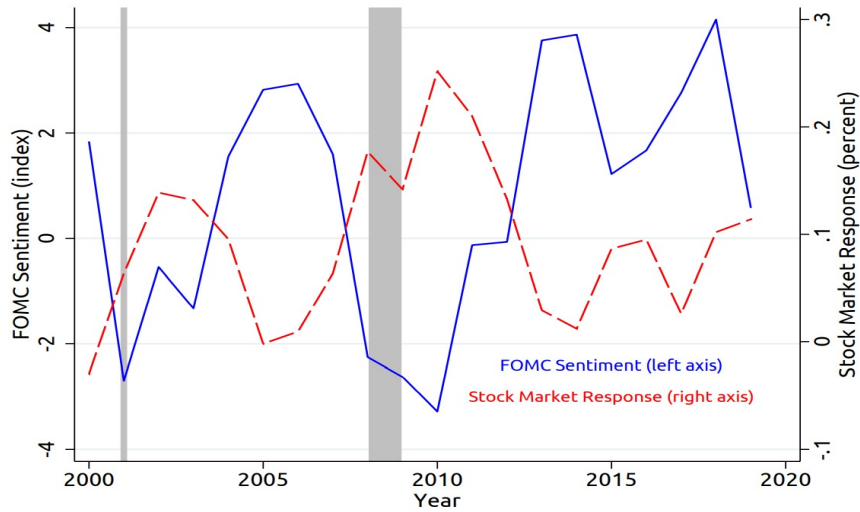
$$r_t = \alpha_j + \sum_{j=2000}^{2019} \beta_{Sj} Surprise_t \times Year_j + \epsilon_t,$$

- where r_t is the 30-minute percent change in the E-mini S&P500 futures contract, $Surprise_t$ are the pooled standardized surprises of the four macroeconomic news announcements

$$r_t = \alpha + \beta_S Surprise_t + \beta_{BX} Surprise_t \times X_t + \beta_X X_t + \epsilon_t$$

- X_t will be different proxies for the state of the economy, monetary policy, and uncertainty measures we described before.

Table 3: Response of Equity Markets to Macroeconomic News: Horse Race



The figure shows that equity prices are more sensitive to macroeconomic news announcements (red line) when the FOMC sentiment index (blue line) is low

	(1)	(2)	(3)
Surprise	0.101*** (0.00796)	0.138*** (0.0117)	0.00601 (0.0515)
Surprise × FOMC Sentiment		-0.0428*** (0.00931)	-0.0319** (0.0126)
Surprise × FFF Expectation		-0.0402*** (0.0103)	-0.0338** (0.0136)
Surprise × UR Gap			0.00826 (0.0138)
Surprise × Inflation			0.0118 (0.00981)
Surprise × ADS Index			0.0589*** (0.0161)
Surprise × Inv. Yield Curve			0.0697* (0.0396)
Surprise × EBP			-0.00774 (0.0118)
Surprise × Recession			0.0625* (0.0362)
Surprise × FFTR		-0.0290*** (0.00834)	-0.0229 (0.0236)
Surprise × Δ FFTR		0.0304*** (0.0101)	0.0340** (0.0132)
Surprise × 5-Year Yield			-0.0311 (0.0443)
Surprise × Δ 5-Year Yield			-0.0215*** (0.00759)
Surprise × PD Ratio			-0.00630 (0.0102)
Surprise × VIX			0.0651*** (0.0119)
Constant	-0.00516 (0.00803)	-0.00702 (0.0113)	-0.0767 (0.0477)
Observations	1,685	1,685	1,685
Adjusted R^2	0.087	0.121	0.162

3. Empirical results

2. Can the FOMC sentiment help explain FOMC Decisions?

$$Pr(MPD_t = s | X_{t-1}) = \Phi(X_{t-1}B + \epsilon_t)$$

- MPD_t is the monetary policy decision on day t , measured as the policy stance variable. X_{t-1} is the matrix of predictors of monetary policy decisions available.

	(1)	(2)	(3)	(4)
	Monetary Policy Stance		Target Rate Change	
	Full Sample	No ELB period	Full Sample	No ELB period
FOMC Sentiment	0.123*** (0.024)	0.140*** (0.026)	0.048** (0.025)	0.052** (0.027)
FFF Expectation	0.222*** (0.036)	0.254*** (0.039)	0.159*** (0.029)	0.171*** (0.031)
UR Gap	-0.036 (0.028)	-0.032 (0.029)	-0.021 (0.027)	-0.031 (0.029)
Inflation	0.011 (0.02)	0.013 (0.021)	-0.005 (0.018)	-0.009 (0.02)
ADS Index	0.071** (0.032)	0.074** (0.035)	0.028 (0.026)	0.024 (0.03)
Inv. Yield Curve	0.134 (0.098)	0.102 (0.094)	0.058 (0.066)	0.067 (0.069)
EBP	0.006 (0.032)	-0.003 (0.037)	-0.017 (0.025)	-0.009 (0.028)

3. Empirical results

3. Can the FOMC Sentiment Help Predict Future Economic Activity?

$$Y_t = \alpha + \beta X_{t-1} + \epsilon_t$$

- where Y_t are the measures of the state of the economy—namely GDP Advanced, the unemployment rate, and nonfarm payroll employment and so on.

	(1) GDP	(2) GDP	(3) Core CPI	(4) Core CPI	(5) NFP	(6) NFP	(7) UR	(8) UR
Lag Dependent	0.398*** (0.104)	0.00907 (0.104)	0.210*** (0.0653)	0.147** (0.0675)	0.687*** (0.0492)	0.389*** (0.0566)	0.978*** (0.00686)	0.994*** (0.00864)
FOMC Sentiment	0.201* (0.107)	-0.112 (0.133)	0.134** (0.0654)	0.0965 (0.0995)	0.169*** (0.0496)	0.0674 (0.0570)	-0.0368*** (0.00692)	-0.00270 (0.00965)
FFTR		-0.0356 (0.243)		0.0799 (0.185)		0.134 (0.106)		0.00682 (0.0171)
FFF Expectation		0.0163 (0.207)		-0.0462 (0.209)		0.0246 (0.0993)		0.00187 (0.0156)
Δ FFTR		-0.257 (0.237)		0.0966 (0.204)		-0.0371 (0.100)		-0.000160 (0.0159)
VIX		0.0797 (0.142)		-0.219* (0.119)		-0.150** (0.0620)		0.00121 (0.01000)
PD Ratio		0.0585 (0.162)		0.106 (0.0838)		0.0920** (0.0454)		-0.00282 (0.00717)

3. Empirical results

4. Robustness(1)

	(1) Output	(2) Labor	(3) Inflation	(4) Financial	(5) Monetary
Surprise	-0.0299 (0.0471)	0.0229 (0.0604)	-0.00233 (0.0504)	-0.0591 (0.0459)	-0.0507 (0.0467)
Surprise \times FOMC Sentiment	-0.0228** (0.0108)	-0.0230* (0.0120)	-0.0228** (0.00947)	-0.0195* (0.0103)	-0.00281 (0.0110)
Surprise \times FFF Expectation	-0.0412*** (0.0132)	-0.0362*** (0.0136)	-0.0367*** (0.0134)	-0.0384*** (0.0134)	-0.0418*** (0.0141)
Surprise \times UR Gap	0.0152 (0.0130)	0.0142 (0.0134)	0.0278** (0.0122)	0.0204 (0.0124)	0.0241* (0.0128)
Surprise \times Inflation	0.0142 (0.00980)	0.00831 (0.0101)	0.0118 (0.00980)	0.00873 (0.0101)	0.0123 (0.0104)
Surprise \times ADS Index	0.0527*** (0.0157)	0.0569*** (0.0161)	0.0455*** (0.0157)	0.0569*** (0.0162)	0.0500*** (0.0160)
Surprise \times Inv. Yield-Curve	0.0611 (0.0394)	0.0565 (0.0394)	0.0378 (0.0402)	0.0605 (0.0394)	0.0583 (0.0394)

3. Empirical results

4. Robustness(2)

Table 10: Response of Equity Markets to Macroeconomic News – Horse Race with Loughran and McDonald (2011) Dictionary

	(1)
Surprise	0.104*** (0.00795)
Surprise \times FOMC Sentiment LM	-0.00680 (0.00876)
Surprise \times FOMC Sentiment	-0.0406*** (0.00893)
Constant	-0.00270 (0.00852)
Observations	1,685
Adjusted R^2	0.106

In the period of 2009 to 2010, the FOMC committee makes frequent references to policies that are stabilizing and strengthening for the economy. The alternative sentiment heavily emphasizes these positive words without capturing the nuance communicated in these statements

4. Conclusion

- We find that news has a bigger impact on equity prices during bad times as described by the FOMC.
- These results shed further light on the two opposite forces behind the effect of macro news on stock prices: a higher discount rate versus higher cash flows.
- An open issue remains to be further investigated:
 - why is the FOMC statement communication predictive of the equity response to macroeconomic news once we control for federal funds futures expectations?
 - Our conjecture is that narrative information can complement point forecasts such as the one implied by federal funds futures