Does FED Communication cause immediate and abnormal returns stock market?

A sentiment analysis on the S&P 500 Stock Market Index

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Abstract

Literature Review

The following research project is mostly based on the work done by Möller and Reichmann (2021) in the field of sentiment analysis. In their paper "ECB Language and Stock Returns - A Textual analysis of ECB Press Conferences" they explore the impact of the language used by the ECB in their regular press conferences on stock returns in the Euro Area.

They achieve this by mining the statements and ranking the sentiments of each statement based on general tone, uncertainty and constraint. Once this is classified, the researchers then cross-check the high frequency intraday data for Euro Area stock returns on each statement day, by employing the technique of an event study. This allows them to see how stock returns reacted to statements by the ECB at whatever point they wanted to examine them.

As mentioned, the researchers focused on tone, uncertainty and constraining language for the sentiment analysis. Tone captures the overall language - or the overarching narrative - of a statement, uncertainty measures how ambiguous a statement may be and constraining language quantifies how constraining the ECB communicates to be in the future. Of course the researchers did not read through every single statement by the ECB, instead, they employed a dictionary-based sentiment mining approach that considered grammatical and syntactical cues to analyze the sentiment expressed in ECB press conferences. Afterwards they scored each statement with regards to each category by employing heuristic-adjusted sentiment scores based on word lists used in previous studies. Möller and Reichmann (2021a)

Data

The data used for this project consists of the following:

- Federal Reserve (FED) Meetings: The U.S. American FED holds regular meetings multiple times per year where they talk about the current economic situation and what the plan is going forwards. This leaves us with 76 statements over 10 years from January 30th 2013 until July 26th 2023.
- Standard & Poor's 500 stock market index pricing: We cross-check the statements and their nature with the price of the S&P 500 stock market index on each day of a statement. This index is of particular interest since it incorporates 500 U.S. american companies representing a large part of the whole market itself. This means that we can use the S&P 500 as a proxy for how the market behaves at a given day.

Methodology

```
simple_tone <- lm(abnormal_return ~ Tone, data = Core)
simple_unc <- lm(abnormal_return ~ Unc, data = Core)
simple_con <- lm(abnormal_return ~ Con, data = Core)
simple_bert <- lm(abnormal_return ~ Bert, data = Core)

stargazer(simple_tone, simple_con, simple_unc, simple_bert, column.labels = c("Tone", "Unc", "Con", "Be
```

Table 1:

	Dependent variable:			
	abnormal_return			
	Tone	Unc	Con	Bert
	(1)	(2)	(3)	(4)
Tone	0.013			
	(0.010)			
Con		0.009		
		(0.024)		
Unc			0.018	
			(0.019)	
Bert				0.001
				(0.043)
Constant	−0.002	−0.001	−0.003	−0.00003
	(0.002)	(0.003)	(0.004)	(0.041)
Observations	76	76	76	76
R^2	0.023	0.002	0.011	0.00000
Adjusted R^2	0.010	−0.011	−0.002	−0.014
Residual Std. Error (df = 74)	0.010	0.010	0.010	0.010
F Statistic (df = 1; 74)	1.774	0.156	0.859	0.0002
Note:	*p<0.1; **p<0.05; ***p<0.01			

```r
simple_tone_IR <- lm(abnormal_return~Tone + IR, data = Core)
simple_unc_IR <- lm(abnormal_return~Unc + IR, data = Core)
simple_con_IR <- lm(abnormal_return~Con + IR, data = Core)
simple_bert_IR <- lm(abnormal_return~Bert + IR, data = Core)

stargazer(simple_bert_IR, simple_bert_IR, simple_bert_IR, simple_bert_IR,
          column.labels = c("Tone", "Unc", "Con", "Bert"), header = F)
```

Table 2:

	Dependent variable:			
	abnormal_return			
	Tone	Unc	Con	Bert
	(1)	(2)	(3)	(4)
Bert	0.009	0.009	0.009	0.009
	(0.045)	(0.045)	(0.045)	(0.045)
IR	−0.001	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	−0.007	−0.007	−0.007	−0.007
	(0.043)	(0.043)	(0.043)	(0.043)
Observations	76	76	76	76
R^2	0.006	0.006	0.006	0.006
Adjusted R^2	−0.021	−0.021	−0.021	−0.021
Residual Std. Error (df = 73)	0.010	0.010	0.010	0.010
F Statistic (df = 2; 73)	0.211	0.211	0.211	0.211
Note:	*p<0.1; **p<0.05; ***p<0.01			

```r
simple_tone_LR <- lm(abnormal_return ~ Tone + IR + lagged_return, data = Core)
simple_unc_LR <- lm(abnormal_return ~ Unc + IR + lagged_return, data = Core)
simple_con_LR <- lm(abnormal_return ~ Con + IR + lagged_return, data = Core)
simple_bert_LR <- lm(abnormal_return ~ Bert + IR + lagged_return, data = Core)

stargazer(simple_tone_LR, simple_con_LR, simple_unc_LR, simple_bert_LR, column.labels = c("Tone", "Unc"
```

```r
simple_tone_SUR <- lm(abnormal_return ~ Tone + IR + lagged_return + Surprise, data = Core)
simple_unc_SUR <- lm(abnormal_return ~ Unc + IR + lagged_return + Surprise, data = Core)
simple_con_SUR <- lm(abnormal_return ~ Con + IR + lagged_return + Surprise, data = Core)
simple_bert_SUR <- lm(abnormal_return ~ Bert + IR + lagged_return + Surprise, data = Core)

stargazer(simple_tone_SUR, simple_unc_SUR, simple_con_SUR, simple_bert_SUR, column.labels = c("Tone", "
```

```r
simple_tone_DE <- lm(abnormal_return ~ Tone + IR + lagged_return + Surprise + debt_equity, data = Core)
simple_unc_DE <- lm(abnormal_return ~ Con + IR + lagged_return + Surprise + debt_equity, data = Core)
simple_con_DE <- lm(abnormal_return ~ Con + IR + lagged_return + Surprise + debt_equity, data = Core)
simple_bert_DE <- lm(abnormal_return ~ Bert + IR + lagged_return + Surprise + debt_equity, data = Core)

stargazer(simple_tone_DE, simple_unc_DE, simple_con_DE, simple_bert_DE, column.labels = c("Tone", "Unc"
```

Table 3:

	Dependent variable:			
	abnormal_return			
	Tone	Unc	Con	Bert
	(1)	(2)	(3)	(4)
Tone	0.018			
	(0.014)			
Con		−0.001		
		(0.034)		
Unc			0.016	
			(0.020)	
Bert				0.010
				(0.046)
IR	0.001	−0.001	−0.0003	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)
lagged_return	−0.090	−0.060	−0.067	−0.062
	(0.162)	(0.163)	(0.162)	(0.162)
Constant	−0.003	0.001	−0.002	−0.008
	(0.004)	(0.005)	(0.004)	(0.043)
Observations	76	76	76	76
R^2	0.030	0.007	0.016	0.008
Adjusted R^2	−0.011	−0.034	−0.025	−0.034
Residual Std. Error (df = 72)	0.010	0.011	0.010	0.011
F Statistic (df = 3; 72)	0.736	0.172	0.382	0.188
Note:	*p<0.1; **p<0.05; ***p<0.01			

Table 4:

	Dependent variable:			
	abnormal_return			
	Tone	Unc	Con	Bert
	(1)	(2)	(3)	(4)
Tone	0.024*			
	(0.014)			
Unc		0.012		
		(0.020)		
Con			0.013	
			(0.034)	
Bert				0.015
				(0.045)
IR	0.0004	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)
lagged_return	−0.047	−0.023	−0.018	−0.019
	(0.160)	(0.162)	(0.162)	(0.162)
Surprise	0.022**	0.017	0.019*	0.018*
	(0.011)	(0.011)	(0.011)	(0.011)
Constant	−0.005	−0.001	−0.001	−0.013
	(0.004)	(0.004)	(0.005)	(0.043)
Observations	76	76	76	76
R^2	0.084	0.049	0.046	0.046
Adjusted R^2	0.033	−0.004	−0.007	−0.008
Residual Std. Error (df = 71)	0.010	0.010	0.010	0.010
F Statistic (df = 4; 71)	1.635	0.919	0.862	0.855
Note:		*p<0.1; **p<0.05; ***p<0.01		

Table 5:

	Dependent variable:			
	abnormal_return			
	Tone	Unc	Con	Bert
	(1)	(2)	(3)	(4)
Tone	0.032**			
	(0.015)			
Con		0.025	0.025	
		(0.037)	(0.037)	
Bert				0.003
				(0.050)
IR	−0.0003	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)
lagged_return	−0.057	−0.019	−0.019	−0.016
	(0.159)	(0.162)	(0.162)	(0.163)
Surprise	0.022**	0.019*	0.019*	0.017
	(0.011)	(0.011)	(0.011)	(0.011)
debt_equity	0.00003	0.00002	0.00002	0.00001
	(0.00002)	(0.00002)	(0.00002)	(0.00002)
Constant	−0.016**	−0.008	−0.008	−0.005
	(0.008)	(0.009)	(0.009)	(0.045)
Observations	76	76	76	76
R^2	0.113	0.057	0.057	0.051
Adjusted R^2	0.050	−0.010	−0.010	−0.017
Residual Std. Error (df = 70)	0.010	0.010	0.010	0.010
F Statistic (df = 5; 70)	1.792	0.853	0.853	0.756

Note: *p<0.1; **p<0.05; ***p<0.01

```r
interactions_tone <- lm(abnormal_return ~ Tone * debt_equity + IR + lagged_return + Surprise * debt_equi

interactions_unc<-lm(abnormal_return~Unc*debt_equity + IR + lagged_return + Surprise*debt_equity + debt_

interactions_con<-lm(abnormal_return~Con*debt_equity + IR + lagged_return + Surprise*debt_equity + debt_

interactions_bert <- lm(abnormal_return~Bert*debt_equity + IR + lagged_return + Surprise*debt_equity + d

stargazer(interactions_tone, interactions_unc, interactions_con, interactions_bert, column.labels = c("
```

```r
trial_tone<-lm(abnormal_return~Tone + IR + lagged_return + Surprise + debt_equity, data=Core)
trial_unc<-lm(abnormal_return~Unc + IR + lagged_return + Surprise + debt_equity, data=Core)
trial_con<-lm(abnormal_return~Con + IR + lagged_return + Surprise + debt_equity, data=Core)
trial_bert<-lm(abnormal_return~Bert + IR + lagged_return + Surprise + debt_equity, data=Core)

stargazer(trial_tone, trial_unc, trial_con, trial_bert,
          column.labels = c("Tone", "Unc", "Con", "Bert"), header = F)
```

BMA

After regressing everything and getting the results we do a final check via Baysian Model Averaging, where we can see which of the Variables from our Core data set truly are important to abnormal returns. This methodology is to check which variables have variable importance in a regression.

```r
# Defining the Model
abnormal_return_model <- Core$abnormal_return ~ Core$Tone + Core$Unc + Core$Con + Core$Bert + Core$IR +

# Doing the BMA itself
bms_results <- bms(abnormal_return_model)
```

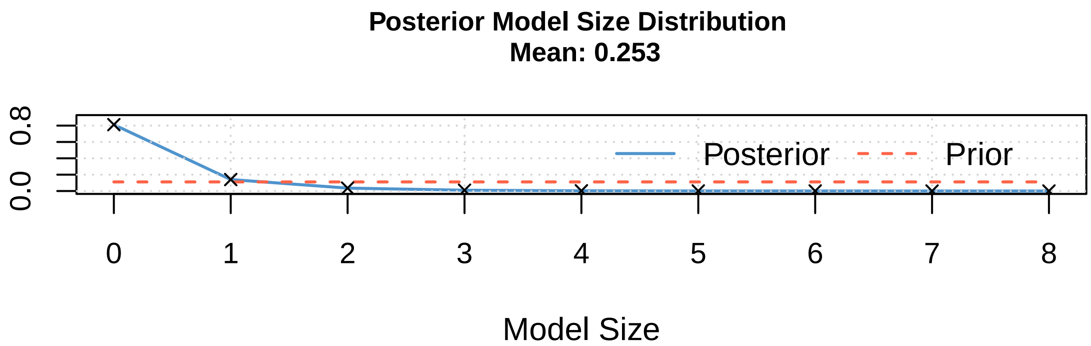
```
##                           PIP     Post Mean      Post SD Cond.Pos.Sign Idx
## Core$Surprise      0.05896313  9.967645e-04 4.782526e-03    1.00000000   7
## Core$Tone          0.05623271  1.074809e-03 5.605947e-03    1.00000000   1
## Core$Unc           0.02703853  4.553171e-04 4.441457e-03    0.96803485   2
## Core$debt_equity   0.02421109  2.725401e-07 3.423660e-06    0.95062231   8
## Core$Con           0.02401279 -1.773257e-04 7.184673e-03    0.69543177   3
## Core$IR            0.02300608 -1.155113e-05 1.646098e-04    0.08399735   5
## Core$lagged_return 0.02023056 -1.327445e-03 2.449888e-02    0.00000000   6
## Core$Bert          0.01926924  1.154585e-04 6.683659e-03    0.88214338   4
##
## Mean no. regressors               Draws             Burnins                Time
##            "0.2530"               "256"                 "0"   "0.08465099 secs"
##  No. models visited      Modelspace 2^K           % visited         % Topmodels
##               "256"               "256"               "100"               "100"
##            Corr PMP            No. Obs.         Model Prior             g-Prior
##                "NA"                "76"      "random / 4"               "UIP"
##     Shrinkage-Stats
##         "Av=0.987"
##
## Time difference of 0.08465099 secs
```

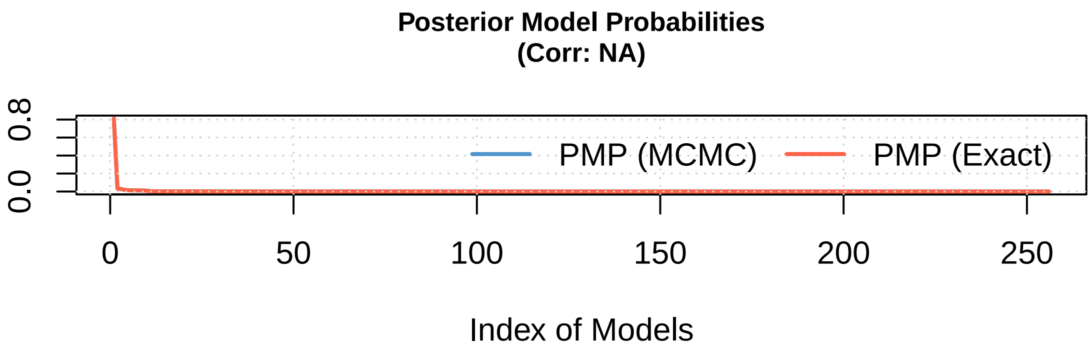
Table 6:

	Dependent variable:			
	abnormal_return			
	Tone	Unc	Con	Bert
	(1)	(2)	(3)	(4)
Tone	0.082			
	(0.053)			
Unc		0.143		
		(0.094)		
Con			0.147	
			(0.126)	
Bert				−0.095
				(0.207)
debt_equity	0.0001	0.0001	0.0001	−0.0002
	(0.00004)	(0.0001)	(0.0001)	(0.001)
IR	−0.001	−0.001	−0.001	−0.001
	(0.002)	(0.001)	(0.002)	(0.001)
lagged_return	−0.154	−0.166	−0.116	−0.086
	(0.158)	(0.163)	(0.161)	(0.165)
Surprise	0.305***	0.356***	0.310***	0.279***
	(0.102)	(0.107)	(0.103)	(0.103)
Tone:debt_equity	−0.0001			
	(0.0002)			
Unc:debt_equity		−0.0003		
		(0.0003)		
Con:debt_equity			−0.0003	
			(0.0004)	
Bert:debt_equity				0.0002
				(0.001)
debt_equity:Surprise	−0.001***	−0.001***	−0.001***	−0.001**
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Constant	−0.032**	−0.041*	−0.029	0.082
	(0.015)	(0.022)	(0.019)	(0.193)
Observations	76	76	76	76
R^2	0.205	0.190	0.158	0.135
Adjusted R^2	0.123	0.106	0.071	0.046
Residual Std. Error (df = 68)	0.010	0.010	0.010	0.010
F Statistic (df = 7; 68)	2.500**	2.272**	1.819*	1.514
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 7:

	Dependent variable:			
	abnormal_return			
	Tone	Unc	Con	Bert
	(1)	(2)	(3)	(4)
Tone	0.032**			
	(0.015)			
Unc		0.024		
		(0.023)		
Con			0.025	
			(0.037)	
Bert				0.003
				(0.050)
IR	−0.0003	−0.002	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)
lagged_return	−0.057	−0.029	−0.019	−0.016
	(0.159)	(0.162)	(0.162)	(0.163)
Surprise	0.022**	0.015	0.019*	0.017
	(0.011)	(0.011)	(0.011)	(0.011)
debt_equity	0.00003	0.00002	0.00002	0.00001
	(0.00002)	(0.00002)	(0.00002)	(0.00002)
Constant	−0.016**	−0.011	−0.008	−0.005
	(0.008)	(0.009)	(0.009)	(0.045)
Observations	76	76	76	76
R^2	0.113	0.066	0.057	0.051
Adjusted R^2	0.050	−0.001	−0.010	−0.017
Residual Std. Error (df = 70)	0.010	0.010	0.010	0.010
F Statistic (df = 5; 70)	1.792	0.990	0.853	0.756
Note:			*p<0.1; **p<0.05; ***p<0.01	





Bibliography

Möller, Rouven, and Doron Reichmann. 2021b. "ECB Language and Stock Returns – a Textual Analysis of ECB Press Conferences." *The Quarterly Review of Economics and Finance* 80 (May): 590–604. https://doi.org/10.1016/j.qref.2021.04.003.

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