Exploration of Different AI Methods for Stock Movement and Value Prediction during Earnings Season

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Introduction

- Stock market behavior is most interesting during earnings season due to spikes in volatility and stock volume.
- We study stock value and movement prediction during earnings season.

Data Acquisition: Part I

- Data obtained from the CRSP database. Our stock universe includes NYSE, AMEX, and NASDAQ from 1996 to 2018.
- Portfolio sorted into quintiles using 3-day cumulative returns from pre-announcement period.
- Long-short portfolio formed by buying (selling) firms in the lowest (highest) quantile.
- Each stock for every period within the portfolio is equally-weighted.

Data Acquisition: Part II

- Earnings conference call transcripts taken from relevant company websites, and 10-K reports gathered from SEC.
- Data treated using Stopwords corpus and lemmatized using Wordnet corpus.
- For the earnings transcripts, feature extraction was done via n-grams model for various values of n.
- Labels were denoted "+1" or "-1" depending on whether the stock price increased or decreased between $\pm d$ days of the earnings call day.
- Feature extraction was done via Loughran and McDonald sentiment word master dictionary for the 10-K reports.

Implementation

Long-short Portfolio

- Jensen's alpha and beta were first estimated when the model was exposed to basic CAPM

$$R_t - R_f = \alpha + \beta_{mkt}(Mkt_t - R_f) + \epsilon_t$$

and 3-Factor Fama & French (FFM):

$$\begin{aligned} R_t - R_f &= \alpha + \beta_{mkt}(Mkt_t - R_f) \\ &+\beta_{smb} SMB_t \\ &+\beta_{hml} HML_t + \epsilon_t \end{aligned}$$

NLP

- For the call transcripts, n-grams model was used with minimization of hinge loss via stochastic gradient descent.
- Jaccard similarity (J) and cos similarity (C) were assessed for neighboring bag of words of 10-Ks.

$$J(U,V) = \frac{|U \cap V|}{|U \cup V|}, \quad C(U,V) = \frac{|U * V|}{|U| * |V|}.$$

- Define (non-) changers by quintile of J/C. Return and Sharpe ratio were assessed by word list.

Experimental Results

Long-short Portfolio

Figure 1: Correlation Heatmap

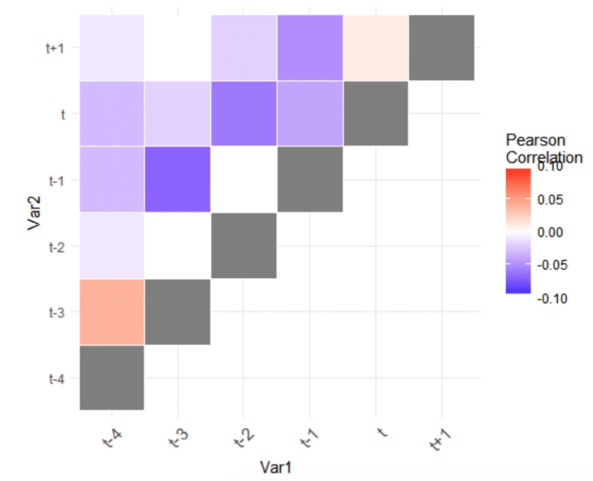


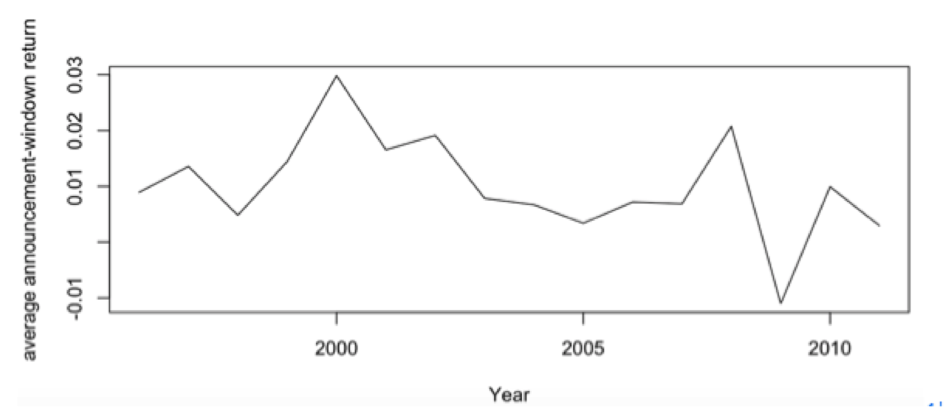
Table 1: 3-day Cumulative Excess Return

Mean	0.02
Standard Deviation	0.076
3-Day Sharpe Ratio	0.158

Table 2: Regression on CAPM and Fama-French 3-Factor

CAPM	Estimate	Std. Error	t-value	P(>|t|)
α_{Mkt}	0.00374	0.000633	5.89	$1.03 \cdot 10^{-8}$
β_{Mkt}	0.0342	0.054092	0.71	0.48
F-F 3-F	**Estimate**	**Std. Error**	**t-value**	**P(>|t|)**
α_{total}	0.00385	0.000667	5.61	$1.16 \cdot 10^{-8}$
β_{Mkt}	0.0371	0.04821	0.85	0.45
β_{SMB}	0.0860	0.08912	0.93	0.35
β_{HML}	0.0579	0.08457	0.66	0.51

Figure 2: Average Announcement-Window Return



Sentiment Analysis with 10-K Reports

Table 3: Sharpe Ratio (SR) by Word List Category

Sentiment	SR (size = 5)	SR (size = 10)
negative	-3.08	-1.95
positive	3.04	-0.52
uncertainty	0.57	-3.11
litigious	1.64	5.98
constraining	-2.38	-4.31
interesting	-2.34	-4.41

Figure 3: Cumulative Return by Word List Category over Year

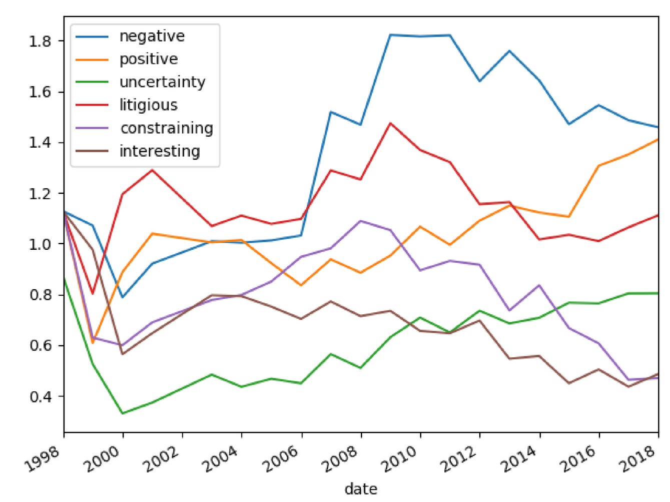
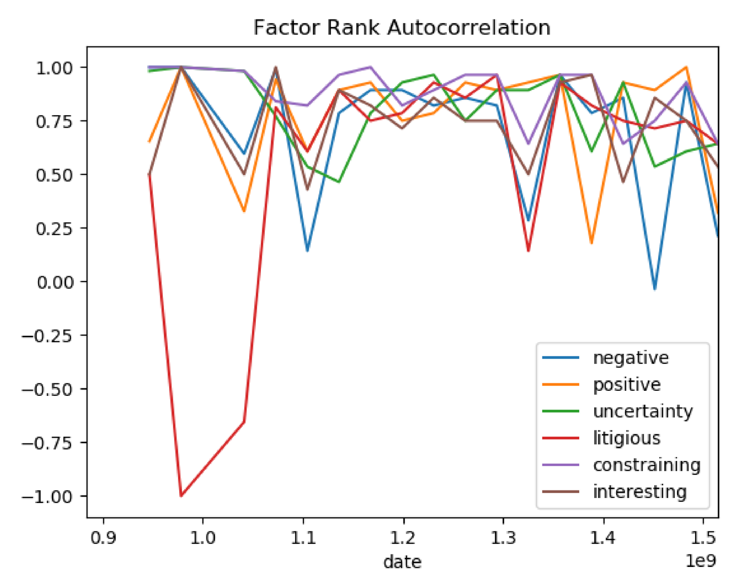


Figure 4: Factor Rank Autocorrelation to measure stability



Experimental Results, Contd.

Machine Learning with Call Transcripts

Figure 5: Linear Classifier Accuracy for Varying N-Gram Feature Extraction

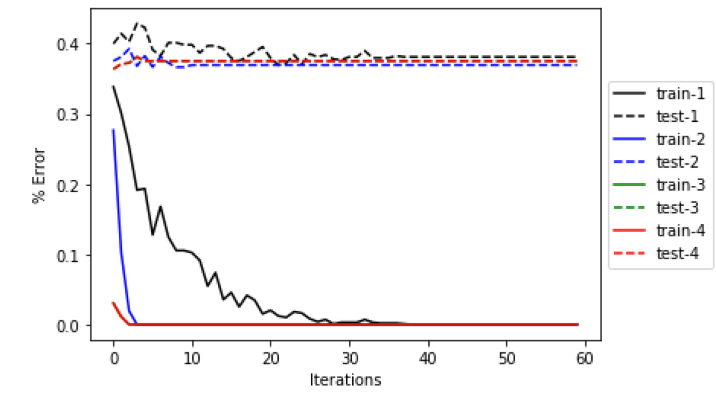
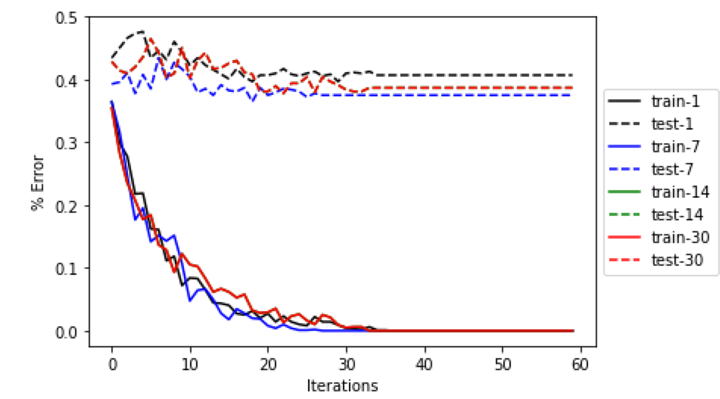


Figure 6: Linear Classifier Accuracy for Varying Days before and After Earnings Call



Conclusions

- Short term reversals around earnings announcements is a viable trading strategy. Abnormal returns over the CAPM model and FAMA French Three-factor model are observed in this strategy.
- Including more consecutive words in the feature space did not improve the classifier's accuracy by much, hinting at the possible non-linear nature of the feature space.
- Significant change in "litigious" and "negative" generated earning surprises, while "constraining" and "interesting" gave the opposite. It is unclear for "positive" and "uncertainty".

Future Work

- Adding alpha factors explored in NLP on call transcripts and 10-Ks such as changer in "litigious" to the CAPM or FFM during earnings announcements to verify higher stock movement prediction.
- Expanding the scope of data by including, e.g., 10-Qs, news reports, etc. would enhance the model stability and accuracy.
- Moreover, non-linear classifiers such as neural networks can be utilized to improve stock movement prediction, along with the increase in data points.