Impact of News Events on the Financial Markets

Miha Torkar, Dunja Mladenic
Artificial Intelligence Laboratory
Jozef Stefan Institute
Problem Setting

Goal: market analysis using world-wide events

Approach: observe the change in volume (price) between the closing value of today and the day after the event

- Extend traditional technical market analysis to include unstructured datasets
- Combine data sources
  - information from the news
  - historical market data

Usage:
- risk management tool against large market movements around news events
- trading strategy
Overview

- Data: Market and News
- Methods
- Results
- Conclusion and future work
Data

• Combine two sources:
  1. Historical Markets Data
  2. News events

• Analysis done on data of investment bank Goldman Sachs

  • 777 trading days
  • 4336 news events from Event Registry
Market Data

- Open, close, high, low and volume value
- VIX index as measure of volatility
- Daily frequency
- Source: Yahoo Finance
Market data pre-processing

• Market change measured through change in volume and price:

\[(\text{Volume Change})_t \equiv VC_t = \frac{V_{t+1} - V_t}{V_t},\]

\[(\text{Returns})_t \equiv r_t = \frac{P_{t+1} - P_t}{P_t}.\]

• \(V_t, P_t\) are volume and price at time \(t\)

• Additionally calculated: Rolling mean and Exponential Moving Average (EMA) for 5 and 10 days of \(VC_t, r_t\)
News data

• News event:
  • Cluster of articles
  • Multilingual (100+ languages)
  • Extracted: concepts, topics, date, location, social score, ...

• Source: Event Registry
News data (cont.)

• To reduce noise lower boundary for relevance was set, left with 424 events

• For each event, past similar events were found

• Change of market on the dates of past similar events was used as dataset for making prediction about impact of current event

• Prediction from similar events used as a feature in the time series model
Similar Events - example

Goldman Results Smash Expectations
But Stock Can't Escape The Selling Spree

Goldman Sachs 1Q rev jumps 14% on trading

Goldman Profit Rises 74% as Bond Trading Beats Estimates

2014-10-16 = t_{i-k}
(Open, Close, Volume, High, Low, Vix Close)_{t_{i-k}}

2015-04-13 = t_{i-j}
(Open, Close, Volume, High, Low, Vix Close)_{t_{i-j}}

2016-07-19 = t_i
(Open, Close, Volume, High, Low, Vix Close)_{t_i}
Correlation between events relating to Goldman Sachs

Data source: [Event Registry]
Methods – Time series model

• ARMA(p,q) model:

\[
X_t = \mu_t + Z_t,
\]

\[
\mu_t = \sum_{i=0}^{p} \alpha_i X_{t-i} + \sum_{j=1}^{q} \omega_j Z_{t-j}
\]

\[
Z_t = \sigma \epsilon \Rightarrow Z \sim N(0, \sigma^2)
\]

\(X_t\) … Target variable
\(\mu_t\) … Equation for the mean
\(\epsilon\) … Iid normaly distributed noise term
\(\sigma\) … Variance
Methods (cont.)

• Extend the ARMA model to non-constant variance, GARCH model:

\[ \sigma_t^2 = \beta_0 + \sum_{i=1}^{r} \beta_i Z_{t-i}^2 + \sum_{j=1}^{s} \gamma_j \sigma_{t-j}^2 \]

• Evaluation criteria
  • Stationarity assumption tested with Augmented Dicky Fuller and KPSS Test
  • Model selection with Akaike and Bayesian Information Criterion (AIC, BIC)
Results

• Relevant features:
  • Volatility - VIX Close price
  • Rolling mean 5 and 10 days
  • Rolling EMA 5 and 10 days
  • Prediction of Returns from similar events

• Predictions from the similar events improve model
• Final Model: ARMA (2,2) – GARCH (5,1)
Results (cont.)

• Improvement in AIC by 11 (drop in relative information lost when a given model is used)

• In terms of relative likelihood, the baseline model is 0.007 times as likely as the proposed model to minimize information loss
Conclusion

• Approach to determining the impact of news events on the financial markets
• Complex news data source was used and combined with market data
• Predictions of returns from past similar events shown to be statistically significant improvement for modelling volume change
• Future work includes further analysis of network formed from similar events

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