The Impact of Information Shocks on the Dispersion of Betas

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Dissertation Proposal

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Roadmap

Introduction

Introduction

- Stock returns are affected by changes to the company's expected **cash flow** and **discount rate** (Campbell and Shiller, 1988);
- **This paper**:
  - How these components affect the distribution of betas throughout the trading day.
  - New measure to capture the amount of information received by the market.
  - Controlling for these effects help explain the intraday variation on dispersion (Andersen et al., 2021, 2023; Hansen and Luo, 2023)

Introduction

Literature

- Information shocks have been largely studied in the literature:

  Cash Flow effect:
  - Value Premium (Campbell and Vuolteenaho, 2004);
  - Return Variability (Chen et al., 2013);
  - Portfolio Betas (Da and Warachka, 2009);

  Information flow:
  - Volatility (Engle and Ng, 1993; Braun et al., 1995);
  - Volume (Mitchell and Mulherin, 1994; Barber and Odean, 2008);
  - Future Returns (Calomiris and Mamaysky, 2019);
- I contribute to this literature by finding another channel through which information affects the stock market.

Model

Model

- Stocks: j (Market: $j = 0$); Date: t; Time: i;
- Following Campbell and Vuolteenaho (2004):

$$r^{(0)}_{t,i} - \mathbb{E}_{t-1}\left[r^{(0)}_{t,i}\right] = N_{CF,t,i} + N_{DR,t,i} \qquad \textbf{Assume: } N_{CF} \perp N_{DR}$$

$$\Downarrow$$

$$\beta^{(j)}_{t,i} = \omega_{t,i}\beta^{(j)}_{CF,t,i} + (1 - \omega_{t,i})\beta^{(j)}_{DR,t,i} \qquad \omega_{t,i} := \sigma^2_{CF,t,i}/(\sigma^2_{DR,t,i} + \sigma^2_{CF,t,i})$$

- $\beta^{(j)}_{CF}$ ($\beta^{(j)}_{DR}$): stock j exposure to **systematic** CF (DR) shocks;

Model

- $\mathfrak{D}_{t,i}$: cross-sectional variance of betas (dispersion):

$$\mathfrak{D}_{i,t} := \frac{1}{N}\sum_{j=1}^{N}\left(\beta_{t,i}^{(j)} - 1\right)^2$$

$$\Downarrow$$

$$\mathfrak{D}_{t,i} = \omega_{t,i}^2\mathfrak{D}_{CF,t,i} + (1-\omega_{t,i})^2\mathfrak{D}_{DR,t,i} + 2\omega_{t,i}(1-\omega_{t,i})\mathbb{C}_{t-1}(\beta_{CF,t,i}, \beta_{DR,t,i})$$

$$\omega_{t,i} \to 1 \quad \Longrightarrow \quad \mathfrak{D}_{t,i} \to \mathfrak{D}_{CF,t,i} \qquad \beta_{t,i}^{(j)} \to \beta_{CF,t,i}^{(j)}$$

$$\omega_{t,i} \to 0 \quad \Longrightarrow \quad \mathfrak{D}_{t,i} \to \mathfrak{D}_{DR,t,i} \qquad \beta_{t,i}^{(j)} \to \beta_{DR,t,i}^{(j)}$$

Data

Data

- **CF and DR Index**: NLP-based measures on amount of information received;
- Calculated using real-time news data;
- Higher frequency:
  - Fama et al. (1969); Patton and Verardo (2012); Da and Warachka (2009);
- Broader scope of information:
  - Pettenuzzo et al. (2020);

Data

News Index

- RavenPack Analytics (RPA) news data;
  1. *RPA Equities*
     - Earnings, Mergers, Dividend News, CEO Changes, etc.
  2. *RPA Global Macro*
     - CPI, Unemployment, Balance of Payments, Interest Rates, etc.
- Classification algorithms: entities, types, . . . ;
- NLP-based sentiment analysis;
  - CSS $\in (-1.00, 1.00)$: news impact on stock price;

News Types

Data

News Index

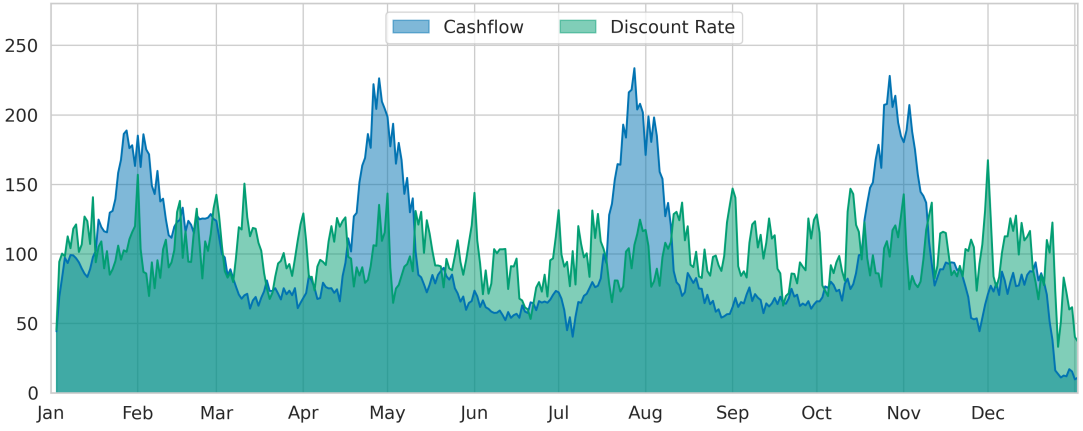
- **CF Index:** RPA Equities;
- **DR Index:** RPA Global Macro;
- Total absolute CSS per day across **all** news.
- Number of news per day + how impactful they are to the market;

News Indices

Data

News Index

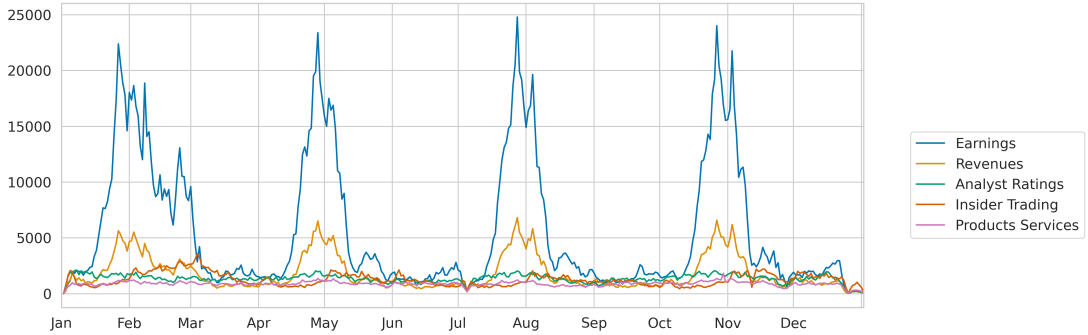
- Consistent with the literature:



Average Index per Day of the Year

Data

News Index



Average Number of News by Group per Day of the Year

Data

Stock Returns and Betas

- NYSE TAQ;
- *Any* stock that has been on the S&P 500 index from 2000-01-01 to 2023-12-31;
  - 973 stocks;
- 2004 to 2023; 9:30 AM to 4:00 PM (EST); 3 min intervals;
  - 4866 days; 130 intervals per day;

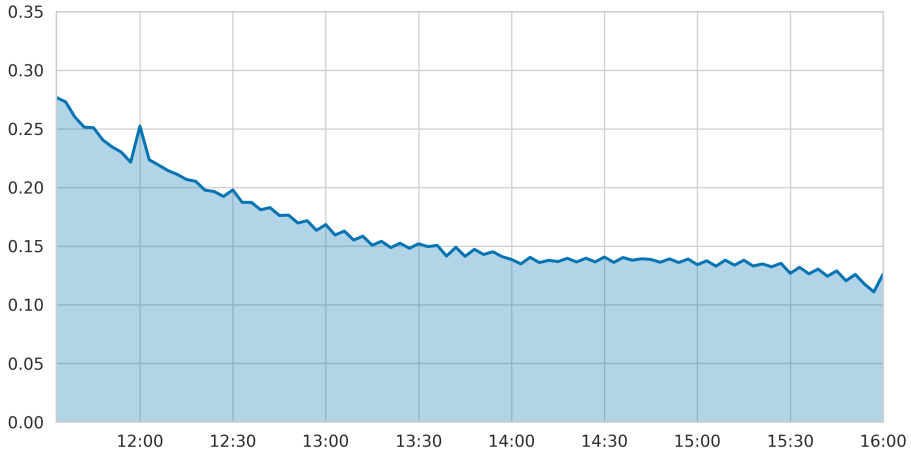
Data

Stock Returns and Betas

- β estimated over 2 hour local window by realized measures
  - (Andersen et al., 2006);
- Dispersion estimated as in Andersen et al. (2021);
- **Target:** Variation over the trading day: $\mathfrak{D}_{\cdot,i}$;

Data

Stock Returns and Betas



Average Dispersion over the Trading Day $\mathfrak{D}_{\cdot,i}$

Results

Results

- How does each type of news affect beta distribution?
- **Hypothesis #1:**
  - Cash Flow news increase dispersion;
  - Discount Rate news decrease dispersion;
  - **Intuition:**
    Systematic cash flow shocks have a spillover effect across the market;
    Ramnath (2002); Lang and Stulz (1992)
- **Hypothesis #2:**
  - Controlling for these effects, we can explain the intraday variation found in the literature.
  - **Intuition:**
    Arrival of News → Price Discovery → Distribution of Risk

Results

- Estimate average dispersion conditional on the intensity of news;
- **Assume:** $\omega_{t,i}$ constant over i;
- Split the sample into deciles of CF_t and DR_t;

$$HCF := \{t : CF_t \geq Q_{0.9}(CF)\} \quad LCF := \{t : CF_t \leq Q_{0.1}(CF)\}$$
$$HDR := \{t : DR_t \geq Q_{0.9}(DR)\} \quad LDR := \{t : DR_t \leq Q_{0.1}(DR)\}$$

Results

$$\begin{aligned}\mathfrak{D}_{t,i} = \alpha_{0,i} &+ \alpha_{HCF,i}\mathbb{1}\{t \in HCF\} + \alpha_{LCF,i}\mathbb{1}\{t \in LCF\} \\ &+ \alpha_{HDR,i}\mathbb{1}\{t \in HDR\} + \alpha_{LDR,i}\mathbb{1}\{t \in LDR\} + \epsilon_{t,i}\end{aligned}$$

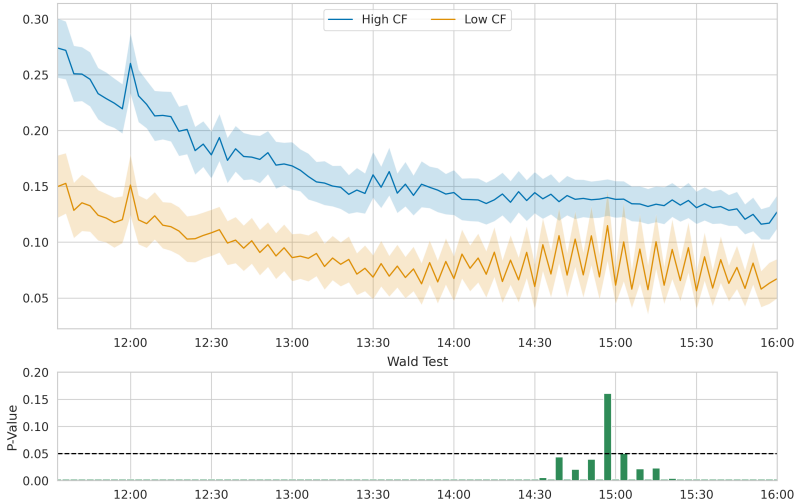
- OLS regression for each time of the day i;
- CF Effect:

$$LCF \to HCF \quad \Rightarrow \quad \alpha_{HCF,i} - \alpha_{LCF,i}$$

- DR Effect:

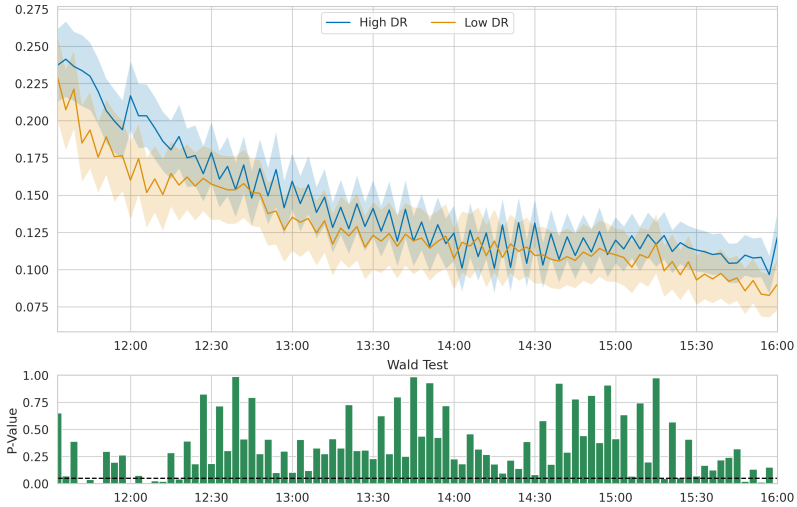
$$LDR \to HDR \quad \Rightarrow \quad \alpha_{HDR,i} - \alpha_{LDR,i}$$

Results



CF Effect on Intraday Dispersion

Results



DR Effect on Intraday Dispersion

Results

- How does this translates into the distribution of betas?
- As distribution increases, does that makes high beta stocks higher and low beta stocks lower?
- I classify stocks into high and low beta stocks (HB and LB);

$$HB := \left\{ j : \bar{\beta}^{(j)} \geq Q_{0.9}(\bar{\beta}) \right\} \qquad LB := \left\{ j : \bar{\beta}^{(j)} \leq Q_{0.1}(\bar{\beta}) \right\}$$

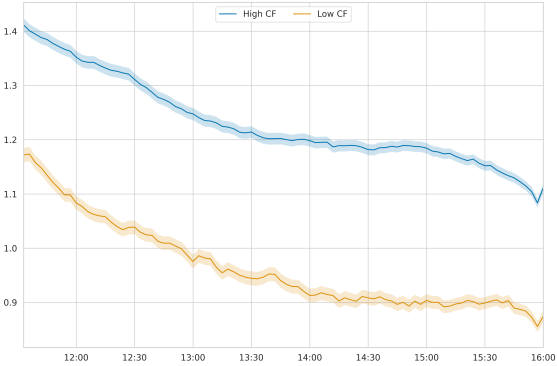
Results

$$\begin{aligned}\hat{\beta}_{t,i}^{(j)} = \alpha_{0,i} &+ \alpha_{HBHCF,i}\mathbb{1}_{\{j\in HB,t\in HCF\}} + \alpha_{HBLCF,i}\mathbb{1}_{\{j\in HB,t\in LCF\}} \\ &+ \alpha_{HBHDR,i}\mathbb{1}_{\{j\in HB,t\in HDR\}} + \alpha_{HBLDR,i}\mathbb{1}_{\{j\in HB,t\in LDR\}} \\ &+ \alpha_{LBHCF,i}\mathbb{1}_{\{j\in LB,t\in HCF\}} + \alpha_{LBLCF,i}\mathbb{1}_{\{j\in LB,t\in LCF\}} \\ &+ \alpha_{LBHDR,i}\mathbb{1}_{\{j\in LB,t\in HDR\}} + \alpha_{LBLDR,i}\mathbb{1}_{\{j\in LB,t\in LDR\}} + \epsilon_{t,i}\end{aligned}$$

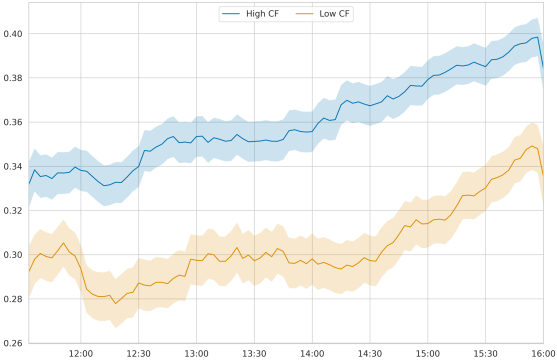
- Pooled OLS for each time of the day i

Results

CF Effect



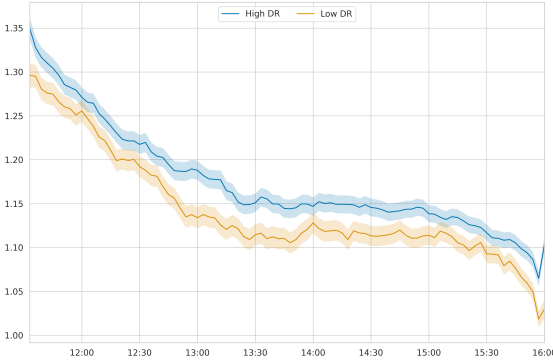
High Beta Stocks



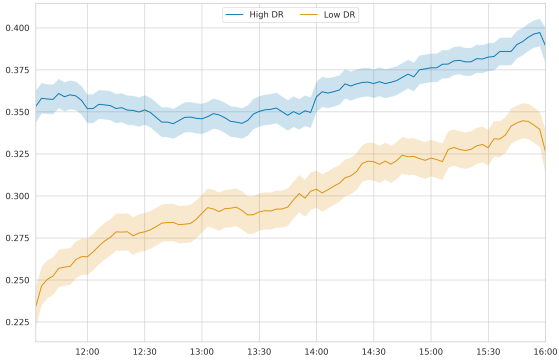
Low Beta Stocks

Results

DR Effect



High Beta Stocks



Low Beta Stocks

Results

Main Findings:

- **Cash Flow News**
  - $\uparrow \mathfrak{D}_{t,i} \quad \Leftarrow \quad \Uparrow \beta_{t,i}^{High}$ and $\uparrow \beta_{t,i}^{Low}$
  - *LCF* days exhibit lower decay in dispersion (intraday variation);
- **Discount Rate News**
  - No Effect $\mathfrak{D}_{t,i} \quad \Leftarrow \quad \uparrow \beta_{t,i}^{High}$ and $\uparrow \beta_{t,i}^{Low}$

Conclusion

Conclusion

- Cash flow news affect dispersion more than discount rate news;
- This effect is significant in every period of the trading day;
- Days with low intensity of cash flow news also exhibit lower decay in dispersion;

Conclusion

Further Work

- Which type of news is more important for the effect?
- Heterogeneities at the company level for this effect:
  - Value vs Growth stocks; Leveraged firms; Different sectors;
- Assess the timing of the news;
  - Assumption that $\omega_{t,i}$ is constant on i.

Other Projects

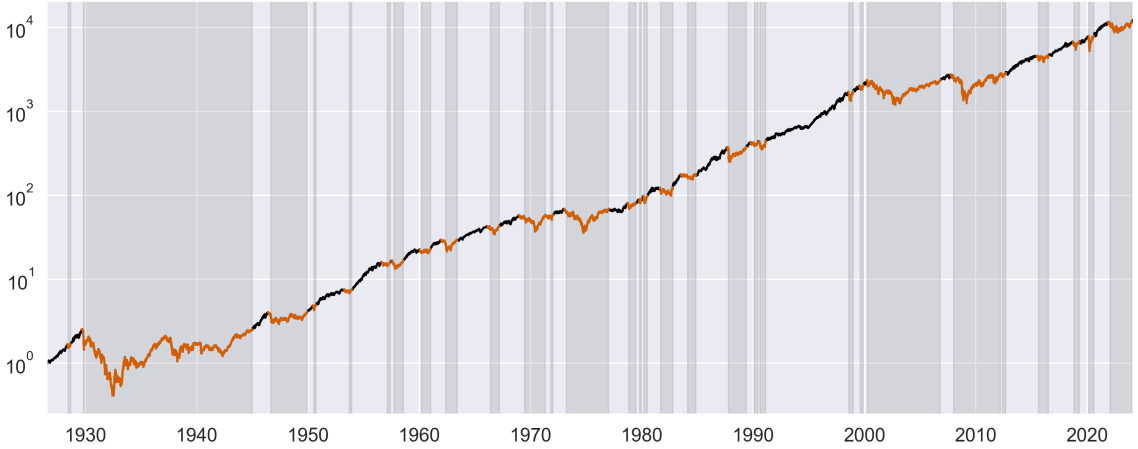
Duration of Stock Market Crashes

with Prof. Ravi Jagannathan

- In this project, we investigate the determinants of the duration of crisis;
- We identify 30 episodes of stock market crashes since 1926;

Duration of Stock Market Crashes

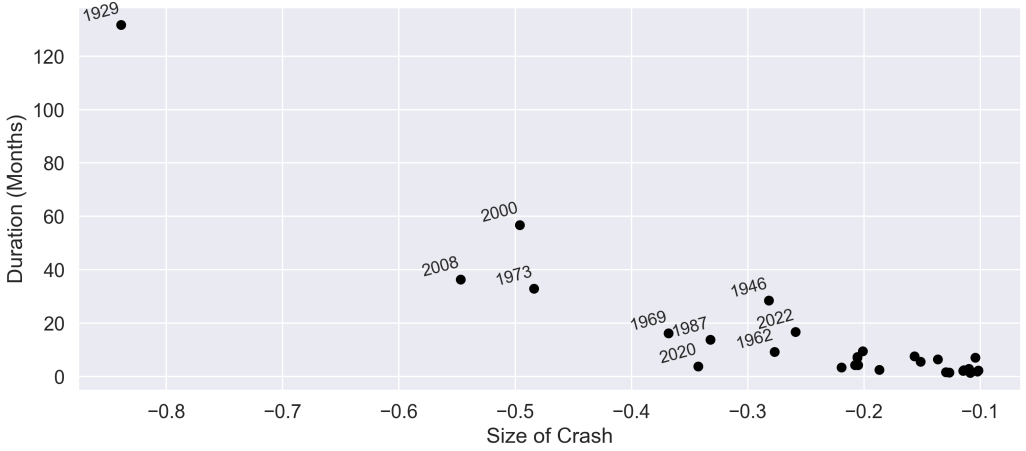
with Prof. Ravi Jagannathan



Crashes in the CRSP Index

Duration of Stock Market Crashes

with Prof. Ravi Jagannathan



Crashes in the CRSP Index

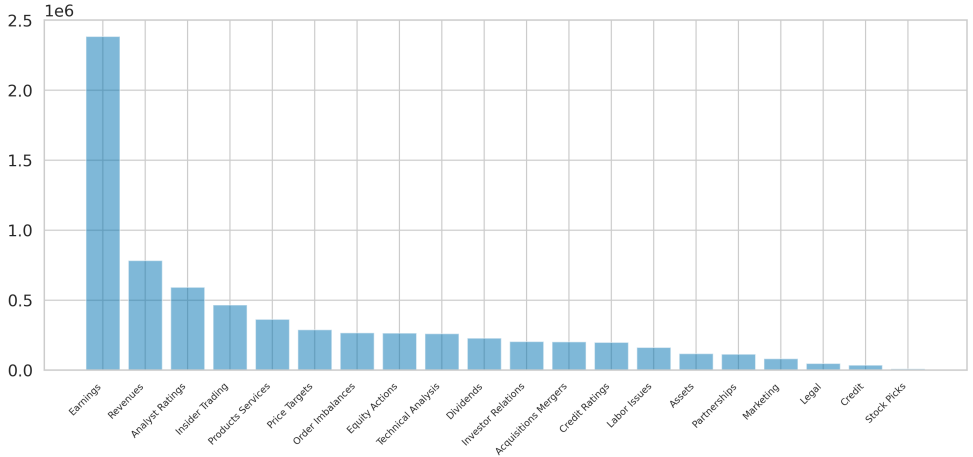
Duration of Stock Market Crashes

with Prof. Ravi Jagannathan

- Build a model for the duration of the crisis;
- Use a series of macroeconomic variables as explaining variables;
- Phillips, Shi & Yu (2012) to identify bubbles;

Thank you!

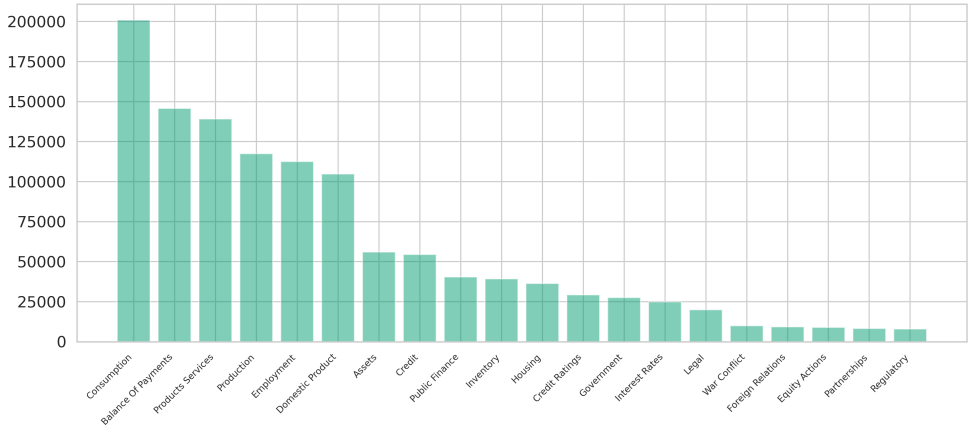
Appendix



Equity News Types

Return

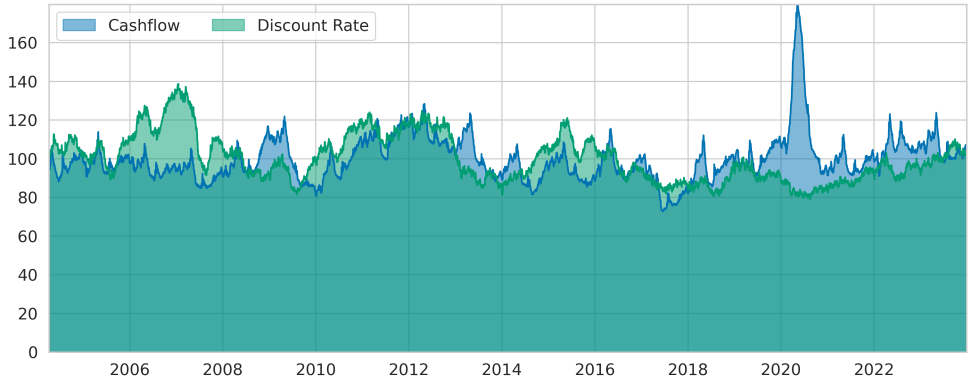
Appendix



Macro News Types

Return

Appendix



News Indices (65D MA)

Return

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