

The Impact of Information Shocks on the Dispersion of Market Betas

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March 7, 2025

Abstract

Keywords: News, Cash Flow, Public Information, CAPM Beta, High Frequency

JEL Codes: G12, G14, G41

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1 Introduction

Stock returns are driven by changes to the company's expected cash flow and discount rate (Campbell and Shiller, 1988). This, in turn, affects the sensitivity of stocks to market-wide shocks, i.e., the CAPM beta of Sharpe (1964), which has been a key object of study in the empirical asset pricing literature. In this article I show that the cash flow and discount rate components can affect how betas behave in the intraday, most specially, I show that cash flow shocks tend to increase the dispersion of betas in the market, making them more heterogeneous.

To do this, I combine high-frequency returns, observed at the intraday level, for a large universe of stocks with real time news data collected from top business news websites. High frequency returns are required to precisely estimate risk measures, such as realized volatility and betas (Andersen, Bollerslev, Diebold, and Wu, 2006; Andersen, Bollerslev, Diebold, and Labys, 2003) and therefore their distribution. Similarly sampled news data is used to measure the impact of cashflow and discount rate shocks on the market. To create the measures of cash flow and discount rate impact, I collect company-specific and macroeconomic news articles. Using Natural Language Processing based measures of sentiment, I am able to obtain a measure of the impact of these news on the market. Aggregating the sentiment of news at the daily frequency, I create indices that capture the amount of cash flow and discount rate information that is being incorporated into the market.

Cash flow shocks have been found to be a determinant of the size and value premium (Campbell and Vuolteenaho, 2004), return variability (Chen, Da, and Zhao, 2013) and portfolio's betas (Da and Warachka, 2009). More recent research has also focused on news articles to measure information flow and found that these measures affect volatility (Engle and Ng, 1993; Braun, Nelson, and Sunier, 1995), trading volume (Mitchell and Mulherin, 1994; Barber and Odean, 2008) and can predict returns (Calomiris and Mamaysky, 2019). ADD REFERENCE TO YASIN'S PAPER Instead, this paper looks at the cross-sectional distribution of betas across all stocks in the market and how does it change relative to the arrival of cash flow and discount rate shocks. The use of cash flow and discount rate news allow us to identify the unobserved components of betas and dispersion and assess their heterogeneity.

The contribution of cash flow shocks to higher dispersion of betas is caused by their intrinsic heterogeneous impact on the market. Literature has already shown that cash flow shocks, such

as earnings (Ramnath, 2002), bankruptcy (Lang and Stulz, 1992) tend to spillover to related firms such as competitors or stakeholders. Therefore, a market-wide cash flow shock have secondary and tertiary effects throughout the firms, which generate a more diverse effect across the stocks. On the other hand, discount rate innovations, such as interest rate changes and macroeconomic shocks, tend to affect the companies in a more similar way, not creating much effect on the distribution of risk.

This distribution has been a focus of recent research, Andersen, Thyrsgaard, and Todorov (2021), Andersen, Riva, Thyrsgaard, and Todorov (2023) and Hansen and Luo (2023). These papers highlight a key aspect of the high frequency distribution of betas, which is that the cross-sectional variation of betas tends to shrink as the trading day progresses. This seems to be robust to model specification, as the inclusion of the usual risk premium factors does not seem to completely eliminate this intraday trend (Andersen et al., 2023). There has not been an extensive study on the determinant factors of this phenomenon. This paper fills that gap as it provides evidence that the dispersion of betas is influenced by the arrival of shocks that are informative about future cash flow realizations. Moreover, I extend this analysis even more, by comprehensively studying which characteristics of both cash flow news are the most important.

This paper also contributes to the literature by providing a new measure of cash flow and discount rate shocks that can be applied in other contexts. By using real time news data, collected at the millisecond frequency, I am able to measure the information flow into the market with a higher degree of precision, and at a higher frequency than traditional measures. Previous works in the literature such as Fama, Fisher, Jensen, and Roll (1969); Patton and Verardo (2012) use quarterly earnings announcement events to gather information about cash flow shocks. Other works, such as Da and Warachka (2009) use analyst forecasts changes as a way to capture unexpected shocks. All these measures have the disadvantage of being either quarterly or monthly observed only. The measures proposed in this paper are obtained at the daily frequency and can easily be extended to the intraday level. Other daily measures such as Pettenuzzo, Sabbatucci, and Timmermann (2020) rely on use dividend announcement information. The measure proposed in this paper is more general as it includes other types of cash flow news, such as mergers, acquisitions, and other corporate events.

While the metric introduced in this article is unprecedented in the literature to capture cash

flow innovations, it relates to the existing literature as it is able to capture some common events that are known to affect cash flow. For example, my Cash Flow Index maintains the seasonality of earnings announcements throughout the year, strongly correlating with the earnings season. On the other hand, I show that the Discount Rate Index captures a broader set of events, such as CPI, interest rates and production data.

The paper is structured as follows: Section 2 describes the data used in this analysis, both the high frequency returns and the news data. Section 3 explains how the cash flow and discount rate indices are constructed. Section 4 presents a simple model that allow us to link how news enable us to identify the unobserved components of dispersion. Section 5 presents the main result of the paper and a series of robustness checks. Finally, Section 6 concludes. More explanation on the data and methodology can be found in the Appendix A

2 Data

I combine real-time news data with high-frequency stock returns to investigate how does public information releases influence the cross sectional distribution of betas over the trading day. For the universe of stocks, I select any company which has been in the S&P 500 index since 2000.¹ For the market security, I select the SPY ETF which closely follows the S&P 500 Index and is traded almost continuously in my sample. My observations span from 2004-01-01 to 2023-11-21 with each trading day going from 9:30 a.m. to 4:00 p.m (Eastern Standard Time). This gives me a total of 973 firms and 4866 trading days.

2.1 Stock Returns

Stock returns are obtained from NYSE's Trades and Quotes (TAQ) database. I observe trades at the second frequency and calculate the price at that point as the weighted average of all trades in the second (weighted by their size). If there are no trades at that second, I use the last available price on my series. I then calculate log-returns and trim outliers that are further than 3 standard deviations of the mean to avoid outliers, data errors and big jumps. To reduce microstructure noise, I sample my returns at the 3 minute frequency by selecting the last available information at that time window. Therefore, for a given stock at a given day in my sample I have 130 observations.

Figure 1 shows the number of stocks available in my sample for each day. Although the number of companies in my sample decreases with time due to survivorship bias, I still end up with a large number of stocks even for the last days of my sample which will allow me to closely capture the cross-sectional distribution of betas.

2.2 News Data

I collect news data from RavenPack Analytics (RPA). This dataset consists of real-time news on both company-specific and macroeconomic events. Company news are stored in the *RPA Equities* dataset. This contains information on news releases such as earnings reports, analyst rating changes, press releases, merges, etc. On the other hand, *RPA Global Macro* contains information on macroeconomic news such as GDP, inflation, FOMC announcements, geopolitical events

¹The list of all stocks is shown in Appendix A.1



Figure 1: Number of stocks available per day

and others. News articles are obtained from many business news sources such as Dow Jones the Wall Street Journal, Newswires, Benzinga, MarketWatch and more, observed at the millisecond frequency. RavenPack receives unstructured news data from these sources and process it through a series of classification, filtering and scoring algorithms to extract the most relevant information.

Every observation in the RPA dataset is categorized by:

- *Entities*: companies, countries, organizations, etc. mentioned in the article;
- *Events*: The type of event detected in the article;
- *Scores*: A set of numerical scores identifying different aspects of an event and entity.

For the *RPA Equities*, I use the same universe of companies as mentioned in the previous subsection. I then extract every news article mentioning at least one of these companies from 2004-01-01 to 2022-12-31. For the *RPA Global Macro*, I consider only news about the United States. I subset these news to only consider articles that have been sufficiently relevant (assigned by ² and remove scraped from social media and other sources ³ following the procedure exhibited in the RPA User Guide⁴. I also filter for most novel stories, by dropping news articles about the same story in a

² $relevance \geq 75$

³ $provider_id \neq "MRVR"$

⁴https://wrds-www.wharton.upenn.edu/documents/1497/RavenPack_Analytics_1.0__User_Guide.pdf

given day⁵ and drop news from the topic "stock-prices", which tend to be more backward looking, not bringing any new information to the market.⁶

Figures 2 and 3 show a histogram of the most common types of news in the *RPA Equities* and *RPA Global Macro* datasets, respectively. The most common news articles for companies relate to earnings and revenues. For macro news, CPI, international trade and GDP dominate the news.

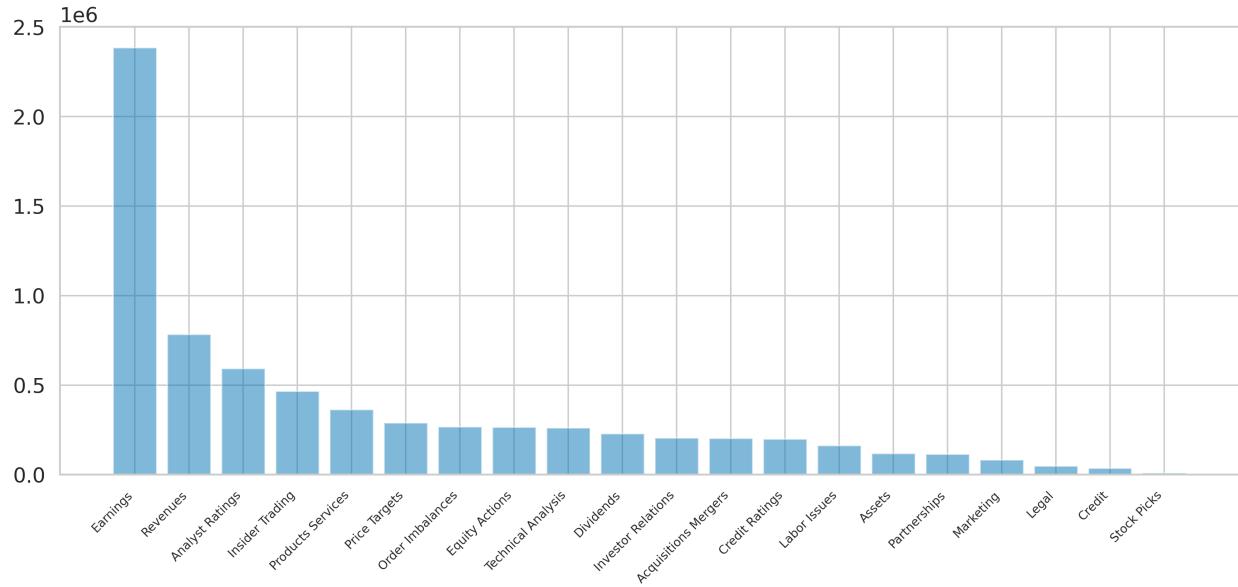


Figure 2: Most Common Groups of News (RPA Equities)

The final dataset has 7,094,016 articles on the *RPA Equities* dataset and 1,254,461 articles on the *RPA Global Macro* dataset.

⁵ $event_similarity_key \geq 1$

⁶According to RavenPack, this topic shows some non-stationarity in the data caused by an increasing number of this type of event, mostly price gains and losses covered the MarketWatch provider.

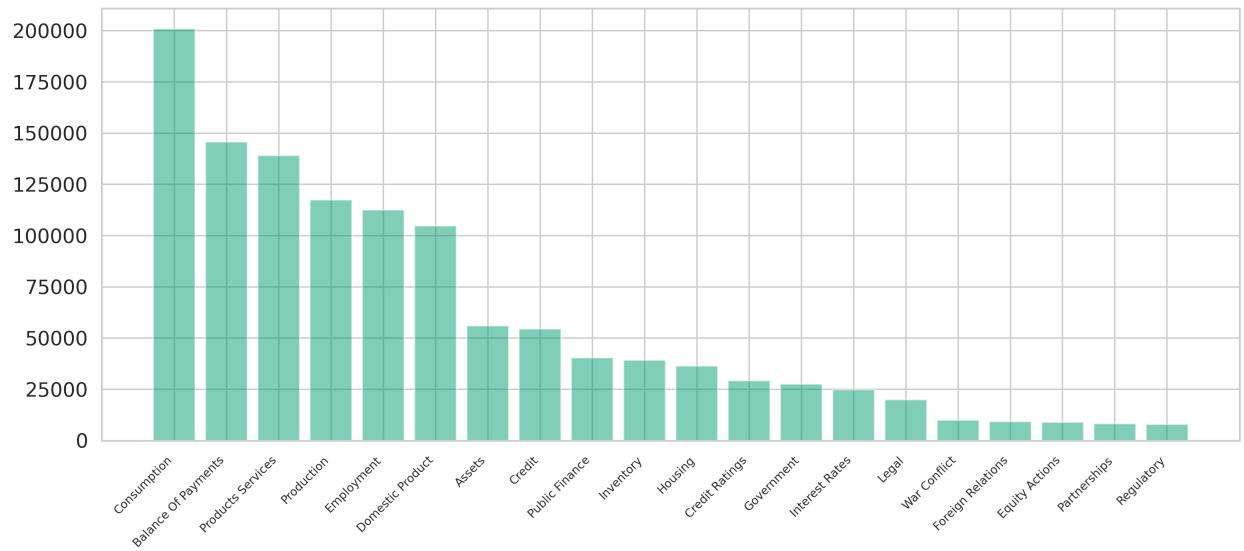


Figure 3: Most Common Groups of News (RPA Global Macro)

3 Methodology

3.1 Dispersion Estimation

Denote $r_{t,i}^{(j)}$ the stock log-returns of company $j = 0, 1, \dots, N$ at day $t \in \mathbb{N}_{++}$ and time $i = 1, \dots, n$ where $j = 0$ denotes the market asset. Beta dispersion is defined as in Andersen et al. (2021) as the cross sectional variance of betas across all stocks:

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

where $\beta_t^{(j)}$ corresponds to the conditional beta of asset j at day t and time i .

To estimate this object, I follow Andersen et al. (2021) with the estimator being described below. The estimates are calculated over a local window of i of length k_n defined as

$$\mathcal{I}_\kappa^n := \{\lfloor \kappa n \rfloor - k_n + 1, \lfloor \kappa n \rfloor - k_n + 2, \dots, \lfloor \kappa n \rfloor\} \quad \kappa \in [0, 1]$$

The quadratic variation estimate of asset j at day t and time κ is given as

$$\widehat{V}_{t,\kappa}^{(j,l)} := \frac{n}{k_n} \sum_{i \in \mathcal{I}_\kappa^n} \left(r_{t,i}^{(j)} \right)^2 \mathbb{1}_{\{\mathcal{A}_{t,i}^{(j,l)}\}} \quad l = 0, 1, \dots, N$$

where $\mathcal{A}_{t,i}^{(j,l)} := \left\{ \left| r_{t,i}^{(j)} \right| \leq v \right\} \cap \left\{ \left| r_{t,i}^{(l)} \right| \leq v \right\}$ is used to remove jumps in the return processes.

The next step is to estimate the difference between the covariance and the market volatility. For this I use a coarser frequency of returns and redefine the local window

$$\tilde{\mathcal{I}}_\kappa^n := \{\lfloor \kappa n \rfloor - k_n + 2, \lfloor \kappa n \rfloor - k_n + 4, \dots, \lfloor \kappa n \rfloor\} \quad \kappa \in [0, 1]$$

the estimator is then given by

$$\widehat{C}_{t,\kappa}^{(j)}(2) = \frac{n}{k_n} \sum_{i \in \tilde{\mathcal{I}}_\kappa^n} \left[\left(r_{t,i-1}^{(j)} + r_{t,i}^{(j)} - r_{t,i-1}^{(0)} - r_{t,i-1}^{(0)} \right) \times \left(r_{t,i-1}^{(0)} + r_{t,i}^{(0)} \right) \right] \mathbb{1}_{\{\mathcal{A}_{t,i-1}^{(j,0)} \cap \mathcal{A}_{t,i}^{(j,0)}\}}$$

Finally, dispersion is estimated across assets

$$\widehat{D}_{t,\kappa}^N := \frac{1}{N} \sum_{j=1}^N \left(\frac{\widehat{C}_{t,\kappa}^{(j)}(2)}{\widehat{V}_{t,\kappa}^{(0,j)}} \right)^2 \mathbb{1}_{\{\widehat{V}_{t,\kappa}^{(0,j)} \geq \alpha\}}$$

where α is a threshold to remove observations with too low volatility. The hyperparameters are set according to the data as described in Section 2. The values are shown in Table 1.

	Description	Value
n	# Obs. per day	130
k_n	Size of local window	40
v	Jump-trimming parameter	0.023
α	Variance lower bound	0.00002

Table 1: Parameter values

Following Andersen et al. (2021), I include the bias correction term to $\widehat{D}_{t,\kappa}^N$ as high-frequency estimations possess a small signal-to-noise ratio leading to a big bias. This estimator is shown to be consistent and asymptotic normal as $N \rightarrow \infty$.

3.1.1 Unconditional Estimation

The results of the estimation are shown in this section. At first, I display the 21 days moving average of $\widehat{D}_{t,\kappa}^N$ for the whole sample period. The results are shown in Figure 4. The dispersion is very volatile and is higher both in the beginning of the sample and during the financial crisis.

Next, I plot the calendar effect of the dispersion, which averages the dispersion estimates by day of the year. The results are shown in Figure 5.

Finally, I plot intraday pattern of dispersion. For this, I pool the values of $\widehat{D}_{t,\kappa}^N$ and, for a given time of the day (κ) I average the estimates for every day in my sample (t). The results are shown in Figure 6. This is in line with what we see in Andersen et al. (2021). Dispersion is significantly higher in the first hours of the trading day and dampens as the day goes by.

To assess the systematic nature of this pattern, I split the sample in 3 and redo the calculations. This is shown in Figure 7. Even though the level of dispersion seems to vary over the three thirds of the sample, the intraday pattern seems to be the same in all three portions.

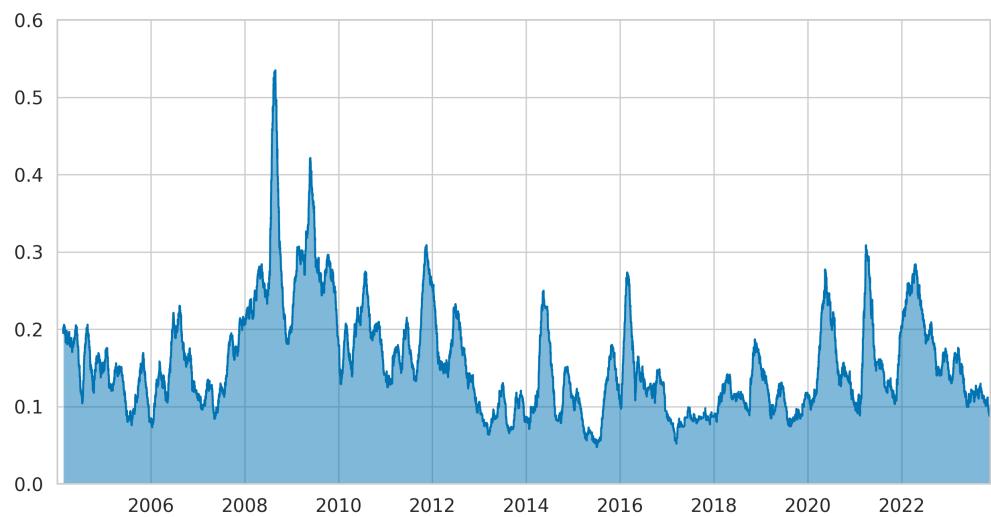


Figure 4: Dispersion Estimates (21D MA)

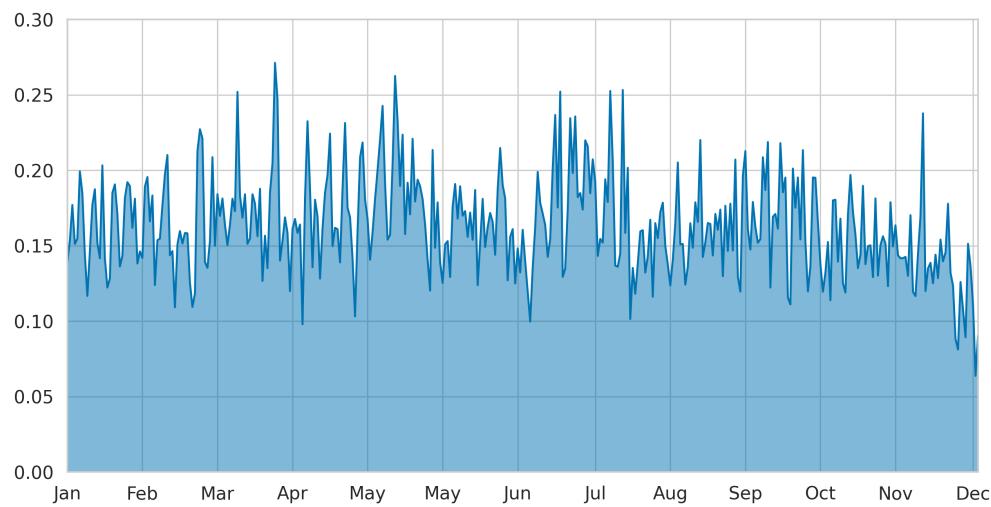


Figure 5: Average Dispersion by Day of the Year

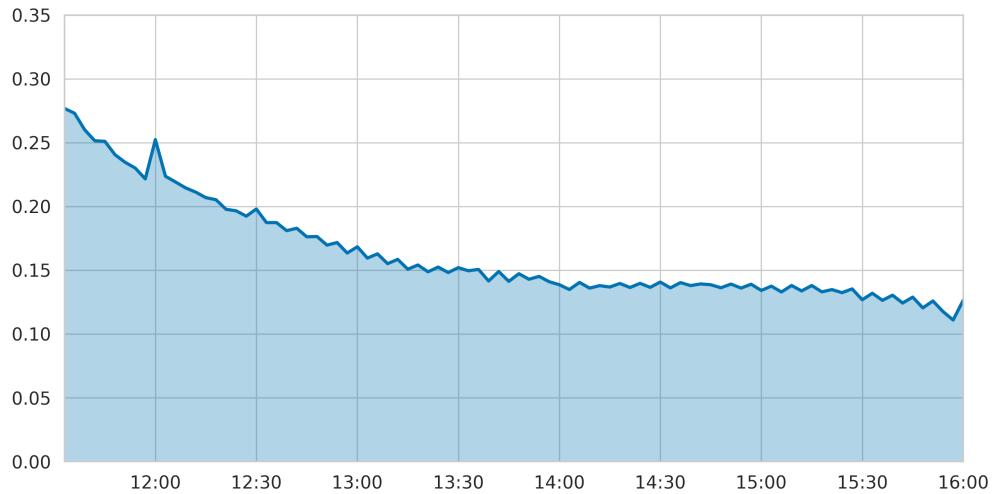


Figure 6: Average Dispersion by Time of the Day (EST)

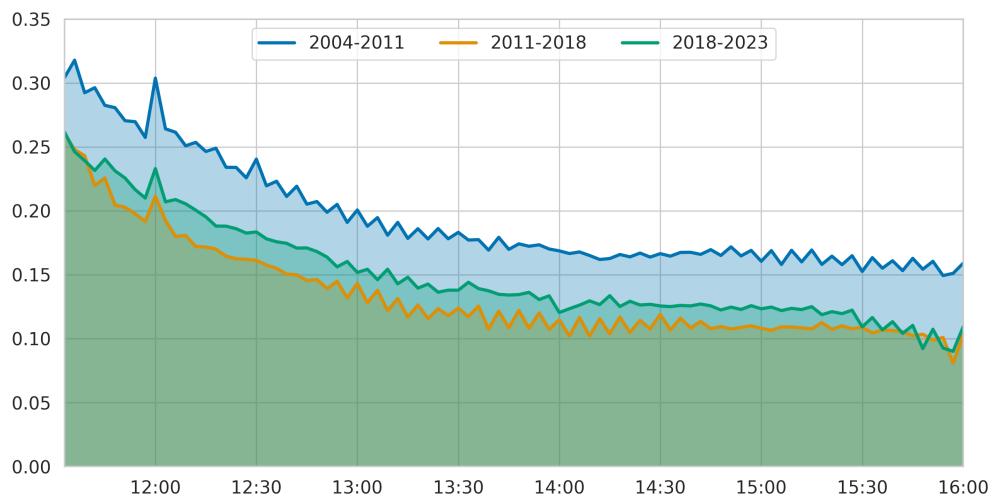


Figure 7: Average Dispersion by Time of the Day per Window (EST)

3.2 News Indices

Using RavenPack’s database, I construct a measure of the amount of public information released on everyday. I distinguish between information on cash flow and discount rate news. For cash flow news, I consider all the articles in the *Equities* dataset, which contain information about idiosyncratic events such as earnings reports, analyst rating changes, press releases, merges, etc. For discount rate news, I consider all the articles in the *Global Macro* dataset that are classified as being about a country or organization⁷ containing information on more systematic shocks, such as GDP, inflation, etc. To understand how much information arrives in the market on a specific day, I take use of RavenPack’s NLP-based scores. I construct the Cashflow (CF) and Discount Rate (DR) News Indices using RPA’s *Composite Sentiment Score* (CSS) which measures the news sentiment of a given story using sentiment analysis techniques. It is available directly on the RPA database and ranges from -1.00 to 1.00. The score is determined by intraday stock price reactions to news and is designed to capture the overall reaction of the stock market to a given event. For cash flow news, I consider all the articles in the *RPA Equities* dataset. For discount rate, the observations in the *Global Macro* dataset are taken into account. For each one, the daily news index is constructed by summing the absolute value of *CSS* for all articles released on that day from Close to Close.⁸ Finally, I normalize the indices to have a mean of 100 over the sample for comparability. It is important to stress out that this normalization does not impact the results as the indices are used relative to their own history, not compared to each other.

Figure 8 shows the time series for both the CF and DR index (on a Quarter Moving Average). As we see, there is a big increase in the total sentiment of news after 2022, but throughout the series the indexes tend to be less volatile. Figure 9 shows the calendar effect of the news indexes. As we can see, there is some seasonality of the amount of information released throughout the year, which coincides with the earnings season. To see that, I group articles by their type and plot the total number of different articles by day of the year in Figure 10 for the 5 most common types. As the figure shows, the pattern in 9 is driven mostly by earnings-related news (Earnings, Revenues and Earnings per Share) as other type of articles don’t possess the same quarterly seasonality such

⁷ $entity_type \notin \{"PROD", "PEOP", "CMDT"\}$

⁸That means that, if an articles appear in our database after 4:00pm, it is considered as published in the next business day.

as Analyst Rating Changes and Price Target.

When comparing to the same graph for the discount rate index shown in Figure 11, we see that the discount rate tends to be influenced by a wider variety of events, such as CPI news, production, employment, etc. Unlike with the cash flow index, no group tends to dominate the dynamics of the discount rate index.

Finally, Figure 12 shows the day-of-the-week effect. This figure shows that there is less information released on Mondays, compared to the other days of the week in our sample for both datasets. For the discount rate index, we see that there is a large increase in the number of news released on Fridays, which is when the US releases unemployment data.

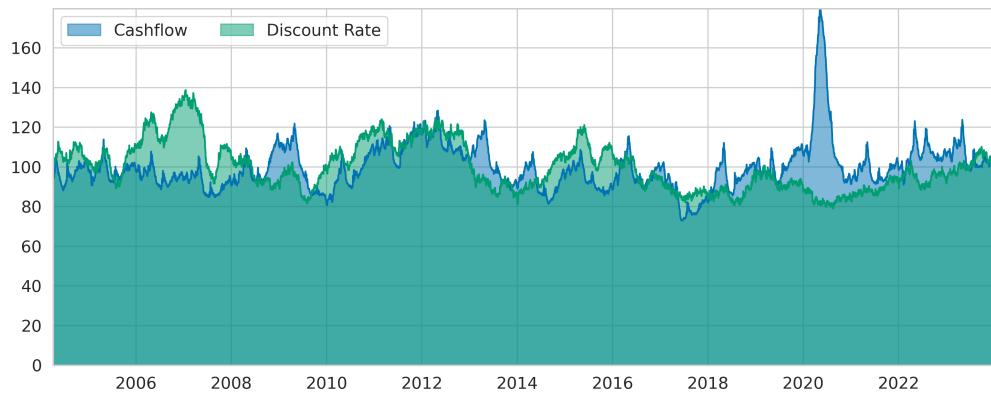


Figure 8: News Indices (Quarter MA)

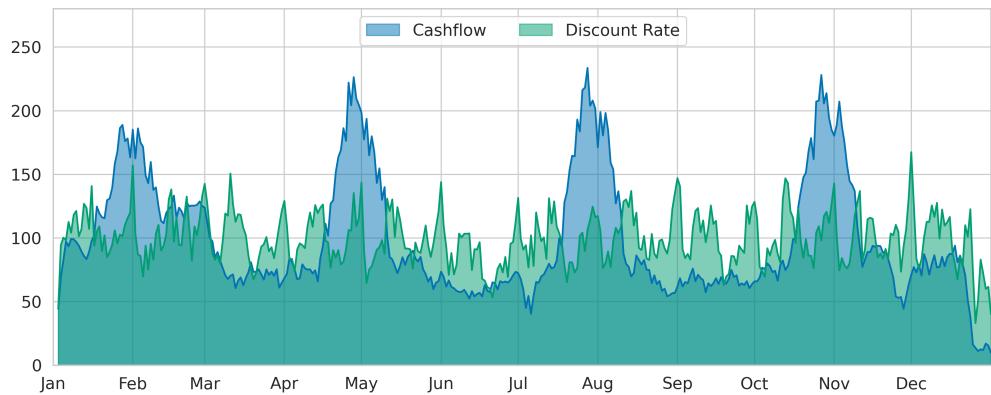


Figure 9: Calendar Effect of News Indices

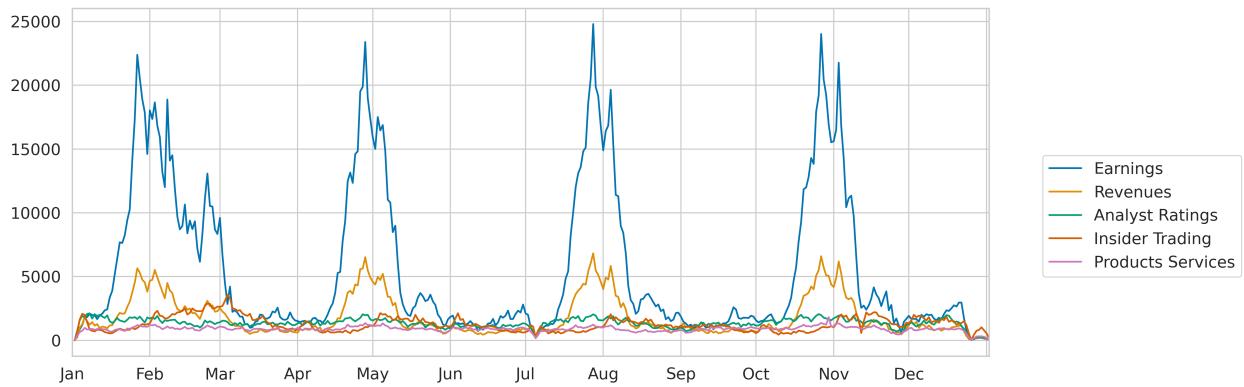


Figure 10: Average Number of CF News Articles by Day of the Year (Top 5 Types)

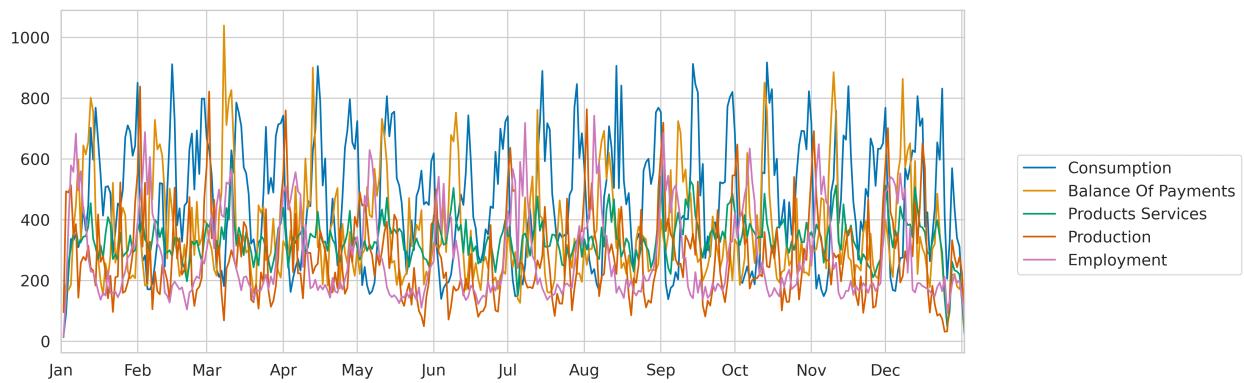


Figure 11: Average Number of DR News Articles by Day of the Year (Top 5 Types)

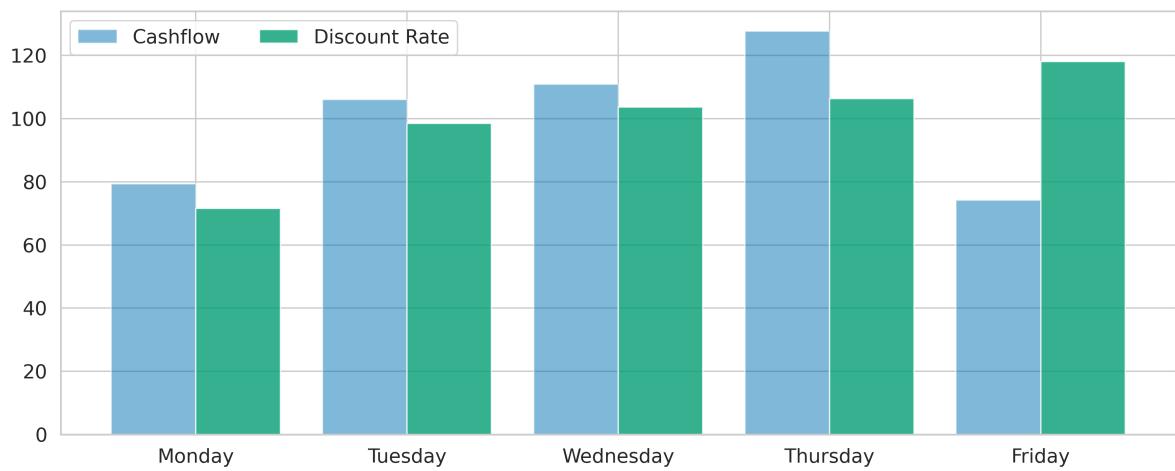


Figure 12: Average News Index per Day of the Week

3.3 Dispersion Tests

The paper by Andersen et al. (2021) provides a methodology to test for significant variation in dispersion. This variation can be seen either between different times or dates. Both will be important for our analysis and are explained below. For these results, we first need to introduce the notation

$$\hat{\mathcal{D}}_{\mathcal{T}, \kappa}^N = \sum_{t \in \mathcal{T}} \hat{\mathcal{D}}_{t, \kappa}^N \quad \mathcal{D}_{t, \kappa}^N = \sum_{t \in \mathcal{T}} \mathcal{D}_{t, \kappa}$$

3.3.1 Test for Intraday Variation

This test is used to assess whether the dispersion substantially changes from one time κ to another κ' within the same set of days and it is based on the asymptotic normality of the dispersion estimator. The null hypothesis in consideration is:

$$\mathcal{H}_0 : \mathcal{D}_{\mathcal{T}, \kappa}^N = \mathcal{D}_{\mathcal{T}, \kappa'}^N \quad \kappa \neq \kappa'$$

The test statistic is defined as:

$$Z(\kappa, \kappa') = \frac{|\hat{\mathcal{D}}_{\mathcal{T}, \kappa}^N - \hat{\mathcal{D}}_{\mathcal{T}, \kappa'}^N|}{\sqrt{\sum_{t \in \mathcal{T}} \widehat{Avar}(\hat{\mathcal{D}}_{t, \kappa}^N) + \widehat{Avar}(\hat{\mathcal{D}}_{t, \kappa'}^N)}} \quad (2)$$

which is asymptotically normal under the null.

3.3.2 Test for Functional Variation

This test is used to compare the level of dispersion between two different (and disjoint) sets of dates. First, we define a measure of total dispersion, which aggregates the dispersion over the day:

$$\mathcal{T}\mathcal{D}_t(u) := \int_0^1 \omega_u(\kappa) \mathcal{D}_{t, \kappa} d\kappa$$

where the weight function is defined as $\omega_u(z) := e^{izu}$ for $u \in [0, \mathcal{U}]$. Equivalently, the estimator for \mathcal{TD} is defined as

$$\widehat{\mathcal{TD}}_t^N(u) := \frac{1}{n - k_n + 1} \sum_{i=k_n}^n \omega_u(i\Delta_n) \hat{\mathcal{D}}_{t,i}^N$$

The test then is given as follows. Let \mathcal{T}_1 and \mathcal{T}_2 be two disjoint sets of dates. The null hypothesis is given by:

$$\mathcal{H}_0 : D_{\mathcal{T}_1, \kappa} = D_{\mathcal{T}_2, \kappa} \quad \kappa - a.e.$$

And the test statistic is defined by:

$$\mathcal{F}(\mathcal{T}_1, \mathcal{T}_2) := \sqrt{n - k_n + 1} \sup_{u \in [0, \mathcal{U}]} \left| \widehat{\mathcal{TD}}_{\mathcal{T}_1}(u) - \widehat{\mathcal{TD}}_{\mathcal{T}_2}(u) \right|$$

whose asymptotic distribution can be calculated using by simulation.

4 Model

This section explains a simple model that helps us understand why does the distribution of betas might differ with information shocks. I argue that conditional CAPM beta can be written as a convex combination of two unobserved components, the cash flow and discount rate betas. This has two important implications. It provides an explanation for why can the observed beta vary throughout the day. Also, it identifies two sources of variation in the cross-sectional distribution of betas, being the cash flow and the discount rate term.

Let $r_{t,i}^{(j)}$ denote the returns of company j stock at day/time t . I suppress the time index i in this section for simplicity, as t can be viewed as the date and time tuple with the trivial ordering. Following a similar argument as in [Campbell and Shiller \(1988\)](#), we can decompose the stock return innovations into changes in future cash flows (i.e. dividends) and future discount rates (i.e., expected returns):

$$r_{t+1}^{(j)} - \mathbb{E}_t r_{t+1}^{(j)} = (\mathbb{E}_{t+1} - \mathbb{E}_t) \sum_{s=1}^{\infty} \rho^s \Delta d_{t+1+s}^{(j)} - (\mathbb{E}_{t+1} - \mathbb{E}_t) \sum_{s=1}^{\infty} \rho^s r_{t+1+s}^{(j)} \quad (3)$$

where d denotes firms future dividend payments and ρ is the investor's discount factor. Define the cash flow and discount rate components as

$$N_{CF,t+1}^{(j)} := (\mathbb{E}_{t+1} - \mathbb{E}_t) \sum_{s=1}^{\infty} \rho^s \Delta d_{t+1+s}^{(j)} \quad N_{DR,t+1}^{(j)} := (\mathbb{E}_{t+1} - \mathbb{E}_t) \sum_{s=1}^{\infty} \rho^s r_{t+1+s}^{(j)} \quad (4)$$

Applying it to the market return, we decompose the conditional CAPM beta into:

$$r_{t+1}^{(0)} = N_{CF,t+1}^{(0)} - N_{DR,t+1}^{(0)} \quad (5)$$

$$\beta_t^{(j)} = \frac{\mathbb{C}_t(r_{t+1}^{(j)}, r_{t+1}^{(0)})}{\mathbb{V}_t(r_{t+1}^{(0)})} = \frac{\mathbb{C}_t(r_{t+1}^{(j)}, N_{CF,t+1}^{(0)})}{\mathbb{V}_t(r_{t+1}^{(0)})} + \frac{\mathbb{C}_t(r_{t+1}^{(j)}, -N_{DR,t+1}^{(0)})}{\mathbb{V}_t(r_{t+1}^{(0)})} \quad (6)$$

Assuming the arrival of cash flow and discount rate innovations are uncorrelated, this creates a convex combination between two unobserved betas:

$$\beta_t^{(j)} = \frac{\mathbb{V}_t(N_{CF,t+1}^{(0)})}{\mathbb{V}_t(r_{t+1}^{(0)})} \beta_{CF,t}^{(j)} + \frac{\mathbb{V}_t(N_{DR,t+1}^{(0)})}{\mathbb{V}_t(r_{t+1}^{(0)})} \beta_{DR,t}^{(j)} = \omega_t \beta_{CF,t}^{(j)} + (1 - \omega_t) \beta_{DR,t}^{(j)} \quad (7)$$

where

$$\omega_t := \frac{\mathbb{V}_t(N_{CF,t+1}^{(0)})}{\mathbb{V}_t(r_{t+1}^{(0)})} \quad \beta_{CF,t}^{(j)} := \frac{\mathbb{C}_t(r_{t+1}^{(j)}, N_{CF,t+1}^{(0)})}{\mathbb{V}_t(N_{CF,t+1}^{(0)})} \quad \beta_{DR,t}^{(j)} := \frac{\mathbb{C}_t(r_{t+1}^{(j)}, -N_{DR,t+1}^{(0)})}{\mathbb{V}_t(N_{DR,t+1}^{(0)})} \quad (8)$$

This shows that betas can vary either because one of their components has changed or because either cashflow or discount rate shocks have been more predominant in the market. Moreover, the dispersion of betas will be influenced by both these terms

$$\mathcal{D}_{t,i} := \frac{1}{N} \sum_{j=1}^N \left(\beta_{t,i}^{(j)} - 1 \right)^2 \quad (9)$$

$$= \frac{1}{N} \sum_{j=1}^N \left(\omega_t \beta_{CF,t,i}^{(j)} + (1 - \omega_t) \beta_{DR,t,i}^{(j)} - \omega_t \bar{\beta}_{CF,t,i} - (1 - \omega_t) \bar{\beta}_{DR,t,i} \right)^2 \quad (10)$$

$$= \omega_t^2 \frac{1}{N} \sum_{j=1}^N \left(\beta_{CF,t,i}^{(j)} - \bar{\beta}_{CF,t,i} \right)^2 + (1 - \omega_t)^2 \frac{1}{N} \sum_{j=1}^N \left(\beta_{DR,t,i}^{(j)} - \bar{\beta}_{DR,t,i} \right)^2 \quad (11)$$

$$+ 2\omega_t (1 - \omega_t) \frac{1}{N} \sum_{j=1}^N \left(\beta_{CF,t,i}^{(j)} - \bar{\beta}_{CF,t,i} \right) \left(\beta_{DR,t,i}^{(j)} - \bar{\beta}_{DR,t,i} \right) \quad (12)$$

with the first term being the dispersion of cash flow beta and the second the dispersion of discount rate beta. As ω_t approaches 1, the dispersion of cash flow beta dominates the dispersion of the observed beta. On the other hand, when ω_t approaches 0, the dispersion of discount rate beta dominates the dispersion of the observed beta.

This decomposition allows us to identify the unobserved components

$$\mathcal{D}_{CF,t,i} := \frac{1}{N} \sum_{j=1}^N \left(\beta_{CF,t,i}^{(j)} - \bar{\beta}_{CF,t,i} \right)^2 \quad \mathcal{D}_{DR,t,i} := \frac{1}{N} \sum_{j=1}^N \left(\beta_{DR,t,i}^{(j)} - \bar{\beta}_{DR,t,i} \right)^2 \quad (13)$$

by correctly selecting periods in which the market is highly affected by cash flow news ($\omega_t \approx 1$) or discount rate news ($\omega_t \approx 0$).⁹

⁹These results hold when the arrival of news is (not perfectly) correlated. In that case, β can be written as a linear combination of β^{CF} and β^{DR} and we would still identify the dispersion of each component whenever they dominate the news.

5 Results

Using the model from Section 4, I use the Cash Flow (CF_t) and Discount Rate Index (DR_t) constructed in Section 3 to identify the unobservable components of dispersion and betas. I start by sorting the sample into days in which the market is highly affected by cash flow (discount rate) news. This is done by selecting the days for which the cash flow (discount rate) index is in its top decile. Equivalently, I select the days for which the index is in its bottom decile to represent low cash flow (discount rate) intensity days.

$$\begin{aligned} HCF &:= \{t : CF_t \geq Q_{0.9}(CF_t)\} \\ LCF &:= \{t : CF_t \leq Q_{0.1}(CF_t)\} \\ HDR &:= \{t : DR_t \geq Q_{0.9}(DR_t)\} \\ LDR &:= \{t : DR_t \leq Q_{0.1}(DR_t)\} \end{aligned} \tag{14}$$

Using these variables, I estimate the following model by saturating the dispersion with the news index:

$$\begin{aligned} \mathcal{D}_{t,i} = & \alpha_{0,i} + \alpha_{1,i} \mathbb{1}_{\{t \in HCF\}} + \alpha_{2,i} \mathbb{1}_{\{t \in LCF\}} + \alpha_{3,i} \mathbb{1}_{\{t \in HDR\}} + \alpha_{4,i} \mathbb{1}_{\{t \in LDR\}} \\ & + \alpha_{5,i} \mathbb{1}_{\{t \in LCF \cap LDR\}} + \alpha_{6,i} \mathbb{1}_{\{t \in HCF \cap LDR\}} \\ & + \alpha_{7,i} \mathbb{1}_{\{t \in LCF \cap HDR\}} + \alpha_{8,i} \mathbb{1}_{\{t \in HCF \cap HDR\}} + \epsilon_{t,i} \end{aligned} \tag{15}$$

This model is estimated by running an OLS regression for each time of the day (i). The estimates of the average Cash Flow and Discount Rate dispersion are then calculated as:

$$\begin{aligned} \hat{\mathcal{D}}_i^{CF} &:= \hat{\alpha}_{0,i} + \hat{\alpha}_{1,i} + \hat{\alpha}_{4,i} + \hat{\alpha}_{5,i} \\ \hat{\mathcal{D}}_i^{DR} &:= \hat{\alpha}_{0,i} + \hat{\alpha}_{2,i} + \hat{\alpha}_{3,i} + \hat{\alpha}_{7,i} \end{aligned}$$

For comparison, I also introduce the baseline dispersion, defined as the average dispersion under both low cash flow and discount rate intensity days. This is calculated as:

$$\hat{\mathcal{D}}_i^{BL} := \hat{\alpha}_{0,i} + \hat{\alpha}_{2,i} + \hat{\alpha}_{4,i} + \hat{\alpha}_{5,i}$$

Figure 13 shows the plot for each of these curves as a function of i . The results indicate a close proximity between the DR dispersion and the baseline, which does not happen with the CF dispersion. Moreover, the later possesses a higher degree of intraday variation, which early hours showing a higher dispersion than the later hours of the day. This is not seen on the remaining curves, which possess a flattened pattern throughout the day.

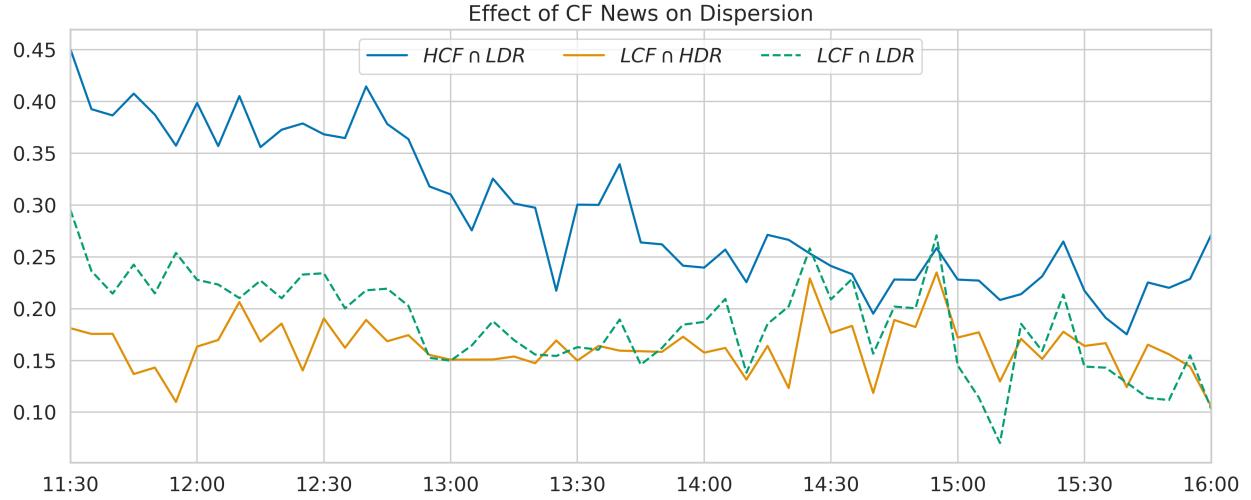


Figure 13: Estimated Average Dispersion by News Index

Next, I use the tests described in Section 3 to test the significance of our hypothesis. We perform two different tests. First, we test the significance of the CF and DR effects by assessing the difference between $\widehat{\mathcal{D}}_i^{CF}$ ($\widehat{\mathcal{D}}_i^{DR}$) and the baseline curve. The null hypothesis are given by:

$$\begin{aligned} \mathcal{H}_0^{CF} : \mathcal{D}_i^{CF} &= \mathcal{D}_i^{BL} \quad \forall i \\ \mathcal{H}_0^{DR} : \mathcal{D}_i^{DR} &= \mathcal{D}_i^{BL} \quad \forall i \end{aligned} \tag{16}$$

Table 2 shows the results of each of these tests.¹⁰ The evidence indicates a strong difference between the cash flow dispersion and the baseline, with p-values close to zero. This is in line with the literature that suggests that cash flow shocks tend to be impactful on the market and closely related to our idea that the heterogeneity of this type of shocks may lead to a higher dispersion of betas.

On the other hand, the discount rate effect does not seem to display any significant difference from the baseline, with p-values close to 1. Contrary to what was initially expected that the

¹⁰The critical values are estimated using Monte Carlo simulations with 1,000 replications.

systematic nature of these shocks would decrease dispersion and homogenize the risks on market, this type of shocks do not have any effect on dispersion.

Test Stat.	Critical Values				P-value
	90%	95%	99%		
CF	2.689	1.500	1.674	1.959	0.000
DR	0.596	1.425	1.589	1.833	0.980

Table 2: Test of Functional Variation in Dispersion

Finally, I test for the presence of any intraday pattern by comparing the differences within the curves at different times of the day. Specifically, I set the base case as the average dispersion at 11:30 AM (denoted as $i = 0$) and test the differences for each subsequent time point. I do this for both the CF and DR dispersion curves in Figure 13. The null hypothesis then are given by:

$$\begin{aligned}\mathcal{H}_0^{CF} : \mathcal{D}_0^{CF} &= \mathcal{D}_i^{CF} \quad \forall i > 0 \\ \mathcal{H}_0^{DR} : \mathcal{D}_0^{DR} &= \mathcal{D}_i^{DR} \quad \forall i > 0\end{aligned}\tag{17}$$

Figure 14 plots the test-statistics as a function of the time of the day i and curve. The dashed line shows the 95% critical value for comparison. As we can see, the results agree with the initial view of Figure 13. Although the difference between the curves is not significant on the first hours (a result consistent with the smoothness of the curves), it starts to become significant after 1:00 PM for the CF dispersion, remaining significant until the end of the trading day. The DR dispersion, on the other hand, does not seem to be significant at any point in time, even in the closing hours. This contributes to the idea that cash flow news are responsible for the intraday variation of dispersion seen on Andersen et al. (2021) as removing their influence results in flattened intraday curves.

5.1 News Groups

The previous section has shown that news shocks can be important to determine dispersion. In this section, I extend this study by looking at different types of news within the *cash flow* and *discount rate* categories. This is done by using RPA's news group classification.

For each article in the database, RavenPack applies a classification algorithm that assigns it to one of the 44 groups. Using these groups, I disentangle the CF and DR indices into their respective

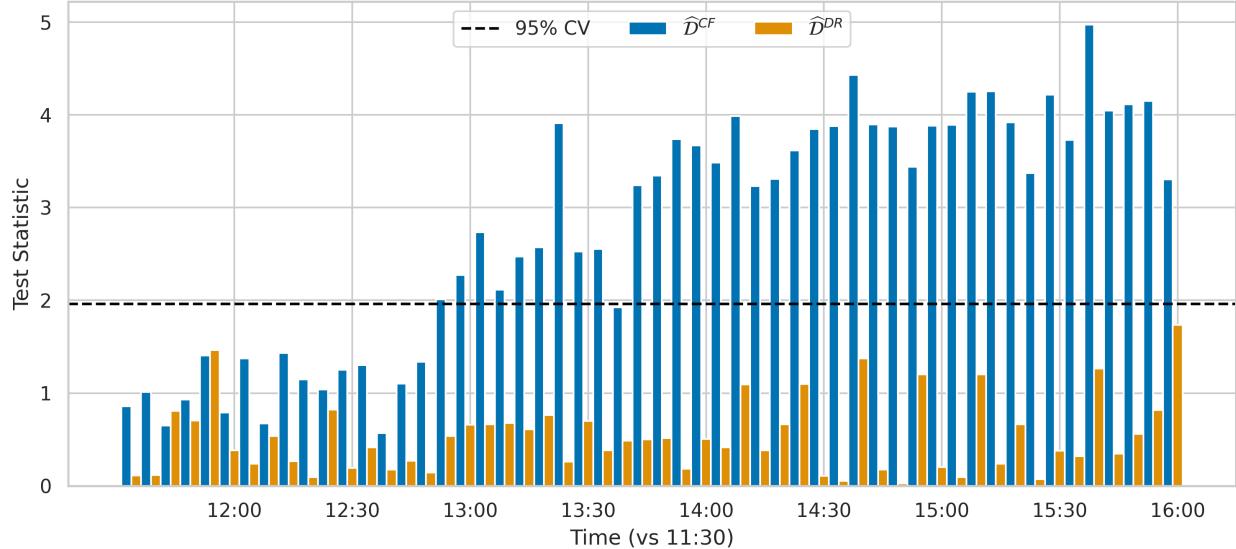


Figure 14: Test for Intraday Variation of Dispersion

news groups. This is done by summing the absolute sentiment for each news group. Finally, I select, for each news type, the 20 most important groups, measured by their total absolute sentiment throughout the sample period. The groups are given in Table 3

Table 3: News Groups for each Type

CF	DR
analyst-ratings	consumption
earnings	employment
revenues	production
price-targets	products-services
credit-ratings	balance-of-payments
dividends	housing
products-services	public-finance
acquisitions-mergers	credit-ratings
equity-actions	assets
insider-trading	domestic-product
labor-issues	interest-rates
investor-relations	inventory
technical-analysis	legal
assets	government
partnerships	regulatory
marketing	credit
order-imbalances	equity-actions
legal	partnerships
credit	labor-issues
stock-picks	commodity-prices

For each group, I then estimate the average dispersion on high (top decile) and low (bottom decile) intensities of the news. This reduction relative to the previous case is due to the high number of classes in this exercise. Using the same methodology as before would lead to a very low number of observations in each group, making the inference unreliable.

The model then estimates the average dispersion under high (top decile) and low (bottom decile) intensities of each news group. For each of these models we test the significance of the difference between the high intensity and the low intensity dispersion. The p-values are shown in Table 4 for each news group. The Appendix A.2.2 includes graphs for each of these groups.

Table 4: Test for Functional Variation in Dispersion by Group

CF		DR	
Group	p-value	Group	p-value
earnings	0.000	production	0.000
revenues	0.000	interest-rates	0.000
credit-ratings	0.000	regulatory	0.000
products-services	0.000	partnerships	0.000
acquisitions-mergers	0.000	credit	0.003
equity-actions	0.000	products-services	0.006
labor-issues	0.000	public-finance	0.029
technical-analysis	0.000	consumption	0.061
assets	0.000	credit-ratings	0.303
order-imbalances	0.000	government	0.419
legal	0.000	employment	0.593
credit	0.000	balance-of-payments	0.675
stock-picks	0.000	domestic-product	0.991
marketing	0.006	legal	0.995
investor-relations	0.011	equity-actions	0.995
price-targets	0.083	inventory	0.998
analyst-ratings	0.180	war-conflict	0.999
partnerships	0.483	housing	1.000
insider-trading	0.591	assets	1.000
dividends	0.666	commodity-prices	1.000

The results in this table show that, when we disentangle the different types of news we find interesting results. Specially for the discount rate news, we find that the groups *production* and *interest-rates* have a significant and negative effect on dispersion. This is more in line with what was initially theorized, as these types of news are more systematic and should have a homogenizing effect on the market. However, when combining all the news into a single index, this effect is not

seen as the mostly insignificant lower the overall effect of those groups.

6 Conclusion and Next Steps

This paper has shown the impact of cash flow and discount rate news on the dispersion of betas throughout the trading day. Overall, the results suggest a strong and positive influence of cash flow news on dispersion. On the other hand, discount rate news do not present strongly significant evidence of a positive or negative effect. However, when disaggregating by the topic of news, we find that some discount rate topics show a negative effect on dispersion. This suggests that the effect of discount rate news on dispersion is not uniform and can be driven by specific topics. Moreover, this paper shows strong evidence that cash flow news are the main driver of the intraday pattern of dispersion first explored by [Andersen et al. \(2021\)](#).

These results enrich the literature on the impact of news on the market. Previous literature has not focused on the distribution of betas, and this paper shows that these types of informational shocks do translate into changes in the distribution.

The work on this paper introduces rich measures on the amount of information received by the market through the Cash Flow and Discount Rate indices. These indices, as previously shown, are able to capture a larger amount of information than traditional measures and can be made in a higher frequency. Therefore, the contribution of this paper is not seen solely on its results, but also on the methodology and measures developed.

Extensions to this paper can be made in several directions. First, it could be interesting to disaggregate the universe of stocks and study how particular groups of stocks move differently with these effects. For example, cash flow shocks can be more impactful on more leveraged firms while discount rate news can behave differently depending on the company's sector.

This findings suggest interesting questions for further research. As the pattern seems to be systematically across the market, we can ask whether the initial dispersion opens space for active traders to participate on the market, gathering short-term alphas generated by the informational shock. As these investors start to agree on the new price, risk tends to concentrate around one and the market looks less volatile. Therefore, passive investors, which follow systematic trading strategies, would be able to enter the market to rebalance their portfolios. This implies an interesting trading dynamic which can be studied in future research.

A Appendix

A.1 Data Appendix

Table 5 shows the stocks that were selected for this exercise sorted by their tenure in the index (depicted in days) as well as their identifiers. Columns *START* and *ENDING* indicate the first and last date this stock has appeared on the index. *TENURE* shows how long (in days) did the stock appeared in the index. As explained in Section 2, I selected all the stocks that appeared in the S&P 500 Index from 2000-01-01 to 2022-12-30 for at least 30 days and that appear on both the TAQ and RPA databases. I match these datasets using the *PERMNO* identifier. For TAQ, I use the [TAQ-CRSP link](#) available on WRDS. For RavenPack Analytics, I use their own [RPA-CRSP link](#) to match these datasets using *RP_ENTITY_ID*.

Table 5: List of Selected Stocks

SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
CVX	D54E62	14541	12/31/1925	01/31/2024	35826
DTE	7AC86E	11674	12/31/1925	01/31/2024	35826
ED	97AAF6	11404	12/31/1925	01/31/2024	35826
EIX	E10D31	15720	12/31/1925	01/31/2024	35826
HON	FF6644	10145	12/31/1925	01/31/2024	35826
IP	8E0E32	21573	12/31/1925	01/31/2024	35826
MRO	902670	15069	12/31/1925	01/31/2024	35826
XOM	E70531	11850	12/31/1925	01/31/2024	35826
PCG	652E62	13688	12/31/1925	01/31/2024	34472
GT	A666C8	16432	12/31/1925	02/26/2019	34026
BEAM	A20989	10225	12/31/1925	04/30/2014	32263
FO	A20989	10225	12/31/1925	04/30/2014	32263
EK	96BFF4	11754	12/31/1925	12/17/2010	31033
GM	248F44	12079	12/31/1925	06/02/2009	30470
NAV	C673BF	12503	12/31/1925	12/19/2006	29574
EXC	B303A6	21776	06/07/1944	01/31/2024	29093
SO	147C38	18411	06/07/1944	01/31/2024	29093
S	DBFB0E	14322	12/31/1925	03/24/2005	28939
PEG	B560AF	23712	07/07/1948	01/31/2024	27602
XEL	1151F4	23931	07/06/1949	01/31/2024	27238
XEL	952E83	23931	07/06/1949	01/31/2024	27238
AEP	D9B1C9	24109	09/06/1951	01/31/2024	26446
AA	EC821B	24643	03/01/1957	01/31/2024	24443
ABT	520632	20482	03/01/1957	01/31/2024	24443
ARNC	EC821B	24643	03/01/1957	01/31/2024	24443
BA	55438C	19561	03/01/1957	01/31/2024	24443
BMY	94637C	19393	03/01/1957	01/31/2024	24443
CAT	767F86	18542	03/01/1957	01/31/2024	24443
CL	EB6965	18729	03/01/1957	01/31/2024	24443
COP	534E72	13928	03/01/1957	01/31/2024	24443

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Table 5: List of Selected Stocks

SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
COP	FE89E0	13928	03/01/1957	01/31/2024	24443
CPB	543900	25320	03/01/1957	01/31/2024	24443
CVS	69CE71	17005	03/01/1957	01/31/2024	24443
DE	431B74	19350	03/01/1957	01/31/2024	24443
ETN	C4073B	11762	03/01/1957	01/31/2024	24443
ETR	6E7060	24010	03/01/1957	01/31/2024	24443
F	A6213D	25785	03/01/1957	01/31/2024	24443
GD	DCD97F	12052	03/01/1957	01/31/2024	24443
GE	1921DD	12060	03/01/1957	01/31/2024	24443
GLW	F40EE2	22293	03/01/1957	01/31/2024	24443
HAL	2B49F4	23819	03/01/1957	01/31/2024	24443
HSY	9F03CF	16600	03/01/1957	01/31/2024	24443
HWM	EC821B	24643	03/01/1957	01/31/2024	24443
IBM	8D4486	12490	03/01/1957	01/31/2024	24443
KMB	3DE4D1	17750	03/01/1957	01/31/2024	24443
KO	EEA6B3	11308	03/01/1957	01/31/2024	24443
KR	95DC1F	16678	03/01/1957	01/31/2024	24443
MHFI	CFF97C	17478	03/01/1957	01/31/2024	24443
MHP	CFF97C	17478	03/01/1957	01/31/2024	24443
MMM	03B8CF	22592	03/01/1957	01/31/2024	24443
MO	2BA977	13901	03/01/1957	01/31/2024	24443
MOT	E49AA3	22779	03/01/1957	01/31/2024	24443
MRK	1EBF8D	22752	03/01/1957	01/31/2024	24443
MSI	E49AA3	22779	03/01/1957	01/31/2024	24443
MWV	188EDA	21186	03/01/1957	01/31/2024	24443
PEP	013528	13856	03/01/1957	01/31/2024	24443
PFE	267718	21936	03/01/1957	01/31/2024	24443
PG	2E61CC	18163	03/01/1957	01/31/2024	24443
PPG	39FB23	22509	03/01/1957	01/31/2024	24443
RTX	2667B6	17830	03/01/1957	01/31/2024	24443
SPGI	CFF97C	17478	03/01/1957	01/31/2024	24443
UTX	2667B6	17830	03/01/1957	01/31/2024	24443
WRK	9D6A24	21186	03/01/1957	01/31/2024	24443
WRK	FB9D27	21186	03/01/1957	01/31/2024	24443
PGL	E79383	13821	04/15/1940	02/21/2007	24419
FE	7B1E50	23026	07/10/1957	01/31/2024	24312
TXN	39BFF6	15579	03/25/1959	01/31/2024	23689
WHR	BDD12C	25419	04/01/1959	01/31/2024	23682
DOW	523A06	20626	04/20/1954	08/31/2017	23145
RTN	1981BF	24942	03/01/1957	04/03/2020	23045
K	9AF3DC	26825	04/26/1961	01/31/2024	22926
MAY	C7BB4B	13100	06/07/1944	08/29/2005	22364
DD	93F9E0	11703	03/01/1957	08/31/2017	22099
WY	FF4BA4	39917	12/05/1963	01/31/2024	21973
PBI	968966	24459	03/01/1957	02/28/2017	21915
SHW	408089	36468	05/14/1964	01/31/2024	21812
CMI	131443	41080	01/07/1965	01/31/2024	21574
CUM	131443	41080	01/07/1965	01/31/2024	21574
EMR	4030E2	22103	01/07/1965	01/31/2024	21574
AAL	13C3E0	21020	06/07/1944	03/13/2003	21464
OKE	09F623	25232	03/01/1957	01/31/2024	21324

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Table 5: List of Selected Stocks

SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
XRX	225CA2	27983	09/05/1963	03/19/2021	21016
JCP	A1A1AF	18403	03/01/1957	11/29/2013	20728
HNZ	C356AC	23077	03/01/1957	06/06/2013	20552
GR	C35C7D	12140	03/01/1957	07/30/2012	20241
CLX	719477	46578	01/16/1969	01/31/2024	20104
CEG	D9593D	24221	03/01/1957	03/13/2012	20102
GIS	9CA619	17144	02/13/1969	01/31/2024	20076
NEM	911AB8	21207	05/15/1969	01/31/2024	19985
ITT	726EEA	12570	03/01/1957	10/31/2011	19968
UIS	C99CC8	10890	04/20/1954	11/10/2008	19929
UNP	D8F347	48725	07/16/1969	01/31/2024	19923
MCD	954E30	43449	06/25/1970	01/31/2024	19579
LLY	F30508	50876	11/19/1970	01/31/2024	19432
SGP	5D7051	25013	03/01/1957	11/03/2009	19241
WYE	6746C5	15667	03/01/1957	10/15/2009	19222
FMC	188394	19166	02/20/1964	01/31/2024	19109
HPC	C887A8	18016	03/01/1957	11/13/2008	18886
WWY	A56654	15472	03/01/1957	10/06/2008	18848
BAX	1FAF22	27887	09/14/1972	01/31/2024	18767
BDX	873DB9	39642	09/14/1972	01/31/2024	18767
JNJ	A6828A	22111	05/31/1973	01/31/2024	18508
TXU	FA1798	24563	03/01/1957	10/09/2007	18485
GPC	C15DB3	46674	11/15/1973	01/31/2024	18340
PD	375319	17806	03/01/1957	03/19/2007	18281
HPQ	4AC91D	27828	10/17/1974	01/31/2024	18004
DCN	0C2A0D	11607	03/01/1957	03/02/2006	17899
WMB	E21871	38156	02/06/1975	01/31/2024	17892
T	17CAC1	10401	03/01/1957	11/18/2005	17795
UCL	33DF64	14891	03/01/1957	08/10/2005	17695
IFF	485445	40272	03/04/1976	01/31/2024	17500
AVP	E29770	40416	05/18/1967	03/20/2015	17474
CR	CFPUMY	20204	03/01/1957	12/17/2004	17459
CR	DF46C5	20204	03/01/1957	12/17/2004	17459
WIN	69C9D6	24803	03/01/1957	12/02/2004	17444
AXP	4C37C5	59176	07/01/1976	01/31/2024	17381
BAC	990AD0	59408	07/01/1976	01/31/2024	17381
DIS	6CGTFN	26403	07/01/1976	01/31/2024	17381
DIS	A18D3C	26403	07/01/1976	01/31/2024	17381
DUK	DB5CA5	27959	07/01/1976	01/31/2024	17381
FPL	2CB4C9	24205	07/01/1976	01/31/2024	17381
JPM	619882	47896	07/01/1976	01/31/2024	17381
NEE	2CB4C9	24205	07/01/1976	01/31/2024	17381
RKY	78F9ED	59248	07/01/1976	01/31/2024	17381
RKY	BAC6B4	59248	07/01/1976	01/31/2024	17381
SPC	A372AE	59459	07/01/1976	01/31/2024	17381
STA	E206B0	59459	07/01/1976	01/31/2024	17381
TRV	E206B0	59459	07/01/1976	01/31/2024	17381
WFC	E8846E	38703	07/01/1976	01/31/2024	17381
LNC	5C7601	49015	07/01/1976	09/15/2023	17243
INTC	17EDA5	59328	12/09/1976	01/31/2024	17220
TGT	F6DCE4	49154	12/09/1976	01/31/2024	17220

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Table 5: List of Selected Stocks

SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
MZ	621006	22680	04/20/1954	06/28/2000	16872
TXT	E0339F	23579	10/05/1978	01/31/2024	16555
MYG	EC8841	13119	12/14/1960	03/31/2006	16544
G	EDB633	16424	10/26/1960	09/30/2005	16411
VFC	D78CCD	43553	05/03/1979	01/31/2024	16345
WAG	FACF19	19502	10/11/1979	01/31/2024	16184
WBA	QN7TZC	19502	10/11/1979	01/31/2024	16184
MCO	3461CF	48506	12/27/1979	01/31/2024	16107
AIG	0BC29E	66800	02/14/1980	01/31/2024	16058
CCK	92B047	17726	03/01/1957	12/08/2000	15989
SUN	CEB009	14656	03/06/1969	10/04/2012	15919
PCAR	ACF77B	60506	10/02/1980	01/31/2024	15827
CSX	E26FC3	62148	11/06/1980	01/31/2024	15792
FDX	6844D2	60628	11/06/1980	01/31/2024	15792
ADP	66ECFD	44644	02/26/1981	01/31/2024	15680
GWW	6EB9DA	52695	05/14/1981	01/31/2024	15603
MAS	3F4497	34032	06/18/1981	01/31/2024	15568
MDP	92D757	42796	05/23/1968	01/03/2011	15566
BCR	7794D5	46877	06/12/1975	01/02/2018	15546
ADM	2B7A40	10516	07/30/1981	01/31/2024	15526
GP	8A9B90	23915	02/20/1964	12/19/2005	15279
CI	86A1B9	64186	04/08/1982	01/31/2024	15274
GAP	50FE96	26657	12/10/1958	08/29/2000	15239
NSC	2D643C	64311	06/03/1982	01/31/2024	15218
GCI	D6EAA3	47941	12/11/1975	06/01/2017	15149
TGNA	D6EAA3	47941	12/11/1975	06/01/2017	15149
WMT	713810	55976	08/19/1982	01/31/2024	15141
SNA	E94704	60206	09/16/1982	01/31/2024	15113
SWK	CE1002	43350	09/16/1982	01/31/2024	15113
BF	859D62	29946	10/14/1982	01/31/2024	15085
AAPL	D8442A	14593	11/18/1982	01/31/2024	15050
OXY	CA212F	34833	12/09/1982	01/31/2024	15029
TEK	BC30E7	40061	02/23/1967	11/15/2007	14876
D	977A1E	64936	05/20/1983	01/31/2024	14867
CAG	FA40E2	56274	09/01/1983	01/31/2024	14763
BBWI	45CF4C	64282	09/15/1983	01/31/2024	14749
LB	45CF4C	64282	09/15/1983	01/31/2024	14749
LTD	45CF4C	64282	09/15/1983	01/31/2024	14749
SBC	21085B	66093	12/01/1983	01/31/2024	14672
T	251988	66093	12/01/1983	01/31/2024	14672
VZ	8A8E41	65875	12/01/1983	01/31/2024	14672
BNI	455B08	50227	03/05/1970	02/12/2010	14590
LOW	76E80F	61399	03/01/1984	01/31/2024	14581
PHM	7D5FD6	54148	04/12/1984	01/31/2024	14539
AHC	D0909F	28484	05/17/1984	01/31/2024	14504
HES	D0909F	28484	05/17/1984	01/31/2024	14504
CB	D1B2E3	59192	07/01/1976	01/15/2016	14443
LMT	96F126	21178	07/19/1984	01/31/2024	14441
HAS	AA98ED	52978	09/13/1984	01/31/2024	14385
BALL	FEE4B0	57568	10/04/1984	01/31/2024	14364
BLL	FEE4B0	57568	10/04/1984	01/31/2024	14364

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Table 5: List of Selected Stocks

SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
APD	DA48E4	28222	04/11/1985	01/31/2024	14175
NUE	986AF6	34817	04/18/1985	01/31/2024	14168
PKI	C062D4	42200	05/09/1985	01/31/2024	14147
NOC	FC1B7B	24766	06/13/1985	01/31/2024	14112
CNP	58B46F	21792	07/25/1985	01/31/2024	14070
TJX	40B903	40539	09/26/1985	01/31/2024	14007
RSH	1E1C4E	15560	03/01/1973	06/30/2011	14001
DOV	636639	25953	10/24/1985	01/31/2024	13979
PH	6B5379	41355	11/07/1985	01/31/2024	13965
BCC	809557	42024	04/23/1970	06/20/2008	13939
OMX	809557	42024	04/23/1970	06/20/2008	13939
NC	053EFF	28118	04/25/1962	06/02/2000	13919
ITW	353DBB	56573	02/13/1986	01/31/2024	13867
DAL	5F2FF7	26112	02/01/1968	08/18/2005	13714
HLT	66E04A	23309	04/23/1970	10/24/2007	13699
TKR	66749D	14795	02/20/1964	08/06/2001	13683
MDT	E68733	60097	10/23/1986	01/31/2024	13615
MAT	F4E882	39538	03/11/1982	06/06/2019	13602
THC	43A74A	52337	02/08/1979	04/15/2016	13582
SYY	9D2790	52038	12/18/1986	01/31/2024	13559
BHI	940C3D	75034	04/09/1987	01/31/2024	13447
ATI	D1173F	43123	10/26/1978	07/01/2015	13398
MMC	9B5968	45751	08/06/1987	01/31/2024	13328
BMS	628CF6	43772	07/20/1978	12/04/2014	13287
AMD	69345C	61241	06/21/1984	01/31/2024	13193
AVY	662682	44601	12/24/1987	01/31/2024	13188
HD	ACDF88	66181	03/03/1988	01/31/2024	13118
PNC	61B81B	60442	04/14/1988	01/31/2024	13076
ACV	BEF4F3	42083	03/04/1971	11/16/2006	13042
C	58CA9A	70519	05/26/1988	01/31/2024	13034
GPS	817ED9	59010	08/21/1986	02/02/2022	12950
BC	07CA6A	10874	03/01/1973	06/20/2008	12896
NKE	D64C6D	57665	11/03/1988	01/31/2024	12873
ECL	9A602D	70578	01/12/1989	01/31/2024	12803
NSM	6DA1EE	51377	12/09/1976	09/23/2011	12707
GL	E90C84	62308	04/27/1989	01/31/2024	12698
TMK	E90C84	62308	04/27/1989	01/31/2024	12698
DXC	095294	40125	05/14/1981	11/30/2015	12619
ORCL	D6489C	10104	08/03/1989	01/31/2024	12600
R	AD9F1D	27633	12/30/1982	06/16/2017	12588
NWL	C3BCD5	60986	04/27/1989	09/15/2023	12560
BDK	A01163	20220	01/15/1976	03/12/2010	12476
ADSK	64E346	85631	12/21/1989	01/31/2024	12460
ABI	964A22	27713	10/17/1974	11/21/2008	12455
JWN	422CE3	57817	08/07/1986	06/19/2020	12371
HRB	56EFC7	49373	11/28/1986	09/18/2020	12349
BGG	7FB38A	17961	04/04/1968	04/02/2001	12052
BUD	46383B	59184	07/01/1976	11/18/2008	11829
CTX	606A93	53831	03/31/1977	08/18/2009	11829
AEE	789A7D	24985	09/20/1991	01/31/2024	11822
SAF	BB0814	59440	07/01/1976	09/22/2008	11772

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SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
SAFC	BB0814	59440	07/01/1976	09/22/2008	11772
AMGN	76F067	14008	01/02/1992	01/31/2024	11718
LPX	14A113	56223	10/17/1974	11/09/2006	11712
CEN	C8EBF3	38914	05/22/1969	03/30/2001	11636
STI	1D3EEA	68144	05/05/1988	12/06/2019	11538
CA	76DE40	25778	07/09/1987	11/05/2018	11443
IPG	E30B34	53065	10/30/1992	01/31/2024	11416
PCH	79340A	49744	04/23/1970	07/06/2001	11398
MEL	8E0633	59379	07/01/1976	06/29/2007	11321
HSH	CEF5B9	22840	09/10/1981	06/28/2012	11250
SLE	CEF5B9	22840	09/10/1981	06/28/2012	11250
KRI	FAE0D0	48960	12/11/1975	06/27/2006	11157
JCI	9803B7	42534	05/08/1986	09/02/2016	11076
COST	B8EF97	87055	10/22/1993	01/31/2024	11059
CSCO	12DE76	76076	12/31/1993	01/31/2024	10989
EMN	D4070C	80080	01/04/1994	01/31/2024	10985
KEY	24CB56	64995	03/02/1994	01/31/2024	10928
TNB	0C176E	38578	10/17/1974	08/02/2004	10883
JP	ECC863	48485	07/01/1976	03/31/2006	10866
MSFT	228D42	10107	06/07/1994	01/31/2024	10831
DJ	DA44AF	58990	05/04/1978	12/13/2007	10816
RDC	3FFA00	45495	01/10/1985	08/18/2014	10813
UNH	205AD5	92655	07/01/1994	01/31/2024	10807
LUV	E866D2	58683	07/13/1994	01/31/2024	10795
MU	49BBCB	53613	09/27/1994	01/31/2024	10719
VIA	3C7F5F	76226	09/30/1994	01/31/2024	10716
BSX	C97B2D	77605	02/24/1995	01/31/2024	10569
AMAT	A4BCDE	14702	03/16/1995	01/31/2024	10549
BK	EF5BED	49656	03/31/1995	01/31/2024	10534
L	968B00	26710	05/10/1995	01/31/2024	10494
LTR	968B00	26710	05/10/1995	01/31/2024	10494
DRI	9BBFA5	81655	05/30/1995	01/31/2024	10474
ALL	E1C16B	79323	07/13/1995	01/31/2024	10430
FCX	D4463B	81774	07/31/1995	01/31/2024	10412
DNY	0BE0AE	38682	07/19/1984	12/11/2012	10373
RRD	0BE0AE	38682	07/19/1984	12/11/2012	10373
MS	9196A2	69032	09/22/1995	01/31/2024	10359
MWD	9196A2	69032	09/22/1995	01/31/2024	10359
USB	6166D1	66157	10/23/1995	01/31/2024	10328
USB	694AF4	66157	10/23/1995	01/31/2024	10328
PPL	5A9A82	22517	11/27/1995	01/31/2024	10293
CMA	8CF6DD	25081	12/01/1995	01/31/2024	10289
HUM	00067A	48653	12/01/1995	01/31/2024	10289
HIG	766047	82775	12/20/1995	01/31/2024	10270
FITB	8377DB	34746	03/08/1996	01/31/2024	10191
AOC	C5EF8D	61735	04/23/1996	01/31/2024	10145
AON	C5EF8D	61735	04/23/1996	01/31/2024	10145
PLL	544390	35051	12/31/1987	08/28/2015	10103
UNM	AFF7B4	71175	03/11/1994	09/17/2021	10053
SVU	0E128A	44951	01/31/1985	04/30/2012	9952
ROK	416C55	84381	12/09/1996	01/31/2024	9915

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SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
STJ	385DD5	68591	12/01/1989	01/04/2017	9897
AZO	ECF709	76605	01/02/1997	01/31/2024	9891
TMO	2FEAEA	62092	01/02/1997	01/31/2024	9891
TMO	8665BA	62092	01/02/1997	01/31/2024	9891
ADBE	C9881C	75510	05/06/1997	01/31/2024	9767
MER	75EE05	52919	04/08/1982	12/31/2008	9765
CAH	3587B4	21371	05/27/1997	01/31/2024	9746
SCH	D33D8C	75186	06/02/1997	01/31/2024	9740
SCHW	D33D8C	75186	06/02/1997	01/31/2024	9740
EFX	AD23DE	52476	06/19/1997	01/31/2024	9723
WEN	6141CA	63060	03/04/1982	09/29/2008	9707
ROH	1F1361	23990	09/16/1982	04/01/2009	9695
APA	16B183	39490	07/28/1997	01/31/2024	9684
APA	5ABEC0	39490	07/28/1997	01/31/2024	9684
PGR	8FF2EF	64390	08/04/1997	01/31/2024	9677
HBAN	C9E107	42906	08/06/1997	01/31/2024	9675
STT	5BC2F4	72726	08/15/1997	01/31/2024	9666
KLAC	507AE7	46886	09/15/1997	01/31/2024	9635
PX	285175	77768	07/06/1992	10/30/2018	9613
YUM	B4C673	85348	10/07/1997	01/31/2024	9613
BBT	1A3E1B	71563	12/04/1997	01/31/2024	9555
TFC	1A3E1B	71563	12/04/1997	01/31/2024	9555
CINF	51E682	23473	12/18/1997	01/31/2024	9541
OMC	C8257F	30681	12/24/1997	01/31/2024	9535
NYT	875F41	47466	11/23/1984	12/17/2010	9521
NTRS	3CCC90	58246	01/30/1998	01/31/2024	9498
BEN	5B6C11	37584	04/29/1998	01/31/2024	9409
FLE	34F7A6	46295	05/09/1974	01/28/2000	9396
SEE	D8DA3D	85926	04/01/1998	12/15/2023	9390
MAR	385DD4	85913	05/21/1998	01/31/2024	9387
SRE	B642E8	86136	06/30/1998	01/31/2024	9347
COF	055018	81055	07/01/1998	01/31/2024	9346
WM	616E3B	11955	07/17/1998	01/31/2024	9330
WMI	616E3B	11955	07/17/1998	01/31/2024	9330
RF	73C521	35044	08/28/1998	01/31/2024	9288
PAYX	6F6559	61621	10/01/1998	01/31/2024	9254
AES	9C8BC3	76712	10/02/1998	01/31/2024	9253
DHR	E124EB	49680	11/18/1998	01/31/2024	9206
MCK	4A5C8D	81061	01/13/1999	01/31/2024	9150
SFA	07D986	45671	02/26/1981	02/24/2006	9130
CMS	7BAAE7	23229	05/03/1999	01/31/2024	9040
AFL	AD3C93	57904	05/28/1999	01/31/2024	9015
RAD	CAC8D0	46922	12/11/1975	07/26/2000	8995
NTAP	934CC3	82598	06/25/1999	01/31/2024	8987
BBY	5E7E82	85914	06/30/1999	01/31/2024	8982
VMC	57B174	15202	07/01/1999	01/31/2024	8981
QCOM	CFF15D	77178	07/22/1999	01/31/2024	8960
FD	C5C137	77462	12/01/1995	04/03/2020	8891
M	C5C137	77462	12/01/1995	04/03/2020	8891
PNW	342218	27991	10/04/1999	01/31/2024	8886
PNW	451FBE	27991	10/04/1999	01/31/2024	8886

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SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
ADI	E68C3D	60871	10/12/1999	01/31/2024	8878
TROW	2F94A5	10138	10/13/1999	01/31/2024	8877
FNP	055551	49905	10/25/1984	12/01/2008	8804
KATE	055551	49905	10/25/1984	12/01/2008	8804
LIZ	055551	49905	10/25/1984	12/01/2008	8804
CTL	E08AF3	60599	03/25/1999	03/17/2023	8759
LUMN	E08AF3	60599	03/25/1999	03/17/2023	8759
FON	047E26	39087	07/27/1989	07/08/2013	8748
S	047E26	39087	07/27/1989	07/08/2013	8748
MEE	3BC4D8	26382	01/17/1980	06/01/2011	8719
A	ED79D9	87432	06/05/2000	01/31/2024	8641
SBUX	3CBA2A	77702	06/08/2000	01/31/2024	8638
DVN	14BA06	87137	08/30/2000	01/31/2024	8555
EOG	A43906	75825	11/02/2000	01/31/2024	8491
NI	6ED519	38762	11/02/2000	01/31/2024	8491
RHI	A4D173	52230	12/05/2000	01/31/2024	8458
X	4E2D94	76644	05/07/1991	07/01/2014	8457
INTU	F11638	78975	12/11/2000	01/31/2024	8452
MET	810E30	87842	12/11/2000	01/31/2024	8452
SYK	C81E00	73139	12/12/2000	01/31/2024	8451
AGN	AA6595	75646	02/10/1992	03/20/2015	8440
BLS	B7A5D4	65883	12/01/1983	01/03/2007	8435
CTAS	BFAEB4	23660	03/01/2001	01/31/2024	8372
EC	29C246	62834	07/07/1983	06/05/2006	8370
PGN	4D06FE	23114	08/24/1989	06/29/2012	8346
CTXS	071860	82686	12/01/1999	09/30/2022	8340
FISV	190B91	10696	04/02/2001	01/31/2024	8340
ZION	4D371E	84129	06/25/2001	01/31/2024	8256
ZBH	56277A	89070	08/07/2001	01/31/2024	8213
ZMH	56277A	89070	08/07/2001	01/31/2024	8213
ABC	41F07D	81540	08/30/2001	01/31/2024	8190
ABC	7D85A9	81540	08/30/2001	01/31/2024	8190
GAS	E1F51F	48274	08/03/1989	12/12/2011	8167
XLNX	373E85	76201	11/08/1999	02/14/2022	8135
NVDA	E09E2B	86580	11/30/2001	01/31/2024	8098
LEG	9D4EC7	60943	10/18/1999	12/17/2021	8097
KSS	0F0440	77606	08/14/1998	09/18/2020	8072
WAT	1F9D90	82651	01/02/2002	01/31/2024	8065
DDS	4ECD1A	49429	10/02/1986	10/21/2008	8056
APC	3279AD	70332	07/28/1997	08/08/2019	8047
MIL	1248BA	54181	07/14/1988	07/14/2010	8036
TRB	C5D8A0	65787	01/30/1986	12/20/2007	7995
TOY	95B8EC	61065	09/08/1983	07/21/2005	7988
ANDW	18B570	14323	11/23/1984	09/29/2006	7981
KMG	A6E670	25769	10/04/1984	08/10/2006	7981
UST	7DA947	15077	04/09/1987	01/05/2009	7943
EA	DB06B0	75828	07/22/2002	01/31/2024	7864
EBAY	972356	86356	07/22/2002	01/31/2024	7864
ERTS	DB06B0	75828	07/22/2002	01/31/2024	7864
GS	50070E	86868	07/22/2002	01/31/2024	7864
PFG	59B229	89195	07/22/2002	01/31/2024	7864

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SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
PRU	FEC475	89258	07/22/2002	01/31/2024	7864
UPS	FAE021	87447	07/22/2002	01/31/2024	7864
ABS	DF8643	50032	11/23/1984	06/01/2006	7861
ANTM	7AB859	89179	07/25/2002	01/31/2024	7861
ATH	7AB859	89179	07/25/2002	01/31/2024	7861
ELV	7AB859	89179	07/25/2002	01/31/2024	7861
WLP	7AB859	89179	07/25/2002	01/31/2024	7861
BOL	B0A073	26518	05/08/1986	10/26/2007	7842
SIAL	84162B	70536	09/21/1994	11/18/2015	7729
DGX	5F9CE3	84373	12/12/2002	01/31/2024	7721
ACT	9C512F	78916	04/12/1999	05/11/2020	7701
WPI	9C512F	78916	04/12/1999	05/11/2020	7701
TIN	C8110B	66114	12/18/1986	12/28/2007	7681
MKC	9D56F2	52090	03/21/2003	01/31/2024	7622
GEN	89F693	75607	03/31/2003	01/31/2024	7612
NLOK	89F693	75607	03/31/2003	01/31/2024	7612
SYMC	89F693	75607	03/31/2003	01/31/2024	7612
KBH	72FCA3	70092	03/08/1989	12/18/2009	7591
TIF	FD5C77	75100	06/21/2000	01/06/2021	7505
EMC	BA5900	10147	03/28/1996	09/07/2016	7469
HDI	DC486E	70033	01/31/2000	06/19/2020	7446
HOG	DC486E	70033	01/31/2000	06/19/2020	7446
BIIB	CEDFD5	76841	11/13/2003	01/31/2024	7385
IDPH	F8D010	76841	11/13/2003	01/31/2024	7385
FNM	450647	51043	08/11/1988	09/10/2008	7336
MTB	D1AE3B	35554	02/27/2004	01/31/2024	7279
WB	76451B	36469	02/09/1989	12/31/2008	7266
VLO	641F17	85269	04/29/2004	01/31/2024	7217
GILD	F6E248	77274	07/01/2004	01/31/2024	7154
NOVL	D14977	90609	11/01/1991	04/27/2011	7118
AOL	2D419D	77418	01/04/1999	06/19/2018	7107
TWX	6203E4	77418	01/04/1999	06/19/2018	7107
COH	BB0787	88661	09/01/2004	01/31/2024	7092
TPR	BB0787	88661	09/01/2004	01/31/2024	7092
ASH	E6A53A	24272	08/03/1989	11/13/2008	7043
LH	9F6B1A	12062	11/01/2004	01/31/2024	7031
RBK	FF00C9	91380	01/08/1987	01/31/2006	6964
SPLS	A3D6F0	75489	10/07/1998	09/15/2017	6919
CC	C119B4	47175	05/11/1989	03/28/2008	6897
DLX	F88A04	61743	04/24/1986	12/17/2004	6813
DHI	06EF42	77661	07/05/2005	01/31/2024	6785
STZ	1D1B07	69796	07/05/2005	01/31/2024	6785
TSN	AD1ACF	77730	08/11/2005	01/31/2024	6748
FLR	D6853F	88853	12/22/2000	06/03/2019	6738
LSI	FA7CCE	48267	12/13/1995	05/07/2014	6721
AMP	9A02C4	90880	10/03/2005	01/31/2024	6695
LEN	91C82E	52708	10/04/2005	01/31/2024	6694
GDW	C8A0B4	53479	06/09/1988	09/29/2006	6687
AMZN	0157B1	84788	11/21/2005	01/31/2024	6646
EL	14ED2B	82642	01/05/2006	01/31/2024	6601
VRSN	A5B913	85753	02/01/2006	01/31/2024	6574

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SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
HET	ACBAA1	76090	02/08/1990	01/28/2008	6564
AET	B8C294	88845	12/14/2000	11/30/2018	6561
GOOG	4A6F00	90319	04/03/2006	01/31/2024	6513
BBBY	9B71A7	77659	10/01/1999	07/25/2017	6508
JNPR	EC99D0	86979	06/02/2006	01/31/2024	6453
CCE	E61E5B	70500	10/08/1998	05/27/2016	6442
YHOO	D91D4E	83435	12/08/1999	06/16/2017	6401
CME	5DD486	89626	08/11/2006	01/31/2024	6383
TER	93F143	51369	11/15/1999	01/31/2024	6378
JAVA	7ABC23	10078	08/20/1992	01/28/2010	6371
SUNW	7ABC23	10078	08/20/1992	01/28/2010	6371
COL	8B4C82	89014	07/02/2001	11/30/2018	6361
CBG	51D876	90199	11/10/2006	01/31/2024	6292
CBRE	51D876	90199	11/10/2006	01/31/2024	6292
CEY	7B0BA6	89003	11/10/2006	01/31/2024	6292
FIS	7B0BA6	89003	11/10/2006	01/31/2024	6292
CTSH	07EC43	86158	11/17/2006	01/31/2024	6285
DELL	33AD83	11081	09/06/1996	10/28/2013	6262
RL	D69D42	85072	02/02/2007	01/31/2024	6208
LLTC	1256D8	10299	04/03/2000	03/10/2017	6186
CHRW	C659EB	85459	03/02/2007	01/31/2024	6180
BMET	A40DEC	18092	08/23/1990	07/11/2007	6167
KFT	7A10FF	89006	04/02/2007	01/31/2024	6149
MDLZ	7A10FF	89006	04/02/2007	01/31/2024	6149
AIZ	DD682D	90038	04/10/2007	01/31/2024	6141
FRE	CD4203	75789	01/02/1992	09/10/2008	6097
DFS	A8CBDA	92121	07/02/2007	01/31/2024	6058
MYL	508CFD	69550	04/23/2004	11/16/2020	6052
AKAM	BB5271	87299	07/12/2007	01/31/2024	6048
ET	28DEFA	83862	04/01/2004	10/06/2020	6033
ETFC	28DEFA	83862	04/01/2004	10/06/2020	6033
NOI	5D02B7	84032	03/14/2005	09/17/2021	6032
NOV	5D02B7	84032	03/14/2005	09/17/2021	6032
TLAB	FC4031	75257	07/03/1995	12/20/2011	6015
WOR	05AF14	83601	07/14/1988	12/17/2004	6001
MCHP	CDFCC9	78987	09/07/2007	01/31/2024	5991
ICE	9F71E5	90993	09/26/2007	01/31/2024	5972
EXPE	39692D	90808	10/02/2007	01/31/2024	5966
EXPD	F5CSAB	87717	10/10/2007	01/31/2024	5958
J	15ABD0	52329	10/26/2007	01/31/2024	5942
JEC	15ABD0	52329	10/26/2007	01/31/2024	5942
SWY	0B4D07	76149	11/13/1998	01/26/2015	5919
AMT	A80FE0	86111	11/19/2007	01/31/2024	5918
ONE	38CC17	65138	04/28/1988	06/30/2004	5908
CTB	D57D99	27430	05/25/1990	07/17/2006	5898
CZN	E7CF49	23887	02/27/2001	03/17/2017	5863
FTR	E7CF49	23887	02/27/2001	03/17/2017	5863
RML	15A8C1	47490	11/23/1984	12/11/2000	5863
PM	CA1620	92602	03/31/2008	01/31/2024	5785
SLM	9CE4C7	66325	07/01/1998	04/30/2014	5783
MON	912DC9	88668	08/14/2002	06/06/2018	5776

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SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
ALTR	BFB833	75577	04/18/2000	12/28/2015	5733
ISRG	18EC17	88352	06/02/2008	01/31/2024	5722
COG	388E00	76082	06/23/2008	01/31/2024	5701
CTRA	388E00	76082	06/23/2008	01/31/2024	5701
LDG	B82C93	53612	11/21/1985	06/29/2001	5700
BRCM	A3902D	85963	07/03/2000	01/29/2016	5689
MA	55C9B5	91233	07/18/2008	01/31/2024	5676
DVA	EFD406	82307	07/31/2008	01/31/2024	5663
CF	61E975	90829	08/27/2008	01/31/2024	5636
FBF	E3A2E4	47159	11/10/1988	03/31/2004	5621
CRM	BB127B	90215	09/15/2008	01/31/2024	5617
FAST	92D3A0	11618	09/15/2008	01/31/2024	5617
HRS	EE6F1C	25582	09/22/2008	01/31/2024	5610
LHX	EE6F1C	25582	09/22/2008	01/31/2024	5610
PXD	2920D5	75241	09/24/2008	01/31/2024	5608
APH	BB07E4	84769	09/30/2008	01/31/2024	5602
NDAQ	25102A	90601	10/22/2008	01/31/2024	5580
WEC	343996	23536	10/31/2008	01/31/2024	5571
ESRX	5771D8	77668	09/26/2003	12/21/2018	5566
SJM	2F98A5	42585	11/06/2008	01/31/2024	5565
WYNN	9E91C6	89533	11/14/2008	01/31/2024	5557
XRAY	2BF36E	11600	11/14/2008	01/31/2024	5557
WU	A16DEA	91461	10/02/2006	12/17/2021	5556
RSG	D96202	86228	12/05/2008	01/31/2024	5536
BIG	1FCC00	67467	01/20/1998	02/13/2013	5504
BLI	1FCC00	67467	01/20/1998	02/13/2013	5504
IRM	6284B5	83143	01/06/2009	01/31/2024	5504
BMC	BC6055	11976	10/01/1998	09/10/2013	5459
HRL	C4A432	32870	03/04/2009	01/31/2024	5447
RAI	3B23F5	86946	09/04/2002	07/25/2017	5439
RJR	AD118E	86946	09/04/2002	07/25/2017	5439
ES	2BAE5F	44206	03/17/2009	01/31/2024	5434
NU	2BAE5F	44206	03/17/2009	01/31/2024	5434
ORLY	6E1E61	79103	03/27/2009	01/31/2024	5424
TE	0665EF	37161	10/10/2001	06/30/2016	5378
PWR	253B2F	85792	07/01/2009	01/31/2024	5328
WDC	CE96E7	66384	07/01/2009	01/31/2024	5328
LLL	E97B04	86021	12/01/2004	06/28/2019	5323
AN	013FA5	76282	02/24/2003	08/07/2017	5279
AN	88350F	76282	02/24/2003	08/07/2017	5279
NCC	7E9F0A	56232	09/27/1994	12/31/2008	5210
NWS	A13375	90441	12/20/2004	03/19/2019	5203
BKNG	034B61	86783	11/06/2009	01/31/2024	5200
PCLN	034B61	86783	11/06/2009	01/31/2024	5200
VAR	4E7C1F	27043	02/12/2007	04/19/2021	5181
ROST	8C6C1B	91556	12/21/2009	01/31/2024	5155
V	93D207	92611	12/21/2009	01/31/2024	5155
ROP	5E6959	77338	12/23/2009	01/31/2024	5153
MOLX	539A78	54827	12/01/1999	12/09/2013	5123
NRG	FD39EB	90071	01/29/2010	01/31/2024	5116
BRK	168A5D	83443	02/16/2010	01/31/2024	5098

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SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
FDO	06E74C	53866	08/06/2001	07/08/2015	5085
VIA	266DD5	91063	01/03/2006	12/04/2019	5084
JBL	26CC63	79094	01/30/2001	01/31/2024	5072
KRB	F711E9	76557	04/23/1992	12/30/2005	5000
FRX	3660F1	45241	11/22/2000	06/30/2014	4969
GLK	C9E636	32379	11/25/1991	07/01/2005	4968
KMX	AA7FE0	89508	06/28/2010	01/31/2024	4966
JDSU	E592F0	79879	07/27/2000	12/20/2013	4895
VIAV	E592F0	79879	07/27/2000	12/20/2013	4895
PBCT	449A26	12073	11/13/2008	04/01/2022	4888
RX	F13C0C	84020	11/01/1996	02/26/2010	4866
SCI	51F541	51625	12/18/1986	03/15/2000	4837
SRV	51F541	51625	12/18/1986	03/15/2000	4837
HCA	DXNKHT	76171	09/01/1993	11/17/2006	4826
LXK	58E293	82643	08/13/1999	09/28/2012	4796
FFIV	41B0E2	86964	12/20/2010	01/31/2024	4791
NFLX	ECD263	89393	12/20/2010	01/31/2024	4791
MBI	1CB9D3	75175	12/03/1996	12/18/2009	4764
CELG	70E789	11552	11/06/2006	11/20/2019	4763
NBL	704DAE	61815	10/08/2007	10/09/2020	4751
FDC	460774	77546	09/27/1994	09/24/2007	4746
CPWR	7E2BC2	78139	01/04/1999	12/30/2011	4744
AT	07964F	41443	12/21/1994	11/16/2007	4714
EW	6137BF	87657	04/01/2011	01/31/2024	4689
BLK	D5AF19	87267	04/04/2011	01/31/2024	4686
IGT	2KQ7BO	45277	09/04/2001	06/20/2014	4673
CMG	A63820	91068	04/28/2011	01/31/2024	4662
MPC	2D2D43	12872	07/01/2011	01/31/2024	4598
EP	36841E	77481	10/26/1999	05/24/2012	4595
FLS	4017AD	30940	10/02/2008	03/19/2021	4552
PDCO	4E4E75	78034	10/11/2005	03/16/2018	4540
IKN	2EEABC	48514	02/11/1988	06/28/2000	4522
FLIR	C1B0D2	79265	01/02/2009	05/13/2021	4515
BR	89CBC2	75333	11/23/1993	03/31/2006	4512
MOS	9C5BA5	90386	09/26/2011	01/31/2024	4511
MTG	E28F22	76804	07/19/1996	10/30/2008	4487
XYL	F46EC9	13035	11/01/2011	01/31/2024	4475
BWA	1791E7	79545	12/19/2011	01/31/2024	4427
DLTR	143C52	81481	12/19/2011	01/31/2024	4427
CERN	9743E5	10909	04/30/2010	06/07/2022	4422
JEF	DA199F	20415	08/27/2007	09/25/2019	4413
LUK	DA199F	20415	08/27/2007	09/25/2019	4413
CHK	66CB62	78877	03/03/2006	03/16/2018	4397
NVLS	7ABE86	12067	06/19/2000	06/04/2012	4369
MUR	949625	28345	08/15/2005	07/25/2017	4363
CCI	275300	86339	03/14/2012	01/31/2024	4341
CCI	924FD4	86339	03/14/2012	01/31/2024	4341
TNL	0F90E1	91392	08/01/2006	05/30/2018	4321
WYN	0F90E1	91392	08/01/2006	05/30/2018	4321
WYND	0F90E1	91392	08/01/2006	05/30/2018	4321
PSX	3FACA7	13356	05/01/2012	01/31/2024	4293

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SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
TSS	D7778A	76639	01/02/2008	09/20/2019	4280
LRCX	0B57D7	48486	06/05/2012	01/31/2024	4258
WFM	319E7D	77281	01/03/2006	08/28/2017	4256
WFMI	319E7D	77281	01/03/2006	08/28/2017	4256
HANS	D09938	88031	06/29/2012	01/31/2024	4234
MNST	D09938	88031	06/29/2012	01/31/2024	4234
ODP	B66928	75573	06/24/1999	12/17/2010	4195
CIN	BD1A8A	22947	10/25/1994	03/31/2006	4176
JNS	1458C5	88313	07/13/2000	11/22/2011	4150
HSP	A4E5E6	90110	05/03/2004	09/02/2015	4140
OI	A62FD6	77157	08/01/1997	12/01/2016	4117
CAR	7F3A5F	25487	05/01/1995	07/31/2006	4110
CD	7F3A5F	25487	05/01/1995	07/31/2006	4110
COOP	35557B	81593	07/02/1997	09/29/2008	4108
WM	3FE7F8	81593	07/02/1997	09/29/2008	4108
WMIH	3FE7F8	81593	07/02/1997	09/29/2008	4108
EQT	366A08	24328	12/19/2008	01/31/2024	4102
DG	DC2B00	93096	12/03/2012	01/31/2024	4077
FHN	CD06A2	36397	05/06/2002	06/21/2013	4065
FTN	CD06A2	36397	05/06/2002	06/21/2013	4065
APOL	F2C233	81138	05/15/2002	06/28/2013	4063
HAR	3CA28D	75224	02/01/2006	03/15/2017	4061
ABBV	665D7D	13721	01/02/2013	01/31/2024	4047
CFC	6B7D53	64565	06/18/1997	06/30/2008	4031
PTV	A5375D	87292	11/05/1999	11/16/2010	4030
ANDV	75560C	37284	09/27/2007	09/28/2018	4020
TSO	75560C	37284	09/27/2007	09/28/2018	4020
CCU	AC65E6	24046	09/02/1997	07/30/2008	3985
REGN	589803	76614	05/01/2013	01/31/2024	3928
Q	D76A42	85032	07/06/2000	03/31/2011	3921
LEH	A78640	80599	01/12/1998	09/16/2008	3901
GM	1BC12C	12369	06/07/2013	01/31/2024	3891
LM	BE4F2F	65330	04/24/2006	12/01/2016	3875
ZTS	C03C8B	13788	06/24/2013	01/31/2024	3874
NWSA	DD1BA1	13963	07/01/2013	01/31/2024	3867
MNST	D065AE	84342	06/04/2001	12/16/2011	3848
MWW	D065AE	84342	06/04/2001	12/16/2011	3848
RRC	1782D5	50017	12/21/2007	06/15/2018	3830
HOT	0F7B72	91207	04/10/2006	09/22/2016	3819
DAL	5F2FF7	91926	09/11/2013	01/31/2024	3795
AME	35F4B5	85257	09/23/2013	01/31/2024	3783
VRTX	57CAAB	76744	09/23/2013	01/31/2024	3783
HP	1DE526	32707	03/01/2010	05/21/2020	3735
AYE	B25172	10137	12/11/2000	02/25/2011	3729
KG	25BFA9	86176	10/03/2000	12/17/2010	3728
LU	877CD0	83332	10/01/1996	11/30/2006	3713
SE	1ED465	91650	01/03/2007	02/27/2017	3709
MXIM	22C58E	11896	05/10/2000	08/27/2021	3695
FB	12E454	13407	12/23/2013	01/31/2024	3692
MHK	69E8E1	77496	12/23/2013	01/31/2024	3692
QLGC	72F37A	80266	12/12/2000	01/14/2011	3686

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SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
SNV	FE7A63	20053	11/28/1997	12/31/2007	3686
SNDK	E5AAB0	82618	04/20/2006	05/12/2016	3676
EDS	66BC50	83596	08/11/1998	08/26/2008	3669
SRCL	C9A96E	83906	11/19/2008	11/30/2018	3664
TSCO	FC1F9D	80286	01/24/2014	01/31/2024	3660
SCG	8D17E0	23085	01/02/2009	12/31/2018	3651
GNW	EB36DE	90162	12/02/2005	11/17/2015	3638
RHAT	B8C039	87184	07/27/2009	07/12/2019	3638
RHT	B8C039	87184	07/27/2009	07/12/2019	3638
BSC	A94325	68304	07/01/1998	05/30/2008	3622
GOOG	4A6F00	14542	04/03/2014	01/31/2024	3591
KSU	F82D37	12650	04/05/1999	12/13/2021	3591
PRGO	0A9D0A	77182	12/19/2011	09/17/2021	3561
PTC	D437C3	75912	04/01/1997	12/29/2006	3560
AVGO	09DE1F	93002	05/08/2014	01/31/2024	3556
DPS	14C7B2	92618	10/07/2008	06/29/2018	3553
FHI	73C9E2	86102	04/16/2003	12/31/2012	3548
FII	73C9E2	86102	04/16/2003	12/31/2012	3548
TDC	793C11	92293	10/01/2007	06/16/2017	3547
CNX	EC70EC	86799	06/28/2006	03/03/2016	3537
SNI	D235F0	92709	07/01/2008	03/06/2018	3536
PBY	00BBE1	35238	08/14/1990	03/31/2000	3518
PVH	414FFF	13936	02/14/2013	09/16/2022	3502
MLM	D6534D	80204	07/02/2014	01/31/2024	3501
CVG	914819	86305	06/13/2000	12/18/2009	3476
MI	E6C221	51706	02/11/2002	07/05/2011	3432
UHS	7448A3	79637	09/22/2014	01/31/2024	3419
URI	32CB22	85663	09/22/2014	01/31/2024	3419
AW	C868BF	76887	08/02/1999	12/04/2008	3413
GDT	260DFC	81126	12/19/1996	04/21/2006	3411
GENZ	249208	10324	12/14/2001	04/01/2011	3396
DYN	DE8B35	90352	10/03/2000	12/18/2009	3364
ALXN	27A356	83111	05/25/2012	07/20/2021	3344
HCR	FCA9C2	77063	09/28/1998	11/08/2007	3329
HCA	34B97A	12622	01/27/2015	01/31/2024	3292
DG	DC2B00	30382	07/16/1998	07/06/2007	3278
SWKS	EB5E78	45911	03/12/2015	01/31/2024	3248
HSIC	A7102F	82581	03/18/2015	01/31/2024	3242
AMR	13C3E0	21020	03/23/2015	01/31/2024	3237
EQIX	315EB0	89617	03/23/2015	01/31/2024	3237
SWN	73529F	63765	06/06/2008	04/03/2017	3224
PBG	20690F	86756	05/14/2001	02/26/2010	3211
SLR	1421F8	75857	12/31/1998	10/01/2007	3197
WIN	8D4B8F	91391	07/18/2006	04/06/2015	3185
HCBK	4410E7	87070	02/15/2007	11/02/2015	3183
PCP	47F938	63830	06/01/2007	01/29/2016	3165
DTV	6C4313	89954	12/04/2006	07/28/2015	3159
HS	6C4313	89954	12/04/2006	07/28/2015	3159
QRVO	7C62A3	85035	06/12/2015	01/31/2024	3156
RFMD	F4160F	85035	06/12/2015	01/31/2024	3156
MHS	E60E69	89813	08/20/2003	04/03/2012	3150

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SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
JBHT	72DF04	42877	07/01/2015	01/31/2024	3137
KHC	C356AC	15408	07/06/2015	01/31/2024	3132
FSLR	061366	91611	10/16/2009	01/31/2024	3119
PYPL	03CF95	15488	07/20/2015	01/31/2024	3118
UAL	6E705B	91103	09/03/2015	01/31/2024	3073
UAUA	6E705B	91103	09/03/2015	01/31/2024	3073
POM	112C41	23501	11/09/2007	03/29/2016	3064
POM	4226A5	23501	11/09/2007	03/29/2016	3064
NWS	DD1BA1	13964	09/21/2015	01/31/2024	3055
GME	D42DBA	89301	12/14/2007	04/22/2016	3053
TEG	AF4207	25099	02/22/2007	06/30/2015	3051
WPS	AF4207	25099	02/22/2007	06/30/2015	3051
DNB	E4D24D	88590	12/02/2008	04/04/2017	3046
VRSK	2E0496	93089	10/08/2015	01/31/2024	3038
PVN	C85220	85073	06/11/1997	09/30/2005	3034
CIEN	0E431C	84519	08/30/2001	12/18/2009	3033
GTW	1C3967	79973	04/27/1998	07/31/2006	3018
HPE	DBB28E	15707	11/02/2015	01/31/2024	3013
SYF	3D9999	14776	11/18/2015	01/31/2024	2997
ILMN	E6D89E	88446	11/19/2015	01/31/2024	2996
CAM	6DE243	81857	01/29/2008	04/01/2016	2986
NFX	9C1A1F	79915	12/20/2010	02/14/2019	2979
ATVI	048590	79678	08/31/2015	10/17/2023	2970
UA	41EC04	90979	05/01/2014	06/17/2022	2970
UAA	41EC04	90979	05/01/2014	06/17/2022	2970
UARM	41EC04	90979	05/01/2014	06/17/2022	2970
AAP	F39E1E	89217	07/09/2015	08/24/2023	2969
CHD	789ADD	23393	12/29/2015	01/31/2024	2956
CFG	BFE02C	14889	02/01/2016	01/31/2024	2922
TRIP	D82EF3	13168	12/21/2011	12/20/2019	2922
BJS	4B74EE	76240	05/15/2002	04/29/2010	2907
AWK	6DBBBC	92614	03/04/2016	01/31/2024	2890
ADCT	06F889	50906	08/02/1999	06/29/2007	2889
CNC	F5D410	89269	03/30/2016	01/31/2024	2864
CNTE	F5D410	89269	03/30/2016	01/31/2024	2864
HOLX	C951A2	76095	03/30/2016	01/31/2024	2864
BTU	D17F7E	88991	11/20/2006	09/19/2014	2861
TUP	2B0AF4	83462	05/31/1996	03/24/2004	2855
ULTA	CF7292	92322	04/18/2016	01/31/2024	2845
GPN	1D9E55	88873	04/25/2016	01/31/2024	2838
NCR	2EC172	84372	01/03/2000	09/28/2007	2826
LKQ	A5151E	89866	05/23/2016	01/31/2024	2810
LKQX	A5151E	89866	05/23/2016	01/31/2024	2810
CVH	73A701	76619	08/30/2005	05/08/2013	2809
AJG	AAADE0B	38093	05/31/2016	01/31/2024	2802
TDG	9F18FA	91152	06/03/2016	01/31/2024	2799
ASO	D125D6	62770	03/10/1999	11/03/2006	2796
FTI	1910BB	89004	06/05/2009	01/13/2017	2780
DO	331BD2	82298	02/26/2009	09/30/2016	2774
ALK	CF6A5A	28804	05/13/2016	12/15/2023	2773
ALB	8E82A6	80191	07/01/2016	01/31/2024	2771

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Table 5: List of Selected Stocks

SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
LNT	F93C8A	58819	07/01/2016	01/31/2024	2771
FTV	567F3D	16087	07/05/2016	01/31/2024	2767
ABK	966DBE	76757	12/11/2000	06/10/2008	2739
MJN	FF56CD	92890	12/21/2009	06/16/2017	2735
KMRT	3CB239	89757	03/28/2005	09/04/2012	2718
SHLD	65D4D9	89757	03/28/2005	09/04/2012	2718
MTD	6B0784	85621	09/06/2016	01/31/2024	2704
CHTR	D88EF3	12308	09/08/2016	01/31/2024	2702
NXTL	6ADD69	77284	04/01/1998	08/12/2005	2691
COO	CD2DA4	65541	09/23/2016	01/31/2024	2687
CMVT	29DC0D	10942	10/27/1999	01/31/2007	2654
JNY	525C7F	76638	12/17/2001	03/03/2009	2634
DF	F97C81	83421	04/03/2006	05/23/2013	2608
TWC	96B4C5	91883	03/30/2009	05/17/2016	2606
URBN	E20BFE	79881	02/08/2010	03/17/2017	2595
IDXX	B7EB38	76709	01/05/2017	01/31/2024	2583
AV	5350A5	88587	10/02/2000	10/25/2007	2580
TSG	865539	84036	03/16/2000	03/30/2007	2571
SANM	6D4636	79108	06/21/2000	06/29/2007	2565
KSE	E5F309	24360	08/21/2000	08/24/2007	2560
LO	4B6CB2	17279	06/11/2008	06/11/2015	2557
MEDI	0D58CF	76656	06/16/2000	05/31/2007	2541
INCY	6CC55E	79906	02/28/2017	01/31/2024	2529
CBOE	F1529C	93429	03/01/2017	01/31/2024	2528
SNPS	7E1D5D	77357	03/16/2017	01/31/2024	2513
RJF	B3CB74	69649	03/20/2017	01/31/2024	2509
IT	F57F6F	79698	04/05/2017	01/31/2024	2493
HBI	3F6A9C	91416	03/23/2015	12/17/2021	2462
ANF	0624BE	83976	03/29/2007	12/20/2013	2459
WPO	1B637E	53225	12/31/2007	09/19/2014	2455
APCC	BC6330	11970	06/01/2000	02/14/2007	2450
ARG	BFC3CB	70308	09/09/2009	05/20/2016	2446
ALGN	221AD7	88860	06/19/2017	01/31/2024	2418
ANSS	2158DF	83621	06/19/2017	01/31/2024	2418
HLT	66E04A	14338	06/19/2017	01/31/2024	2418
AOS	B4703C	65402	07/26/2017	01/31/2024	2381
MGG	8E8E6E	11891	07/26/2017	01/31/2024	2381
MGM	8E8E6E	11891	07/26/2017	01/31/2024	2381
PKG	B6082A	87541	07/26/2017	01/31/2024	2381
RMD	434F38	81736	07/26/2017	01/31/2024	2381
CSC	095294	40125	04/04/2017	10/02/2023	2373
ADS	EF1AD9	89002	12/23/2013	06/19/2020	2371
BFH	EF1AD9	89002	12/23/2013	06/19/2020	2371
FBHS	21DED4	12981	06/24/2016	12/16/2022	2367
FBIN	21DED4	12981	06/24/2016	12/16/2022	2367
KMI	AA5C8E	51596	12/12/2000	05/30/2007	2361
IQV	7E3F8F	13911	08/29/2017	01/31/2024	2347
Q	7E3F8F	13911	08/29/2017	01/31/2024	2347
SGI	F22D3B	10791	01/18/1994	06/20/2000	2346
DD	C8A248	16851	09/01/2017	01/31/2024	2344
DWDP	C8A248	16851	09/01/2017	01/31/2024	2344

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Table 5: List of Selected Stocks

SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
SBAC	1E169E	86996	09/01/2017	01/31/2024	2344
SBAC	7C4168	86996	09/01/2017	01/31/2024	2344
DPH	64CEBB	86591	05/28/1999	10/10/2005	2328
CDN	CC6FF5	11403	09/18/2017	01/31/2024	2327
CDNS	CC6FF5	11403	09/18/2017	01/31/2024	2327
DISH	7FDE1C	81696	03/13/2017	06/16/2023	2287
PSFT	606611	78083	10/02/1998	12/28/2004	2280
ETS	17B07B	75625	05/22/1995	08/03/2001	2266
ETS	73C2ED	75625	05/22/1995	08/03/2001	2266
EHC	BE14CF	10693	01/07/1997	03/20/2003	2264
HLS	BE14CF	10693	01/07/1997	03/20/2003	2264
UA	41EC04	15980	04/08/2016	06/17/2022	2262
UVN	A9F2CA	84001	02/07/2001	03/28/2007	2241
SBL	B32585	73940	12/11/2000	01/09/2007	2221
HII	A1EAC8	12623	01/03/2018	01/31/2024	2220
ASD	3B5A64	81285	05/13/2002	06/05/2008	2216
TT	3B5A64	81285	05/13/2002	06/05/2008	2216
NYX	A0D8E6	91143	10/25/2007	11/12/2013	2211
DNR	94D8C8	82196	04/02/2009	03/20/2015	2179
PMCS	7C90A0	76624	08/03/2001	06/29/2007	2157
TTWO	A01664	84761	03/19/2018	01/31/2024	2145
ACS	324285	80913	04/02/2004	02/05/2010	2136
ACS	7AD9F7	80913	04/02/2004	02/05/2010	2136
MSCI	3ED92D	92402	04/04/2018	01/31/2024	2129
UPC	16E452	78263	10/01/1998	06/30/2004	2100
SEBL	71BCAA	83693	05/05/2000	01/31/2006	2098
XEC	90D6A5	89509	06/23/2014	03/02/2020	2080
SOTR	AA20E8	71686	03/01/1999	10/29/2004	2070
EVRG	AFD7DD	24053	06/05/2018	01/31/2024	2067
WR	AFD7DD	24053	06/05/2018	01/31/2024	2067
BR	24C48B	91849	06/18/2018	01/31/2024	2054
FLT	D29B44	12449	06/20/2018	01/31/2024	2052
CPRT	8B4A45	80320	07/02/2018	01/31/2024	2040
CFN	4AAF4A	92988	09/01/2009	03/17/2015	2024
MERQ	72E340	79718	06/29/2000	01/03/2006	2015
CVC	388C29	68857	12/20/2010	06/23/2016	2013
VC	0F04E5	88319	06/29/2000	12/30/2005	2011
XTO	EB76B5	79212	12/29/2004	06/25/2010	2005
WLP	E00269	83583	06/09/1999	11/30/2004	2002
AMG	30E01D	85593	07/01/2014	12/20/2019	1999
ANET	3DC887	14714	08/28/2018	01/31/2024	1983
PCS	EE44D4	86414	11/24/1998	04/22/2004	1977
CHIR	AE8532	23318	11/24/2000	04/19/2006	1973
AMCC	6409ED	85522	01/02/2001	05/17/2006	1962
ROL	CBA33B	36003	10/01/2018	01/31/2024	1949
HMA	F8BBC5	76565	11/07/2001	03/01/2007	1941
FTNT	63F892	93132	10/11/2018	01/31/2024	1939
VRTS	8FF340	80055	04/03/2000	07/01/2005	1916
KEYS	E4CE73	14939	11/06/2018	01/31/2024	1913
JKHY	D60BB2	88664	11/13/2018	01/31/2024	1906
IVGN	B57CCA	86725	11/24/2008	01/23/2014	1887

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Table 5: List of Selected Stocks

SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
LIFE	B57CCA	86725	11/24/2008	01/23/2014	1887
FANG	E15736	13641	12/03/2018	01/31/2024	1886
LW	5CC29D	16431	12/03/2018	01/31/2024	1886
TIE	661F72	83699	10/29/2007	12/21/2012	1881
CE	370C50	90520	12/24/2018	01/31/2024	1865
TFX	FD6926	44329	01/18/2019	01/31/2024	1840
CPN	41351A	83981	12/01/2000	12/01/2005	1827
QEP	5E91C5	93422	07/01/2010	06/30/2015	1826
SIVB	DBCA3F	11786	03/19/2018	03/14/2023	1822
ATO	B2E6B5	32986	02/15/2019	01/31/2024	1812
WAB	945DE6	81677	02/27/2019	01/31/2024	1800
CXO	154B78	92239	02/22/2016	01/20/2021	1795
FOX	7BFF81	18421	03/19/2019	01/31/2024	1780
FOXA	7BFF81	18420	03/19/2019	01/31/2024	1780
DOW	BA2D83	18428	04/02/2019	01/31/2024	1766
CIT	1E9A6D	89463	10/27/2004	07/24/2009	1732
CTVA	3FB145	18592	06/03/2019	01/31/2024	1704
JOY	3A7767	89105	02/28/2011	10/07/2015	1683
JOYG	3A7767	89105	02/28/2011	10/07/2015	1683
MKTX	60DD84	90454	07/01/2019	01/31/2024	1676
SOV	F50039	10562	07/01/2004	01/29/2009	1674
COMS	EC6E9C	76129	01/02/1996	07/27/2000	1669
ABMD	D65A13	75107	05/31/2018	12/21/2022	1666
AGL	87EAB7	15553	12/13/2011	06/30/2016	1662
ATG	87EAB7	15553	12/13/2011	06/30/2016	1662
GAS	87EAB7	15553	12/13/2011	06/30/2016	1662
PCS	57DDB9	91937	07/15/2019	01/31/2024	1662
SUNE	788AC4	81776	05/31/2007	12/16/2011	1661
WFR	788AC4	81776	05/31/2007	12/16/2011	1661
IEX	E8B21D	75591	08/09/2019	01/31/2024	1637
LDOS	504FE2	91547	08/09/2019	01/31/2024	1637
TWTR	2491BC	14295	06/07/2018	10/31/2022	1608
PWER	D42B45	85516	10/23/2000	03/11/2005	1601
NFB	8FD0C8	58094	07/17/2002	11/30/2006	1598
CDW	87B81A	13949	09/23/2019	01/31/2024	1592
NVR	C29715	79785	09/26/2019	01/31/2024	1589
FRC	C7859D	12448	01/02/2019	05/03/2023	1583
LVS	C9B932	90505	10/03/2019	01/31/2024	1582
IPGP	A23747	91668	03/07/2018	06/17/2022	1564
CLF	4C7DB5	27422	12/21/2009	04/01/2014	1563
CF	E9A20F	10725	06/19/2000	08/31/2004	1535
NOW	BB88B6	13447	11/21/2019	01/31/2024	1533
BER	B8F71F	17743	12/05/2019	01/31/2024	1519
WRB	B8F71F	17743	12/05/2019	01/31/2024	1519
ODFL	119CB6	77037	12/09/2019	01/31/2024	1515
LYV	9C25FF	91041	12/23/2019	01/31/2024	1501
STE	BF23B0	77649	12/23/2019	01/31/2024	1501
ZBRA	070B45	76795	12/23/2019	01/31/2024	1501
NAVI	41785E	14601	05/01/2014	06/04/2018	1496
PAYC	7F9984	14579	01/28/2020	01/31/2024	1465
COTY	F18844	13983	10/03/2016	09/18/2020	1447

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Table 5: List of Selected Stocks

SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
GDI	EEEAA9F	16692	03/03/2020	01/31/2024	1430
IR	EEEAA9F	16692	03/03/2020	01/31/2024	1430
SII	806B61	45794	10/02/2006	08/26/2010	1425
QTRN	7E3F8F	80470	11/16/1999	09/25/2003	1410
TMUS	57DDB9	91937	06/30/2009	04/30/2013	1401
CARR	32BBAA	19285	04/03/2020	01/31/2024	1399
OTIS	C20B75	19286	04/03/2020	01/31/2024	1399
BGEN	FE5A02	11983	01/31/2000	11/12/2003	1382
FOSL	C9E04B	79089	04/04/2012	01/04/2016	1371
SAI	504FE2	91547	12/21/2009	09/20/2013	1370
DPZ	24D81E	90248	05/12/2020	01/31/2024	1360
DXCM	B840EF	90664	05/12/2020	01/31/2024	1360
WST	BF79F5	62498	05/22/2020	01/31/2024	1350
BIO	9D5FA4	61516	06/22/2020	01/31/2024	1319
TDY	9D30A8	87445	06/22/2020	01/31/2024	1319
TYL	442769	76185	06/22/2020	01/31/2024	1319
ADT	97644E	13567	10/01/2012	05/02/2016	1310
STR	63BB7B	27756	12/01/2006	06/30/2010	1308
FOX	A13375	90442	09/21/2015	03/19/2019	1276
NWS	A13375	90442	09/21/2015	03/19/2019	1276
TFCF	A13375	90442	09/21/2015	03/19/2019	1276
AKS	41588B	80303	07/01/2008	12/16/2011	1264
CTLT	44A4FC	14763	09/21/2020	01/31/2024	1228
ETSY	FF4C20	15291	09/21/2020	01/31/2024	1228
FL	0CE7F6	15456	04/04/2016	08/08/2019	1222
POOL	5DE5A5	82515	10/07/2020	01/31/2024	1212
ATGE	7B492C	76708	06/09/2009	09/28/2012	1208
DV	7B492C	76708	06/09/2009	09/28/2012	1208
AWE	4A92EC	89001	07/09/2001	10/26/2004	1206
VTRS	508CFD	20057	11/17/2020	01/31/2024	1171
EQ	DA9D72	91218	05/18/2006	06/30/2009	1140
TSLA	DD3BB1	93436	12/21/2020	01/31/2024	1137
ENPH	C44D01	13323	01/07/2021	01/31/2024	1120
SDS	841A0D	10108	07/22/2002	08/11/2005	1117
TRMB	D4AC65	76230	01/21/2021	01/31/2024	1106
CMX	C637C6	81262	03/25/2004	03/22/2007	1093
ESV	E4DCB7	62519	01/04/2007	12/22/2009	1084
MPWR	6ABC8	90455	02/12/2021	01/31/2024	1084
DINO	68E6E9	32803	06/18/2018	06/03/2021	1082
HFC	KQZMPH	32803	06/18/2018	06/03/2021	1082
HOC	KQZMPH	32803	06/18/2018	06/03/2021	1082
LVLT	836F48	85991	11/05/2014	10/12/2017	1073
CEPH	500B7F	76625	11/17/2008	10/14/2011	1062
CE	536F08	26332	04/02/2001	02/26/2004	1061
CZR	34A959	14882	03/22/2021	01/31/2024	1046
ERI	34A959	14882	03/22/2021	01/31/2024	1046
GNRC	304C94	93246	03/22/2021	01/31/2024	1046
JHF	E79D0C	87536	06/28/2001	04/28/2004	1036
BRL	7EC821	11415	02/27/2006	12/22/2008	1030
PMTC	D437C3	75912	04/20/2021	01/31/2024	1017
KRFT	EABF99	13598	10/02/2012	07/02/2015	1004

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Table 5: List of Selected Stocks

SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
CRL	B13B68	88281	05/14/2021	01/31/2024	993
CBSS	E6293B	22032	12/20/2004	09/06/2007	991
GRA	29E061	85908	04/01/1998	12/08/2000	983
MRNA	8EA478	18312	07/21/2021	01/31/2024	925
SSP	BDE867	84176	12/20/2005	06/30/2008	924
PETM	B4C794	79411	10/05/2012	03/11/2015	888
TECH	85DE00	75694	08/30/2021	01/31/2024	885
CNXT	2FD2F9	86496	01/31/2000	06/25/2002	877
OGN	VUA3RK	21124	06/03/2021	10/17/2023	867
BRO	C598D7	63467	09/20/2021	01/31/2024	864
CDAY	94208D	17700	09/20/2021	01/31/2024	864
MTCH	622DBE	15850	09/20/2021	01/31/2024	864
CSRA	F762FF	15797	11/30/2015	04/03/2018	856
FSH	9AF86D	77150	08/03/2004	11/09/2006	829
WPX	BDE462	13141	01/03/2012	03/21/2014	809
MFE	2B76B6	77976	12/23/2008	02/28/2011	798
NET	2B76B6	77976	12/23/2008	02/28/2011	798
EPAM	88923D	13210	12/14/2021	01/31/2024	779
AYI	66A667	89216	05/03/2016	06/15/2018	774
FDS	12A3A3	83597	12/20/2021	01/31/2024	773
ENDP	B09F19	88436	01/27/2015	03/01/2017	765
PALM	62F538	87800	07/28/2000	08/13/2002	747
PLMO	62F538	87800	07/28/2000	08/13/2002	747
SAPE	479A8C	83413	05/05/2000	05/10/2002	736
CEG	HTA3J9	22623	02/02/2022	01/31/2024	729
FSL	E08E65	90435	12/03/2004	12/01/2006	729
SEDG	73F28D	15272	12/20/2021	12/15/2023	726
NDSN	D56D6D	57809	02/15/2022	01/31/2024	716
GMCR	1AFD04	79588	03/24/2014	03/04/2016	712
MOH	1F716B	89781	03/02/2022	01/31/2024	701
TEX	56632F	58318	12/20/2006	11/05/2008	687
AMSG	97371E	85675	12/02/2016	10/10/2018	678
EVHC	97371E	85675	12/02/2016	10/10/2018	678
CBH	CF2A14	86845	06/06/2006	03/28/2008	662
WBD	ADF092	22976	04/11/2022	01/31/2024	661
MTW	7B1156	51263	11/16/2007	08/31/2009	655
IAC	4B3676	78840	12/01/2006	08/20/2008	629
IACI	4B3676	78840	12/01/2006	08/20/2008	629
VTSS	3003D3	77173	12/12/2000	08/20/2002	617
ACAS	789647	85271	07/09/2007	03/03/2009	604
BHF	7A51FE	16816	08/07/2017	04/02/2019	604
KDP	14C7B2	17942	06/21/2022	01/31/2024	590
ON	790C34	88182	06/21/2022	01/31/2024	590
ONNN	790C34	88182	06/21/2022	01/31/2024	590
TAP	30C00A	89495	08/21/2002	04/01/2004	590
ADPT	AC31A2	10353	10/01/1999	05/11/2001	589
SXCL	AC31A2	10353	10/01/1999	05/11/2001	589
NKTR	649CBD	80539	03/19/2018	10/02/2019	563
PENN	2EB88B	80563	03/22/2021	09/16/2022	544
MMI	B6B014	12456	01/04/2011	05/24/2012	507
CSGP	ED0402	86288	09/19/2022	01/31/2024	500

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Table 5: List of Selected Stocks

SYMBOL	RP_ENTITY_ID	PERMNO	START	ENDING	TENURE
WCG	88059B	90272	09/17/2018	01/27/2020	498
ANR	F43D3F	90547	06/02/2011	10/01/2012	488
TRGP	EAEBF3	12476	10/12/2022	01/31/2024	477
SBNY	5225A4	90090	12/20/2021	03/14/2023	450
STLD	20BEEA	84262	12/22/2022	01/31/2024	406
CPGX	70C9F1	15404	07/02/2015	07/05/2016	370
BXLT	02631C	15401	07/01/2015	06/02/2016	338
PODD	9C5174	92050	03/15/2023	01/31/2024	323
FIC	A247F5	11533	03/20/2023	01/31/2024	318
FICO	A247F5	11533	03/20/2023	01/31/2024	318
BVSN	89F93F	83630	11/06/2000	08/31/2001	299
AAXN	D2AC74	89031	05/04/2023	01/31/2024	273
AXON	D2AC74	89031	05/04/2023	01/31/2024	273
TASR	D2AC74	89031	05/04/2023	01/31/2024	273
H	F53348	91388	08/01/2006	04/09/2007	252
PANW	A52B6B	13511	06/20/2023	01/31/2024	226
VNT	6B613D	19807	10/09/2020	03/19/2021	162
ABNB	09E31A	20190	09/18/2023	01/31/2024	136
BX	C08256	92108	09/18/2023	01/31/2024	136
HUB	E6E012	32942	10/18/2023	01/31/2024	106
HUBB	E6E012	32942	10/18/2023	01/31/2024	106
LULU	97693A	92203	10/18/2023	01/31/2024	106
BLDR	B2256A	90720	12/18/2023	01/31/2024	45
UBER	D90F43	18576	12/18/2023	01/31/2024	45

A.2 Results Appendix

A.2.1 Cash Flow Groups

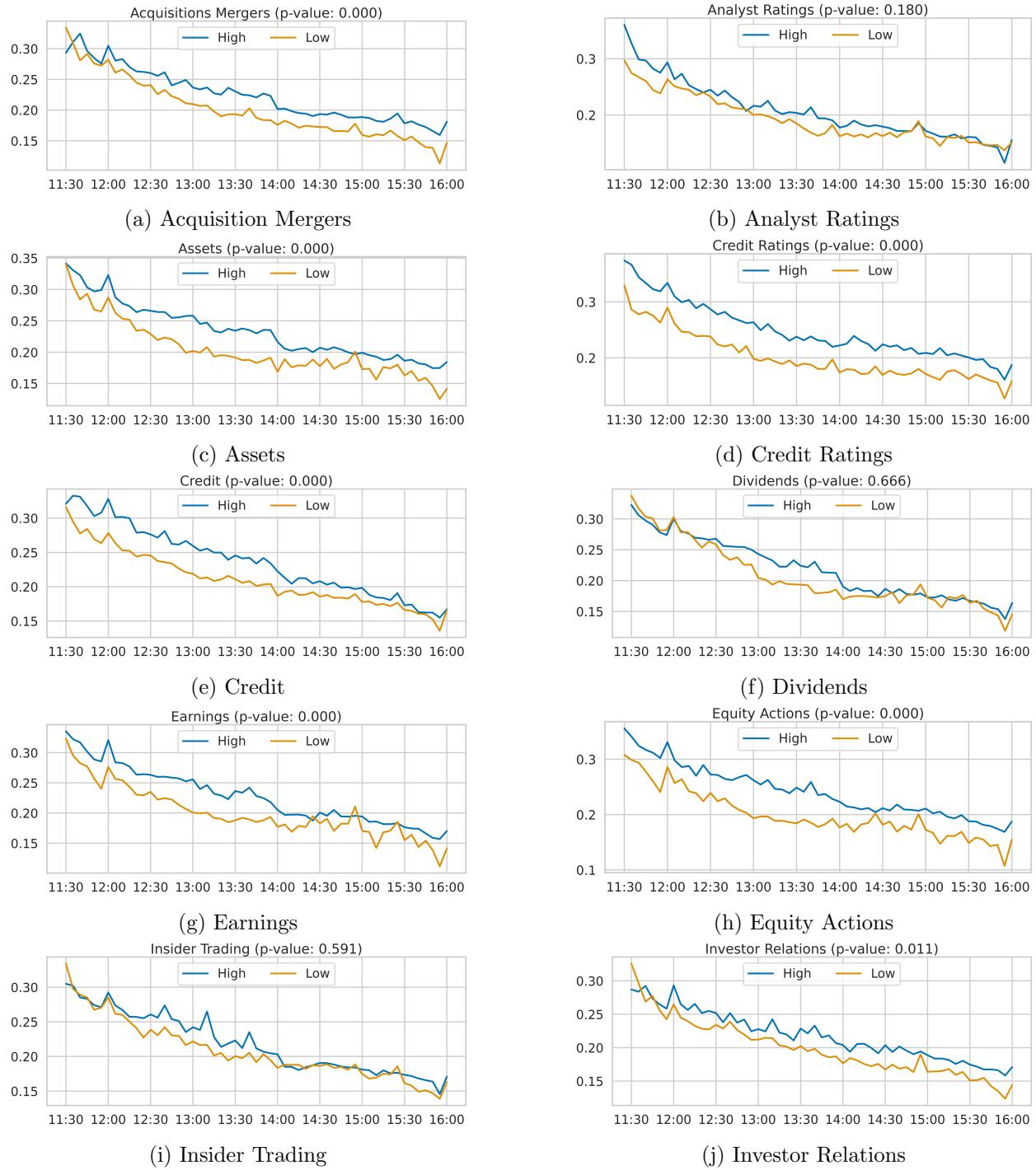


Figure 15: Cash Flow Groups (part 1)

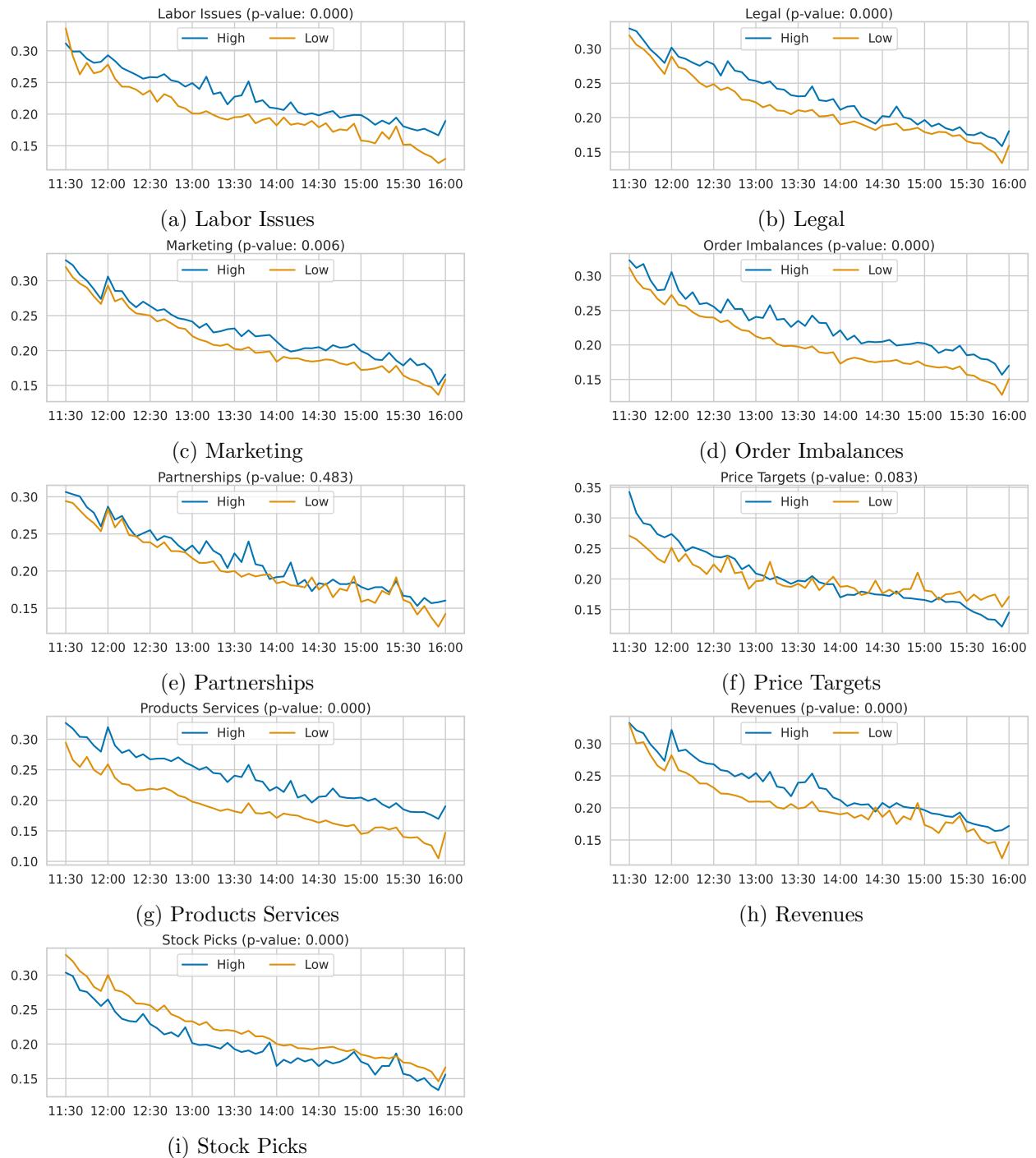


Figure 16: Cash Flow Groups (part 2)

A.2.2 Discount Rate Groups

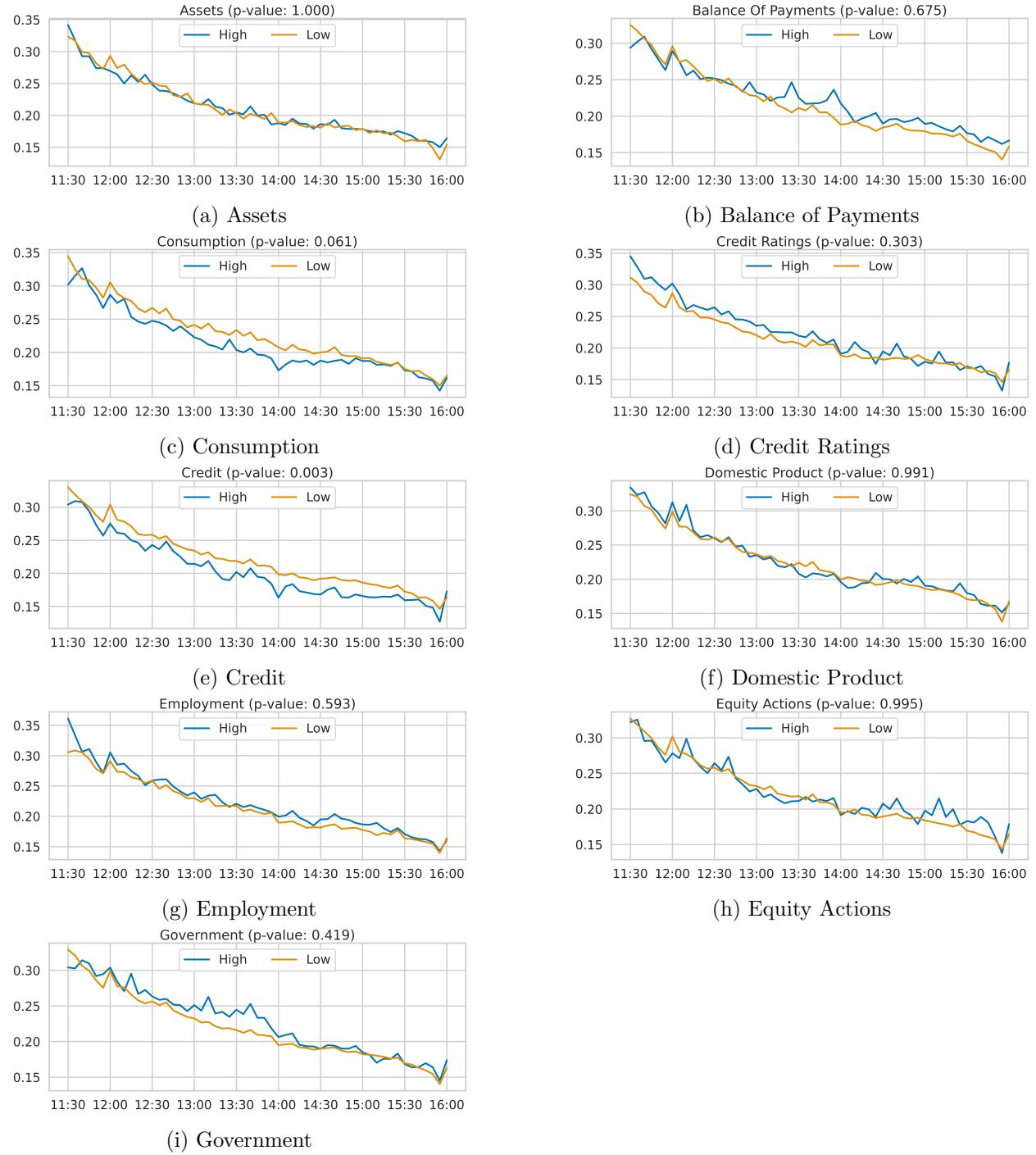


Figure 17: Discount Rate Groups (part 1)

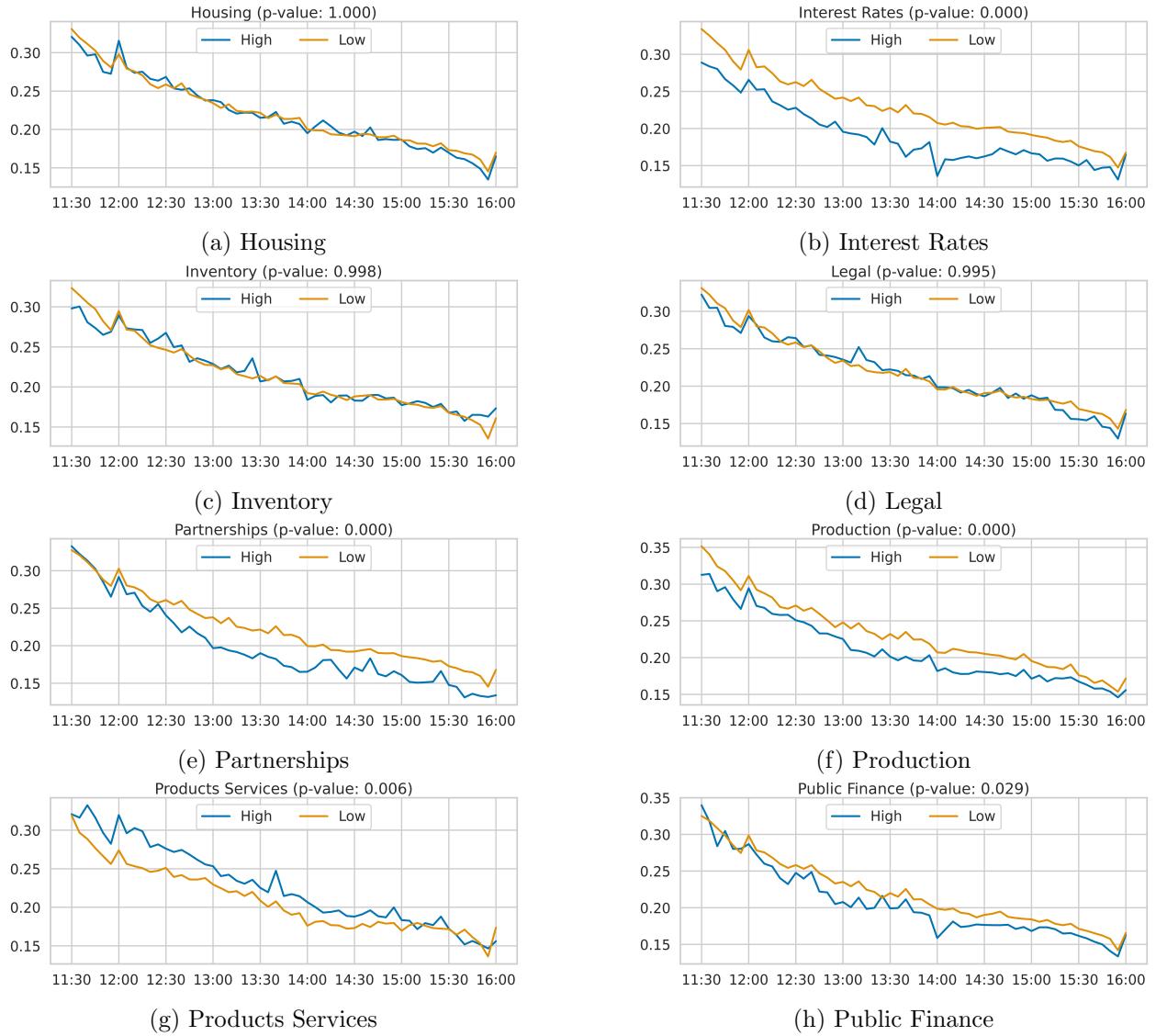


Figure 18: Discount Rate Groups (part 2)

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