MORNINGSTAR®

News Sentiment Factor and Cross-Section of Equity Returns

A study of global equities strategies

Morningstar Quantitative Research

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Contents

Sandeep
Lead Quant Analyst
sandeep@morningstar.com

Sabeeh Ashhar
Director of Quant Research
sabeeh.ashhar@morningstar.com

Executive Summary

Alternative data is the new dark horse of investment management industry. Over the last decade there has been an explosive growth in computing power and personal device usage that has enabled massive growth in data generation. With the availability of sophisticated machine-learning tools it is now possible to churn insights from massive datasets. Alternative data is hence gaining traction within the investment management space. Today, rarely anyone would question the potential of using new and unique data sources to seek alpha opportunities. News events-based sentiment data is one such manifestation of alternative data deployed for improving investor outcomes.

The purpose of this paper is to present a methodology for constructing a modern news sentiment factor for public equities. Also, we demonstrate the potential approaches for effectively leveraging the alternative data factor over various investment universes. Our finds will be of interest to institutional investors and advisors, helping them with a better understanding of potential considerations while leveraging news sentiment as a data asset for improving investment outcomes.

Key Takeaways

- News sentiment factor is a differentiated source of alpha across global financial markets.
- News sentiment factors have dispersed performance globally, excelling in Europe while showing a saturated performance in the United States and the Asia-Pacific regions. It seems to work best in Japan.
- News sentiment factor is a fast-decaying factor and maximum alpha can be generated by tapping into the factor over shorter time periods as evidenced by rapid adoption in the high-frequency trading sector.
- Investors tend to overreact to negative news over shorter periods of time while prices tend to mean-revert over longer periods for investments.
- Given the fast-decaying nature and high turnover associated with news sentiment factor, there is varied support for usage of this factor across managed investments and individual investors.
- Risk management is critical for fast-decaying alpha-generating strategies exposed to news sentiment factor due to underlying sector concentration.
- Managed investments can benefit from usage of new sentiment factor through blending traditional factor with objective to maximize risk-adjusted returns over longer periods of time.

Introduction

Alternative data pertaining to sentiment has found increased attention within academia. Several papers have been published to try to create a better understanding about investor sentiment. While there is no single definition of investor sentiment, according to Johnson and others,[1] most discussions involve a) investor optimism or pessimism about stocks, b) beliefs not justified by fundamentals, or c) misevaluation by some investors. Since investor sentiment is not directly observable, researchers have employed various measures of sentiment. Proxies include the closed-end fund discount, mutual fund redemptions, the volume of initial public offerings, ratio of odd-lot sales/purchases, consumer and investor survey data, technical indicators, and the proportion of fund assets held in cash. The indicators that refer to sentiment are mainly generated from surveys and address consumer sentiment. The release schedule for these indicators is often either monthly or quarterly, making them less timely than the news sentiment indexes suggested in this paper. The mentioned indicators try to capture marketwide sentiment rather than sentiment at the individual company level.

Company-level sentiment proxies have been found to be effective time-series data impacting a cross-section of asset returns. Specifically, Baker and Wurgler (2006) find that when sentiment is low, the average future returns of speculative stocks exceed those of bondlike stocks. When sentiment is high, the average future returns of speculative stocks are, on average, lower than the returns of bondlike stocks. Eventually, valuations may drive stock prices, but in the short term, sentiment may have more impact and may also be an indicator of future valuation changes. Another research in the paper from Tetlock (2005) studies daily data from *The Wall Street Journal* and finds that high media pessimism predicts downward pressure on stock price on the next day. More recently, research by Huynh and others (2015) suggests that the performance of the standard price momentum factor can be enhanced by adding news signals. Lastly, Kearney and others (2013) provide a comprehensive literature review of news and sentiment-related research. In summary, most of these academic studies suffer from limited data coverage and short data history. Furthermore, most existing research seems to suggest that the predictive power of textual data is only relevant for a short horizon, usually consisting of a few days. We therefore attempt to leverage news sentiment data available from popular data vendors as it is available in a timely and consistent fashion from real-time media outlets and has wider coverage for global equities.

We have extended our previous research from the "Corporate Filings in the Age of Natural Language Processing" paper with a focus on the news sentiment factor for explaining the cross-section of asset returns for global equities, as it is the most popular asset class. We use news sentiment data from Alexandria, a leading provider of news data in this sector. The data is timely and has wider coverage for global equities, beginning in 2006 and onward. The data is in turn derived from the deployment of emerging technologies and sifting through enormous number of news articles, blogs, and unstructured content. Asset managers can therefore benefit from the scale of technology deployment that data vendors could offer. This would also help overcome the drawbacks of earlier sentiment factors that either have low coverage or are available for a shorter history or have been derived through surveys. As part of the paper, we first explore the Alexandria Data, which is used for creating our sentiment factor. We next evaluate the distinctiveness of this factor against our popular Fama-French factors. We further

evaluate the efficacy of sentiment factor through back-testing on various universes, holding sizes, and rebalance periods. In addition, we explore blending of news sentiment factors with traditional factors for boosting investment outcomes. Finally, we demonstrate case studies for effective usage of this data.

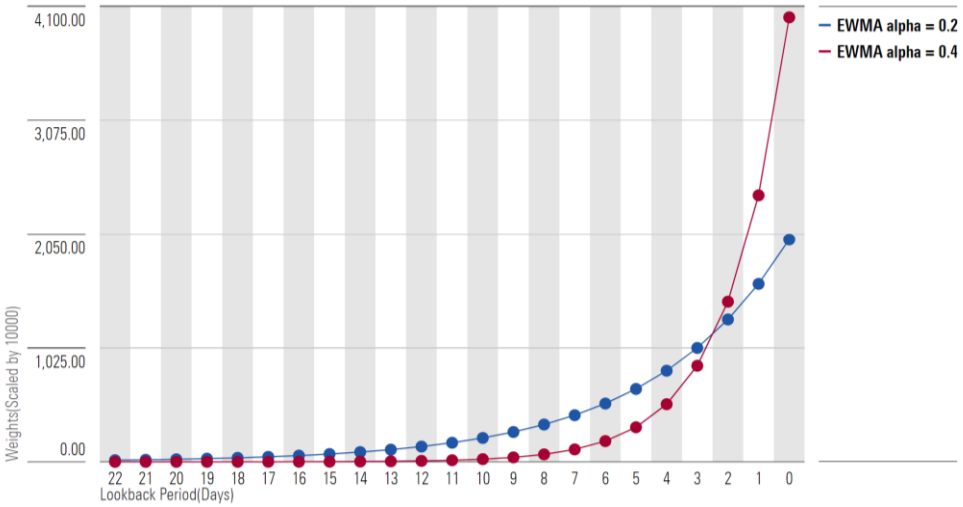
Sentiment Score Construction Methodology

Generally, sentiment factors try to capture the prevailing sentiment trend for a particular asset or markets. To capture such trend, it seems reasonable to consider an aggregation of sentiment based on information available through media outlets over a well-defined time window to capture the general "mood" of the market. When performing such aggregations, it may be necessary to consider normalizing the data since equity news is characterized by strong seasonal patterns. Without normalizing for seasonality, it becomes difficult to evaluate what values reflect high and low net sentiment--for instance, high values may simply be the result of certain bursts of information, or higher volumes especially during earnings season. One may then consider the sentiment ratio as the baseline for constructing market-sentiment indexes. As the ratio is measured as the count of positive to negative news items, it indirectly takes into consideration changes in news volume. This approach is expected to work well under the assumption that seasonality impacts the count of positive and negative news symmetrically. Alexandria news data categorizes the positive and negative news flag for news events from Dow Jones News Wire and PR News Wire. We therefore define our Sentiment Factor as below:

$$\text{Daily\_Sentiment} = \log_{10}((\text{'}Positive\_flag\text{'} + 1)/(\text{'}Negative\_flag\text{'} + 1))$$

The positive and negative flags are defined for each news article in Alexandria news data. We use a log transform, as we are concerned with the relative change in sentiment for a stock. To calculate the sentiment ratio for a particular asset, one must screen the data to obtain only news items that at least mention the asset. To this end, we apply a relevance filter (>0.8) on the news data available from Alexandria. News events also have a follow-on effect on future returns, so we need to apply a decay parameter. To account for seasonal volumes and burst of information, we apply a smoothening

Exhibit 1 Illustration of the Smoothening Factor Chosen to Aggregate the Sentiment Signal



parameter on the data based on EWMA smoothening of 0.2 for weekly aggregation and 0.4 for monthly aggregation as demonstrated in Exhibit 1. As you may observe, the decay rate is much faster for 0.2, as we are considering a weekly lookback period to aggregate the sentiment score. For monthly, it is a more gradual decay with 90% of the weights assigned to the last two weeks.

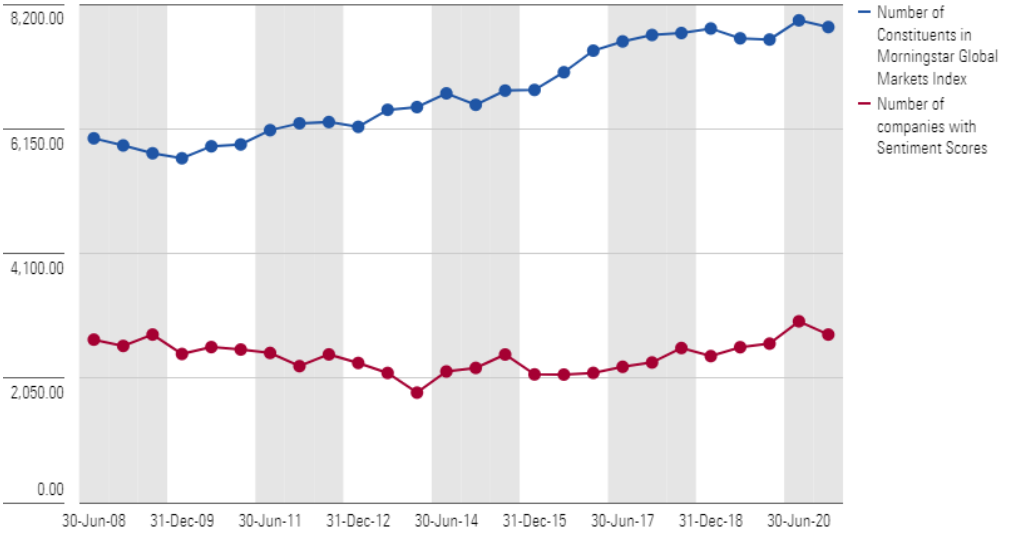
Data Overview and Coverage Analysis

- **Universe used for analysis:** We measure the coverage of news sentiment data available through vendors measured against Morningstar Global Markets Index. The Morningstar Global Markets Index has over 7,500 stocks over the period 2009-2022. Within this universe we have an average of 3,700 stocks, which are covered in the news sentiment data. This coverage accounts for 85% market capitalization coverage for this global universe.

Sentiment Factor Construction

We use the Fama-French factor construction framework to calculate the factor returns and evaluate Sentiment Factor's performance. For all the analysis that follows in the subsequent sections, we start with a benchmark index as our starting universe for the region. We sort the stocks in the index based on their sentiment scores and divide them into five quintiles. We rebalance this portfolio monthly. We go long on the top quantile (stocks with the most positive sentiment) and short the bottom quantile (stocks with the most negative sentiment). The long-short (LS) portfolio returns are used as a proxy for the sentiment factor returns.

Exhibit 2 Coverage of Alexandria Sentiment Data in Morningstar's Global Markets Index



Source: Morningstar Global Markets Index, Alexandria Data Data as of May 31, 2022.

Correlation to Traditional Equity Style Factors

Once we have derived the factor, we try to measure the distinctiveness of this factor measured against the popular Fama-French factors. To this end, we measure the Spearman Rank correlation between our newly derived factor and traditional factors as measured through Fama-French factors, shown in Exhibit below. As can be seen in Exhibit 3, the factor is distinctive and has little correlation with traditional factors over the period of late 2009 till early 2022.

Exhibit 3 Correlation of Sentiment Factor With Five-Factor Fama-French and Momentum

Factor	MKT	SMB	HML	RMW	CMA	MOM	Sentiment
MKT	1.00						
SMB	0.32	1.00					
HML	0.20	0.26	1.00				
RMW	-0.33	-0.26	0.07	1.00			
CMA	-0.15	0.07	0.53	0.17	1.00		
MOM	-0.16	-0.20	-0.55	-0.07	-0.11	1.00	
Sentiment	-0.24	-0.11	0.03	0.21	0.24	0.18	1.00

Source: Kenneth French Data Library "https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html"

Data as of May 31, 2022.

Evaluating the Performance of Sentiment Factor Across the Globe

In order to make a case for a new factor, a key question often posed is regarding the performance of the factor across different geographies. To this end, we use the Fama-French framework to create long-short factor, mimicking portfolios by sorting and dividing the starting universe into quintiles based on the sentiment factor scores. We go long on the stocks with the most positive sentiment and short the stocks with the most negative sentiment. These portfolios are monthly rebalanced. The results of back-tests are presented in Exhibit 4. On the global universe, as we would expect, there is no discernible trend. We further divide the universe into regional universes for North America, Developed Europe, Asia-Pacific, and Japan to rerun the back-tests. The data available to us covers a 12-year period from November 2009 to January 2022. The North American region shows a lower Sharpe ratio and the compound annual growth rate, or CAGR, compared with the other regions. Europe shows a much better performance compared with North America with a better CAGR, higher Sharpe ratio, and lower drawdown. The factor shows the best performance in the Japan region over the entire back-testing period.

Exhibit 4 Performance of Long-Short Sentiment Factor Portfolio Across Different Geographies

Universe	Morningstar Global Markets	Morningstar Dev North America	Morningstar Dev Europe	Morningstar Dev APAC	Morningstar Japan
CAGR	0.81%	1.44%	4.27%	3.60%	5.92%
Volatility	4.74%	5.32%	7.86%	8.32%	8.21%
Sharpe Ratio	0.19	0.29	0.57	0.47	0.76
Max Drawdown	-16.93%	-20.73%	-17.19%	-19.90%	-16.40%

Source: Morningstar Global Markets Index Data as of May 31, 2022.

Critical Evaluation of News Sentiment Factor

Some of the other metrics investors evaluate while focusing on factors are related to strategy turnover (churning of securities in the portfolio), the rebalance frequency, and position sizing. To ascertain insights here, we execute further analysis with a focus on U.S. markets baselined against Morningstar US Markets Index as the starting universe. We first simulate results for various rebalance frequencies as weekly, monthly, and quarterly levels. We sorted the stocks in the Morningstar US Markets Index based on their sentiment scores and divided them into five quintiles. We reconstitute this portfolio over different investment horizons ranging from one week, to a month, to a quarter. The results of the simulations are shown in Exhibit 5. As can be seen in the exhibit below, the Sentiment Signal has maximum dispersion in long-short returns with a weekly rebalance frequency. The results start to saturate within a month and underperform with quarterly rebalance (the spread between the top and the bottom quintile is not significant anymore). This is indicative that the signals are mean-reverting in nature. Investors tend to rely too much on negative news in the short term and prices tend to mean-revert over longer periods of time.

Exhibit 5 Evaluation of Sentiment Factor Performance for Various Investment Horizons

Rebalance Frequency	1 week		1 month		Quarterly	
Quantile	1	5	1	5	1	5
Total Returns(%)	-38.42	769.59	481.87	436.95	504.38	481.35
CAGR(%)	-3.57	17.58	13.49	14.18	14.70	14.36
Sharpe Ratio	-0.22	0.74	0.67	0.80	0.72	0.82
Max Drawdown	-65.28	-37.81	-38.64	-40.29	-37.22	-37.78
One-way turnover at each rebalance	73.41	76.28	81.31	77.92	81.06	77.558

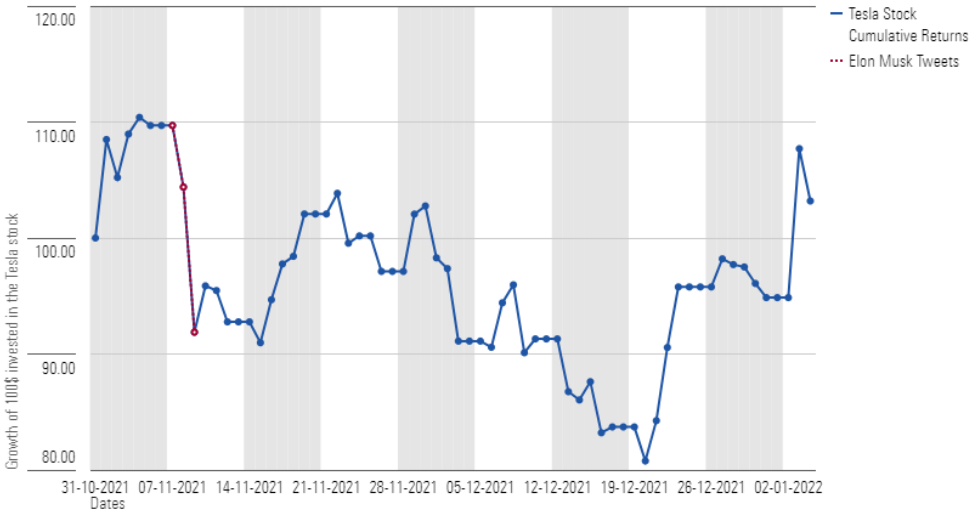
Source: Morningstar US Markets Index Data as of May 31, 2022.

Back-Test Period: January 2009-May 2022

To demonstrate a practical case, we refer to an instance of Tesla stock performance (Exhibit 5(b)) in late 2021. The asset saw a rapid downfall, going down as much as 25% in November 2021 driven by Elon Musk's comment to sell his stake for reasons pertaining to tax considerations. Investors perceive any holdings reduction by promoters and founders as a negative event attributed to change in strategy and/or indicating saturation in value, prompting this decision from the founders. Investors further try to cash in on this information by exiting their stakes to maximize their value—a behavioral bias to discount the long-term valuations over shorter periods immediately following the news availability. We can clearly see this pattern for the next month. However, as the relevancy of the news event decays over

time, the investors have a higher affinity toward long-term valuations and prices tend to revert again to peak levels within the next two months, as evident in the above case.

Exhibit 5(b) Tesla Cumulative Returns



To cover other aspects of investing, we reviewed the turnover associated with the above-discussed strategies. As is evident in Exhibit 5, the strategies demonstrate an alarming one-way turnover of 70% at each rebalance. This can amount to monumental trading costs if we were to implement the

Exhibit 6: Sentiment Factor Stability Over a 12-Month Horizon

Factor Quantile	1	2	3	4	5
1	29.81	21.19	16.86	16.25	15.89
2	22.73	22.30	19.57	18.28	17.12
3	19.79	20.13	20.50	20.47	19.11
4	17.04	18.45	20.30	21.70	22.51
5	14.70	14.32	16.94	20.16	33.88
5	29.81	21.19	16.86	16.25	15.89

strategy. Exhibit 6 further details out the factor stability of the quintiles over a 12-month horizon. We find that on an average, approximately 16% of the stocks are the same in the top decile compared with the last year.

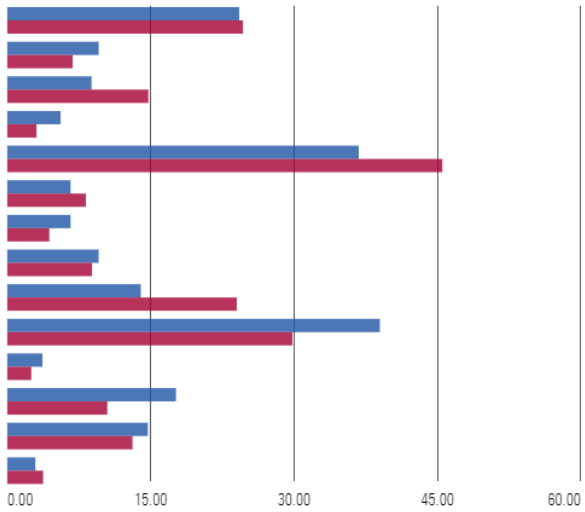
Above insights might help us make sense of the increased usage of alternative data, particularly textual data from news, earning call transcripts by top hedge funds, as turnover cost is an important consideration for managed funds. The recently published report "How to Talk When a Machine is Listening?" points to heightened usage of unstructured text data by leading funds such as Renaissance Technologies, Two Sigma, Point72, Citadel, and D.E. Shaw to name a few. The investment strategies at these funds involve the use of rapidly evolving language- and sentiment-analysis facilitated by large-scale machine-learning computation to build and trade signals faster than others in the market. This is contrarian to a valuation-driven approach prevalent within the investment management industry.

Portfolio Diversification

We looked at the sector exposure of the top quintile portfolio based on the most positive sentiment in Exhibit 6(b). The Morningstar Sector classification has three Super Sectors: sensitive (moderate correlation to the business cycle), cyclical (overly sensitive to the business cycle), and defensive (anticyclical stocks). The portfolio of the most positive sentiment stocks takes an active bet on the cyclical sector (approximately 40% allocation compared with approximately 29% in the benchmark). If we were to make a concentrated portfolio based on sentiment factor only, we expect a strong exposure to the cyclical sector.

Exhibit 6(b) Sector Exposure With Respect to the Benchmark for the Top Quintile Sentiment Portfolio

% of stocks	Top Quintile Portfolio	Benchmark
Defensive	24.26	24.66
Cons Defensive	9.56	6.84
Healthcare	8.82	14.76
Utilities	5.58	3.06
Sensitive	36.77	45.51
Comm Svcs	6.62	8.23
Energy	6.62	4.40
Industrials	9.56	8.87
Technology	13.97	24.01
Cyclical	38.98	29.83
Basic Matls	3.68	2.51
Cons Cyclical	17.65	10.47
Financial Svcs	14.71	13.10
Real Estate	2.94	3.75

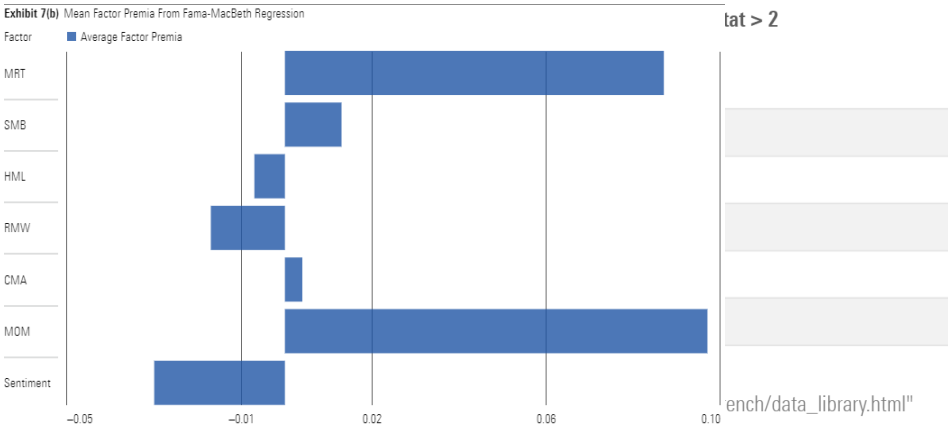


Source: Benchmark - Morningstar US Markets Index

Cross-Section of Equity Returns

We also use the Fama-MacBeth Regression to test the statistical significance of the sentiment factor after controlling for the five Fama-French factors: Market (MKT), Size (SMB), Value (HML), Profitability (RMW), Investment (CMA), and Momentum (MOM), which are well documented in the financial literature. Exhibit 7 shows that post inclusion of sentiment factor in the multifactor model, the mean absolute t-stat for the sentiment factor is > 2 and hence significant (at a 5% level of significance). Adjusted R-Square of the model improves from 0.206 to 0.214 after adding sentiment to the model. Also, the t-stat in the cross-sectional regression is significant almost 57% of the time. The modeling outcomes are interpretive of adding additional information for investors in explaining the cross-section of equity returns.

Exhibit 7 Sentiment Factor Performance After Controlling for Fama-French Factors



Data as of May 31, 2022.

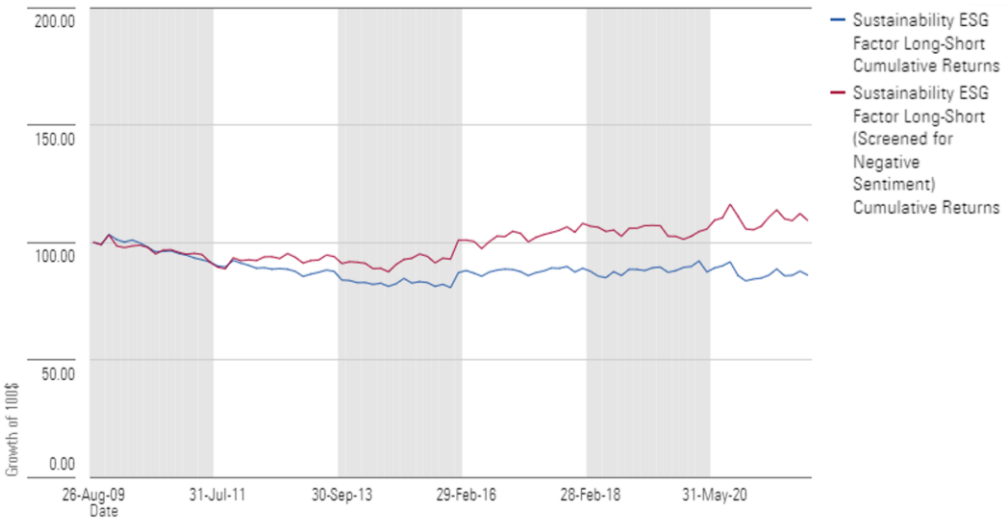
We also plot the mean of the factor premiums generated from the second stage of the Fama-MacBeth regression. As you can see, the sentiment premiums are significantly negative when compared with the other factors. This ties into the fact that in the literature review we found that the sentiment signal can help us in enhancing the effect of other factors. Momentum, for example, is considered to work because of the under-reaction to the news. As evidenced above, we can blend these low correlated factors to get better risk-adjusted returns with a more diversified portfolio.

Blending Sentiment Factor With Traditional Factors

The above sections point to increased usage of fast-decaying sentiment factor for investors in the high-frequency trading space. This may indicate that the managed investments may look at alternative approaches to usage of this data. We will cover one such approach here. We specifically look at the ESG factor, which has become quite imperative for investors in the portfolio construction routine lately, driven by the need to create positive environmental and social impact. Pointing to the recently published Morningstar Sustainable Fund Flows Report, there has been record launches of new products and flows into these assets. As per the Morningstar ESG Risk Rating Assessment, ESG ratings could be used for

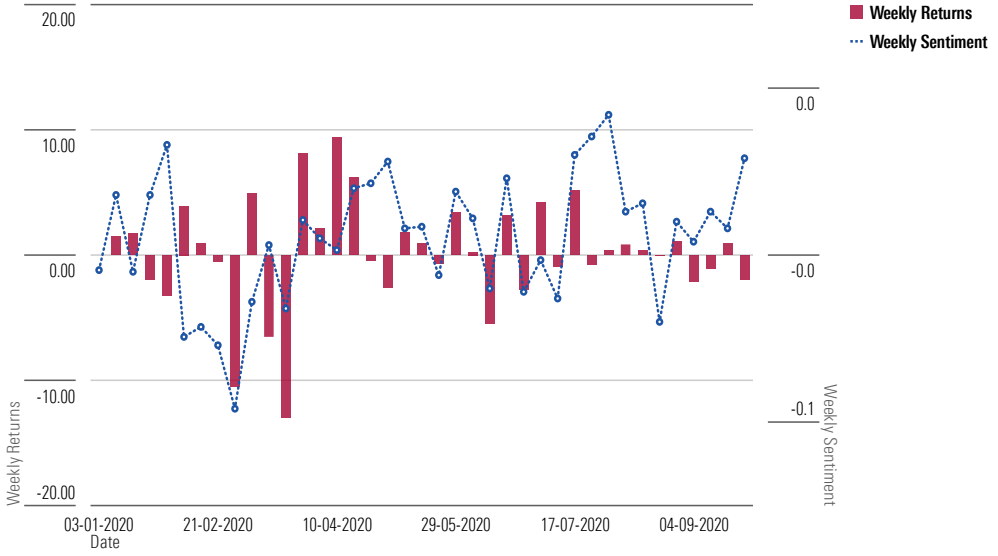
portfolio screening and provide downside risk mitigation and a positive, albeit modest, increase in performance with respect to fully random portfolios. ESG ratings for assets is available at a higher frequency: quarterly or twice a year. We wish to check if the performance of the ESG factor can be enhanced by blending with the news sentiment factor. To this end, we create an enhanced ESG factor, which is overlayed with the sentiment factor in order to avoid negative news events pertaining to companies. The below exhibit demonstrates a comparison of ESG factor and enhanced factor. We can infer from the visuals that the enhanced ESG factor performs better than pure-play ESG factor. From the visual, we can also decipher that the performance diversion increases significantly until the end of the decade in 2020. This may mostly be driven by The Paris Agreement of 2015, which has significantly accelerated the adoption of sustainability within client portfolios. In this sense, the news sentiment factor enhances the ESG ratings stock-screener capabilities by offering more downside protection when aggregated with news and social media. This ESG overlayed signal can also be interpreted as being faster compared with the pure ESG signal.

Exhibit 8 Using the Sentiment Factor to Screen Securities With Negative Sentiment Improves ESG Factor Performance



Case Study: The Pandemic

Exhibit 9 Healthcare Sector Sentiment compared to the sector returns



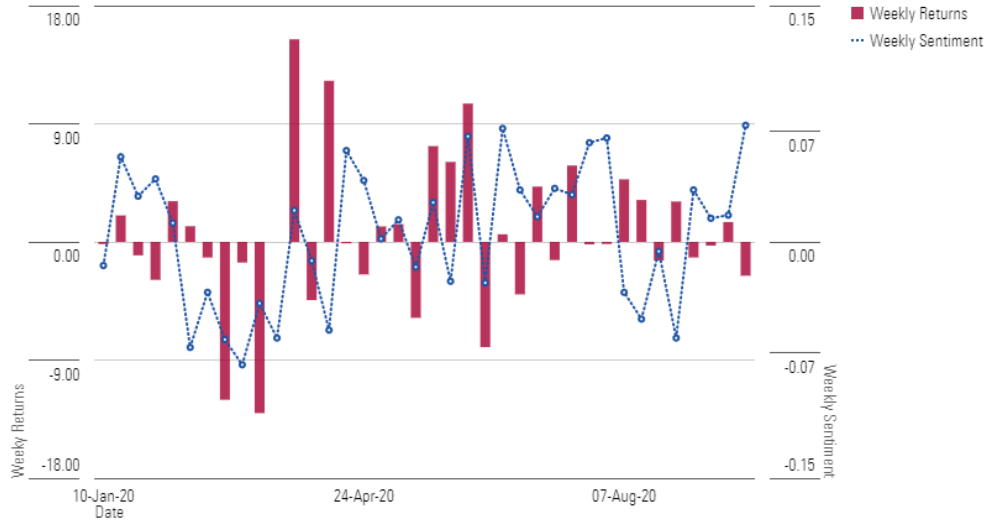
Source: Alexandria Data, Morningstar Data as of May 31, 2022.

We would like to further demonstrate the usage of news sentiment data for some practical use cases as detecting sector rotation. We want to evaluate the performance of the healthcare sector ETF (iShares S&P 500 Health Care Sector UCITS ETF) in initial periods of the pandemic. We aggregated the sentiment scores of securities on a sectoral level to get a sense of how the change in sentiment fares when compared with the market returns during the period. In Exhibit 9, we look at the healthcare sector ETF's weekly returns, with an overlay of the weekly healthcare sector sentiment for the period January 2020 till May 2020. While initial cases of the coronavirus were detected in late-January 2020, the news sentiment started to show early warning signals while the market was in an upward trajectory until late-February 2020. During this period, there was no prediction or visibility about vaccine availability. While we started to see early lockdowns and deaths spiral upward, the U.S. government created massive stimulus to develop vaccines, and grants were provided to major pharma companies for vaccine development as part of CARES, the Coronavirus Aid, Relief, and Economic Security Act.

Accordingly, the sentiment for pharmaceutical companies turned positive early on, indicative of vaccine development in the near future. This was followed by positive return streams. Investors who would have taken notice of the sentiment signal would have seen a huge return potential in future months.

Similarly, another major sector that abruptly came to a halt was industrials, where both the supply and the demand side had major disruptions due to the pandemic. If we look at the relative sentiment index for industrials (Exhibit 9b), it tanks before the stocks and serves as a leading indicator for the impending market crash. Also, after the drawdown in March (the sentiment index also bottoms out), once the vaccine is announced, there is a general revival of sentiment, signaling a recovery in returns. Also, news sentiment moves in the positive territory.

Exhibit 9(b) Industrial Sector Sentiment compared to the sector returns



Source: Alexandria Data, Morningstar Data Data as of May 31, 2022.

Concluding Thoughts

We provided an overview of methodology for constructing the news sentiment factor based on Alexandria News Sentiment Data. The sentiment factor captures the exposure to the change in overall market sentiment. We analyzed the factor performance across various markets and saw the factor performance was good across Europe, with moderate performance in the U.S. and Asia-Pacific regions. The sentiment factor holds a relatively low correlation to more traditional factors such as market, size, value, and momentum. Our analysis indicates that sentiment factors may provide investors with additional transparency into sources of risk and return and may provide a promising avenue for potential positive risk-adjusted returns as compared with traditional factors. The sentiment factor is also mired with a high turnover, indicating that the factor may not be investable from a managed fund perspective. We further analyzed the performance of sentiment factors on various time periods. We can conclude that the sentiment factor is a fast-decaying factor, and the alpha-generating potential depletes quickly as we start looking at longer time periods. Given the shortcomings with the news sentiment factor, there are significant benefits with screening negative news sentiment from popular style factors. Most of this

can be attributed to the short-term reversal due to investor focus on the latest news rather than understanding the bigger picture.

In the current paper, we only explored the sentiment factor constructed as a ratio of positive/negative news sentiment scores. The current factor can be extended to account for momentum of news events considering the number of news articles. As part of the next series of work, we wish to explore other sub-theme event categories within news sentiment data as earning surprise, credit events, and so on. While the current paper focused on equity as an asset class, we can also extend the analysis to other assets.

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About Morningstar Quantitative Research

Morningstar Quantitative Research is dedicated to developing innovative statistical models and data points, including the Morningstar Quantitative Rating, the Quantitative Equity Ratings, and the Global Risk Model.

For More Information
+1 312 244-7541
lee.davidson@morningstar.com

22 West Washington Street
Chicago, IL 60602 USA