Extracting Macro Insights from Digital Media

State Street MediaStats’ Indicators® provide a timely measure of media sentiment drawn from hundreds of thousands of curated, unstructured data sources.

Over the past five years, we have found that this source of data can generate timely insights into the performance of foreign currencies and global equity indices.

This real-time pulse of broad media sentiment enables investors to evaluate the impact of online chatter, including the impact of unusual media coverage and the degree of disagreement in opinion.

Trust one’s instinct regardless of the facts in front of them may not be rational—and making an impulsive decision because they are feeling a certain way is not rational either. However, people make decisions based on their instincts all the time—and the stock market is no exception. Indeed, aggregating news articles and social media posts, and labeling them as positive or negative can shed light on how the general public feels about a certain stock, currency or country—and then, in turn, help anticipate purchasing behavior.

Gauging the Market Mood

Behavioral economists have long advocated that investor perceptions affect markets in predictable ways. What if we could measure market sentiment in real time? What if we could detect patterns as they evolve dynamically—rather than in hindsight? And we can, today. State Street MediaStats’ suite of macro indicators filters news for financial trading relevance, and then plugs the signals into proprietary models that gauge the volume, tone, and dispersion of news. We generate daily scores that help investors understand whether people are feeling good or bad about an individual stock, foreign currency or country equity index. Our data are available in time series you can easily incorporate in your investment process—quantitative or qualitative.

Using Unstructured Data to Generate Insights on Macro Trends

As markets react rapidly to news, effective models that incorporate news data are highly sought after. Our research suggests that the amount of information investors receive about an asset, as well as the tone and dispersion of that information, impact their behavior and asset prices. Indeed, the methodology incorporated in our media indicators is based on an extensive body of research by its founding partners, Professor Ronnie Sadka of Boston College, Professor Emeritus Ken Froot of Harvard Business School, and Gideon Ozik, PhD.

The State Street MediaStats indicators use advanced technologies to gather, score and process thousands of news articles daily. However, not all news sources are equally created—or exert the same influence on asset prices. To sift through the media chatter, we correct for a variety of consistent biases discovered through years of academic research. For instance, our research indicates that when soccer player Rahim Sterling from premier league club Manchester City scores a goal, the Sterling tends to trade up. It is suspected that automated trading systems are bidding up the Sterling, not understanding the significant difference between the man and the currency.
Our proprietary algorithm corrects for a multitude of media biases

<table>
<thead>
<tr>
<th>Information Production Bias</th>
<th>Article Length Bias</th>
<th>Calendar Bias</th>
<th>Redundancy Bias</th>
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<tr>
<td>Some reporters specialize coverage to focus on select financial assets or topics and cover them with a consistent tone.</td>
<td>Shorter articles tend to exhibit more extreme opinions of certain financial assets and topics.</td>
<td>Reporters have regularly scheduled deadlines and topics, which dictate consistently what they cover and when they cover it.</td>
<td>Some sources simply redistribute news items without adding new content, contributing to the media’s echo chamber.</td>
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State Street MediaStats helps filter out similar noise by training machine learning algorithms to account for biases. Our algorithms are trained to know the difference between the man and the Sterling, but they also know to weed out a bias that might exist between Russia and a journalist who must generate coverage on the country every Thursday, even when new information content is lacking.

The Breadth of Our Offering

We deliver daily media-based scores for 44 global country equity indices and 33 foreign currencies.

For currencies and country equity indices, we publish the following indicators each day:

<table>
<thead>
<tr>
<th>Insight</th>
<th>Intensity</th>
<th>Sentiment</th>
<th>Disagreement</th>
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<tbody>
<tr>
<td>Intuition</td>
<td>The abnormal frequency of media coverage of a financial asset</td>
<td>The conditional tone of media coverage of a financial asset</td>
<td>The tone dispersion of media coverage of a financial asset</td>
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<td>• Lesser-covered assets are under-invested (underpriced) while overly-covered assets are over-priced</td>
<td>• FX: A currency’s media sentiment is positively correlated with market returns. Country Equity Indices: Optimism acts as a contrarian signal, when excessive optimism drives prices above intrinsic values, periods of high sentiment are followed by low returns, as market prices revert to fundamental values.</td>
<td>• FX: Risk-return tradeoff — investments in high disagreement currencies are riskier and earn higher expected returns than safer currencies. • Country Equity Indices: Short-sale constraint — if an investor believes a given country is overvalued, they do not sell the country short but rather sit out the market. Thus, the valuations of optimists will be reflected in a country’s price, leading to future underperformance.</td>
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The Media Indicators’ Key Advantages Include:

- Differentiated Investment Insights. Our research suggests that trends in media coverage correlate with forward returns, which may be useful for investment decisions.
- Breadth of Coverage. We scan thousands of media articles daily — and this number continues to grow. Our information spans many
distinct, reputable sources of media.

- **Noise Reduction.** Our proprietary technology provides a calibrated bias reduction. Our signals are pre-processed and ready for integration into the investment process.
- **Comprehensive Data Archive.** Our database dates back to 2013 providing ample history for signal backtesting.
- **Timeliness.** The media indicators are delivered daily, with a one-day lag.
- **Comparability.** The media indicators use a consistent statistical methodology through time and across securities.
- **Academic Rigor.** Our data scientists and researchers have decades of experience in developing quantitative signals.

**Frequently Asked Questions**

**Q. What is the intuition behind the indicators?**

**A. Intensity** is measured by the number of media articles that mention a particular asset above expectations. The motivation for this measure follows the theoretical work of Merton (1987)\(^1\). In his model, some investors are not aware of the opportunity of investing in certain assets (these are the neglected assets)—and therefore will not include them in their optimal portfolios. In equilibrium, the neglected assets are under-invested, thereby resulting in a low expected return for better-known assets relative to less-known assets. Using media coverage intensity of an asset to proxy for how well investors are familiar with it, we find evidence consistent with predictions, that is, high-intensity assets tend to underperform in the short term.

**Sentiment** measures the tone of the media coverage. We investigate the predictability of coverage sentiment across multiple dimensions. The magnitude depends on investment horizon and the type of sources. We adjust for a variety of biases, such as the redundancy bias and the fixed day-of-the-week effect, when constructing our sentiment measures.

A distinction between sentiment scoring of currency and other assets is that the former requires attention to trading conventions. For example, an article about the strength of the Japanese Yen may refer to the strength of the JPY or the weakness of the USDJPY currency pair. Our process adjusts accordingly.

**Disagreement** considers the dispersion in sentiment across media sources for a particular asset. This measure is motivated by the traditional risk-return tradeoff in the literature. It asserts that currencies for which there is high disagreement about fundamental value are riskier, and, therefore, demand high expected return. In contrast, for global equity markets, if an investor believes a given country is overvalued, they do not necessarily sell the country short, but rather sit out of the market. Thus, when accompanied by high disagreement, the valuations of optimists will be reflected in a

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country’s price, leading to future underperformance.

Q. How are the media indicators constructed?

A. We offer indicators in a variety of periodicities, more specifically 1-day, 7-day, 14-day, and 28-day indicators. Abnormal intensity and adjusted sentiment are produced with a one-day lookback period. Their respective 7, 14, and 28-day indicators represent the weighted averages (more recent observations are weighted more heavily than less recent) of the 1-day indicators over the respective lookback periods. 1, 7, 14 and 28-day disagreement indicators are calculated as the standard deviation of sentiment across the pooled set of articles for each country or foreign currency within the respective lookback period.

We do not standardize our macro indicators in the cross-section.

Q. How do you filter relevant articles for a given country? Take UK equities, for example: does the article need to mention FTSE100 or FTSE All-Share—or any other UK-based index?

A. We have built an in-house mapping scheme that includes major equity benchmarks for each country. We identify the articles relevant to each benchmark and pool per country. Therefore, the UK referenced here is represented by FTSE 100, FTSE 250, and FTSE 350.

Q. Do you incorporate any market data (e.g., price, volatility, etc.) in the indicator construction?

A. No market data are incorporated in indicator construction.

Q. What are the indicator units?

A. Our macro media indicators are constructed as follows:

1. Intensity is the difference (in logs) between (1+number of articles) and (1+expected number of articles), and hence the units are log of number of articles.

2. Sentiment is the difference between average daily sentiment across all relevant articles for a given country equity index or currency and the expected sentiment determined by our proprietary model. Empirically, the majority of articles are assigned scores between -5 and +5 (the distribution is continuous and unbounded).

3. Disagreement is the standard deviation of article sentiment, expressed in units of sentiment.

Q. What universes of securities do you cover?

A. Our proprietary technology to dissect news coverage has been leveraged across asset classes. In addition to our stock-level offering, we also track 44 global country equity indices, including ARG, AUS, BEL, BRA, CAN, CHE, CHL, CHN, COL, CZE, DEU, DNK, EGY, ESP, FRA, GBR, GRC, HKG, HUN, IDN, INL, IRL, ITA, JPN, KOR, MEX, MYS, NLD, NOR, NZL, PER, PHL, POL, PRT, RUS, SAU, SGP, SWE, THA, TUR, TWN, USA, ZAF.

Our currency universe comprises of ARS, AUD, BRL, CAD, CHF, CLP, CNY, COP, CZK, DKK, EGP, EUR, GBP, HUF, IDR, ILS, INR, JPY, KRW, MXN, MYR, NOK, NZD,
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Q. Why is the US Dollar not scored?
A. We score foreign currencies against the US Dollar and therefore we do not score the USD. Additionally, the HKD (Hong Kong Dollar) and the SAR (Saudi Arabia Riyal) are pegged to the USD and are not provided in the currency set although they are both included in the country equity set.

Q. What data sources are reflected in your indicators?
A. The panel of sources from which articles are collected is large, allowing for a diversity of opinions; some 10,000 individual sources from 73 countries contribute to our panel. Each news article is classified into one of 10 source types (General, Local General, Local Business, News Services, Industry, International, Business or Investing, company communications, Other, and Unmapped).

Q. Are any articles sourced in languages other than English?
A. No, we are scoring English-language articles only.

Q. How do you weigh the relevance of individual media sources or articles?
A. We have chosen an equal-weighting scheme when aggregating the daily media scores. The implicit assumption is that each news article has equal importance.

Q. When are indicators available for trading?
A. The media indicators are published with a one-day lag. Therefore, Wednesday's indicator values become available to investors Thursday morning, before market open. We track media-related data around the clock, and therefore our indicators also provide Saturday and Sunday values across asset classes, where applicable.

Q. When was the methodology for the indicators finalized?
A. The methodology for the global equity indicators was finalized in March 2017, and the one for foreign currencies—in March 2018.

Q. Can we access your raw data?
A. We cannot resell data from individual sources and thus are unable to provide the raw data to investors.

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