

Event-Driven Trading and the "New News"

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We know that news can move markets. An example in the fall of 2008 shows how truly unexpected news can impact prices dramatically. At 1:37 a.m. EDT on Sunday, September 7, 2008, Google's newsbots picked up a 2002 story about United Airlines possibly filing for bankruptcy. Apparently, activity at 1:36 a.m. on the website of the *Orlando Sentinel* caused an old story to resurface on the list of "most viewed stories." In Orlando, in the middle of the night, with Mickey sound asleep and Gatorland closed, a single viewing of the story was enough to do this and attract the attention of one of the newsbots that populate Google's news database. In a cascade of errors, the story was picked up by a person, who, failing to notice that the date on the story was six years gone, put it on Bloomberg, which then set off a chain reaction on services that monitor Bloomberg news. This remarkable ability of the Internet to disseminate "news" resulted in the stock of United's parent, UAL Corporation, dropping 76% in six minutes, with a huge spike in volume, as Exhibit 1 shows.

Little news is this dramatic, even when current and true. Stories that refer to stories about past price moves, which have reverted, yield no alpha. Profitable news-driven event trading requires gathering information from the right sources, "textual events," that include

news and assigning quality "metadata" (data about data) to filter that information.

NEWS TRADING

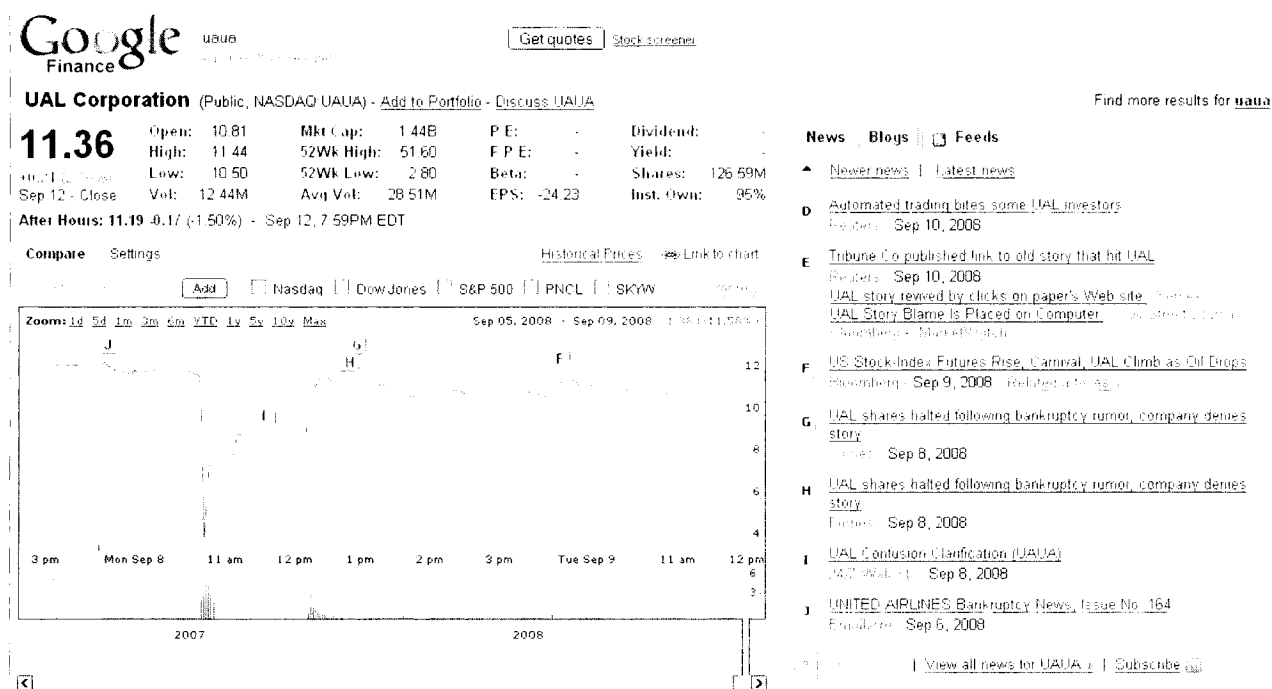
Early forms of electronic news trading tended toward easily quantifiable news involving a single number such as scheduled economic and industry data releases (e.g., imports and housing starts). Computers were barely needed at first; speed wars started when machines got to the buy and sell keys before the fingers. These effects are still observed at ever-higher frequencies (Lo and Healy [2009]).

Conventional wisdom was "buy on the rumor, sell on the news." News would be impounded in prices before it was released publicly. Academic research arguably confirmed that view. But news is changing. Mainstream news organizations have dramatically revised the way they operate, selectively adopting search engine and natural language technology along with globally sourced "wetware" (people) to fill in the gaps. News isn't what it used to be. Volume, breadth, depth, and frequency have increased by hundreds of percent in a short time. Investors have access to similar technologies to add their own globally sourced information, ranging from private research to social media.

The revolution in language technology spawned by the Internet—spiders, crawlers, scrapers, classifiers, and translators—is

EXHIBIT 1

News Moves Markets: UAL Corporation on September 7, 2008, as Old News Rises from the News Crypt



reflected in the analytics and metadata (data about data) that accompany modern news and textual feeds. Detailed topic codes, taxonomies, and entity extraction abstract important aspects of events into data. News analytics measure the relevance, sentiment, relationships, and novelty of news. Das [2010] provided an excellent survey of the relevant technologies.

Prior research (and commercial practice) has demonstrated how signals from these analytics are predictive of volatility and volume. In this article, we extend the approach to the harder problem of predicting returns.

To do this, we constructed filters using Thomson Reuters News Analytics that combine news traffic metrics with metadata (including sentiment, relevance, and novelty) to produce exploitable alpha signals for portfolio management. They were designed using a novel interactive visual Event Study Explorer, which we describe in this article.

A Pure Out-of-Sample Test

All work of this sort runs a risk of data mining (Leinweber [2007]). We have used a practice that we

hope will become common. We sequestered the model for nine months (until the next conference) and made no changes to the code. Then we ran the model on the unseen news data and simulated trading, with costs, on unseen prices. The alpha for the subsequent period (i.e., the first three quarters of 2010) exceeded 10%. The portfolio, driven purely by the news analytics, was volatile because essentially no risk control or constraints were imposed. Actual managers would certainly use both.

We identify three noteworthy, if not entirely unexpected, observations. First, we see the classic trade-off of the number of signals and their size. Second, the negative sentiment signals are more exploitable. Third, stronger effects are observed for mid- and smaller-capitalization stocks than for intensely followed “mega-cap” names at the top of the indices. This is likely a behavioral *attention hypothesis* effect, which makes common sense. Many more eyes and ears hover around all things pertaining to Apple than to, for example, the thousands of less glamorous firms outside the mega-cap zone which show slower rates of information efficiency.

Relating News Analytics to Stock Returns

With speculation that old quant ponds may become “overfished,” the pack moves on. Textual information is promising new hunting territory. Extensive background in this area can be found in the book *Nerds on Wall Street: Math, Machines and Wired Markets*, in particular, in chapter 9, “The Text Frontier” (Leinweber [2009]).

Bill Gross of PIMCO described equity valuation as “that mysterious fragile flower where price is part perception, part valuation, and part hope or lack thereof.” An old Wall Street proverb says, more tersely, “Stocks are stories, bonds are mathematics.” This has enough truth in it that looking for the right stories is a worthwhile activity. Modern newsfeeds facilitate technology-intensive methods in that activity. News gathering is increasingly supported by automation that monitors a large and growing subset of the web and information in proprietary databases. There are plenty of places to find potentially investment-relevant text. The longer version of this article used four broad classifications; the first two are

1. *News*. News was once exclusively disseminated on paper, radio, television, “wire,” fax, and eventually via dedicated electronic feeds. It is now ubiquitous on the web, and news vendors have moved dramatically upscale with richly tagged news suitable for “quantextual” investment and trading strategies.
2. *Pre-news*. Pre-news is the raw material reporters read before they write news. It comes from primary sources, such as the Securities and Exchange Commission (SEC), courts, and other government agencies, and also includes corporate sources, reputable blogs, and specialized news.

Social media, such as Twitter, are in the second group. Some tweets tout specific stocks. It is reported that rapper 50 Cent made a great deal more than 50 cents after a stock recommendation on Twitter. A \$40 million U.K. hedge fund has been announced (Strachan [2011]) based on models developed with the authors of an academic paper, “Twitter Mood Predicts the Stock Market” (Bollen, Mao, and Zeng [2011]). They predicted daily returns on the DJIA based on eight dimensions of “mood states”: “Positive” and “Negative,” the old standbys, plus “Calm,” “Alert,” “Sure,” “Vital,” “Kind,” and “Happy,” based on a Google Profile of Mood States. Fans of the

Asimov science fiction classic *Foundation Trilogy* may recognize much of this.

Firms crawl to locate pre-release news sections of corporate and news websites, and then produce a new literal form of “extreme pre-news” by grabbing it first. News releases, such as earnings, are kept *some-where* before they are public. Mix in security holes, and enterprising IA-enhanced “reporters” can find them, apparently legally.

PREVIOUS WORK ON NEWS AND PRICES

Behavioral Basis

How investors and traders respond to news is of ongoing interest in behavioral finance. Ideas of attention and repetition, well known in advertising, have been explored in previous work. There is a substantial amount of prior research in this area (Mitra and Mitra [2011]).

Chan [2003] compared return patterns for stocks with and without news, and found major differences between the two sets. These differences persist even when earnings-related news (a traditional quant analytic) is removed. Consistent with expectations based on investor attention, these effects are larger for smaller-capitalization firms, an effect also seen in our results.

Broad Long-Period Analysis of the Relation between News and Stock Returns

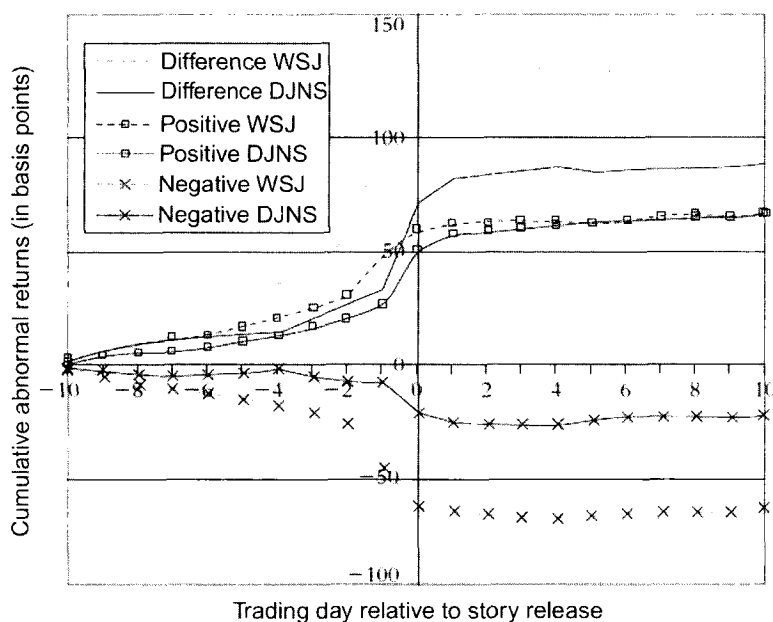
In a study that was first published in 2006, Tetlock, Saar-Tsechansky, and Macskassy [2008] looked at more than 350,000 news stories about S&P 500 companies that appeared in the *Wall Street Journal* and on the Dow Jones News Service from 1984 to 2004. They used a massive program called the General Inquirer to gauge the sentiment of these stories. The General Inquirer is the result of over 25 years of research sponsored by the U.S. National Science Foundation and the British and Australian National Research Councils.

Tetlock and his co-authors scored 350,000 stories, containing over 100 million words, for positive or negative sentiment using the General Inquirer, and summarized the results in an event study chart showing abnormal returns to stocks with positive and negative stories. The chart is shown in Exhibit 2.

These event studies aggregate the results over 20 years (1984–2004). The vertical line in the center of

EXHIBIT 2

Twenty-Year News Event Studies for the S&P 500, 1984–2004



Note: WSJ is the Wall Street Journal and DJNS is the Dow Jones News Service.

Source: Tetlock, Saar-Tsechansky, and Macskassy [2008].

the chart indicates the date the story appeared. The dates shown extend 10 days before and after the news, showing substantial pre-event returns. The sentiment measures appear to work very well. Positive sentiment lines all go up and negative sentiment lines all go down. More problematic is a huge amount of what first appears to be pre-event information leakage. In this example, we see what appears to be close to 90% of the return occurring prior to, or to the left of, the event line. Efficient market hypothesis fans might say we told you so, but that is not the full story here. A substantial portion of this behavior is likely occurring due to the categorization of “me too” stories, referring to the original good or bad news and after-the-fact reporting that “the stock moved up sharply on good news that...” This is an example of the need to consider textual events in context with other events, rather than as autonomous stand-alone events.

At first look, it also paints a somewhat discouraging picture for those who might trade blindly on news characterization—by the time you read it and trade, there’s not much left to be had. The Tetlock, Saar-Tsechansky, and Macskassy [2008] simulated “long on good news,

short on bad news” trading strategies did show simulated profits, but only with extremely low transaction costs (9 basis points); much reporting of actual institutional transaction costs, including commissions and market impact, show one-way costs in the typical range of 25 to 50 basis points (bps). This means that either better quality or filtering of news, or both, is needed for a profitable real-world strategy.

Our efforts in this area are reported here. In comparison with Tetlock, Saar-Tsechansky, and Macskassy [2008], we used a broader investable universe (the S&P 1500 instead of the S&P 500). The period we used, from 2003 to 2009, is fully in the web era with modern dissemination of investment information, so there is no mix of pre- and post-web effects. We also had news tagged with a much richer set of metadata than was used in the earlier study. The next section describes the Reuters news dataset that is the basis for our research.

News Data Structure and Characteristics

We are using data from the Thomson Reuters NewsScope Sentiment Engine (RNSE) that was developed with Infonics/Lexalytics. This product has been renamed Thomson Reuters News Analytics (TRNA).

These data have a variety of desirable features:

- Broad and deep survivor bias-free historical coverage currently with over 7,000 U.S. stocks going back to 2003 for contemporaneous S&P 1500 stocks. Global coverage allows extension to international markets.
- Real-time availability and accurate synchronized pricing data that uses Reuters Instrument Code (RIC) security identifiers to match the news and price data
- Rich metadata including sentiment, relevance to a stock, topic codes, and links to previous related stories, as illustrated in Exhibit 3. Sentiment and relevance are quantitative scores based on qualitative information. Relevance measures the degree to which the news item is about a given company (e.g., a sector story mentioning many firms would have lower relevance for any one of them compared

EXHIBIT 3

A Sample of Thomson Reuters News Analytics Data

Date Time	RIC	Relevance	Sentiment	Positive	Negative	Neutral	Linked Counts	Item Type	Headline	Topic Codes
1/16/09 12:50	IBM.N	100.00%	1	80.68%	5.59%	13.73%	0,0,1,1,1	ARTICLE	Korea Exchange Bank Card Completes Migr	DPR US LEN
1/16/09 15:40	IBM.N	50.00%	0	18.01%	23.07%	58.92%	0,2,5,6,8	ARTICLE	NYSE ORDER IMBALANCE <IBM.N> 260000 SHAR	US LEN RTRS
1/16/09 15:40	IBM.N	100.00%	0	5.93%	1.62%	92.45%	0,2,5,8,10	ARTICLE	NYSE International Business Machines Cor	BACT CORA DPR STX US LEN RTRS
1/16/09 15:50	IBM.N	50.00%	0	18.01%	23.07%	58.92%	1,1,5,7,7	ARTICLE	NYSE ORDER IMBALANCE <IBM.N> 156100 SHAR	US LEN RTRS
1/16/09 15:50	IBM.N	100.00%	0	5.93%	1.62%	92.45%	1,2,6,9,9	ARTICLE	NYSE International Business Machines Cor	BACT CORA DPR STX US LEN RTRS
1/16/09 17:42	IBM.N	12.04%	-1	5.63%	81.61%	12.76%	0,0,0,0,0	ARTICLE	Wall St Week Ahead-Obama, earnings to ca	BUS ENT US FOD LEI MAC JP ELI ASIA PHAG
1/16/09 17:43	IBM.N	11.79%	-1	5.63%	81.61%	12.76%	1,1,1,1,1	APPEND	Wall St Week Ahead-Obama, earnings to ca	BUS ENT US FOD LEI MAC JP ELI ASIA PHAG
1/17/09 1:49	IBM.N	100.00%	-1	7.46%	56.16%	36.38%	0,0,0,0,0	ARTICLE	IBM buys \$16 mln stake in China Sichuan	CN EMRG ASIA CELE MUL APL ITSE DPR HDWR
1/17/09 2:55	IBM.N	50.00%	0	18.01%	23.07%	58.92%	2,2,6,8,8	ARTICLE	NYSE ORDER IMBALANCE <IBM.N> 156100 SHAR	US LEN RTRS
1/18/09 4:02	IBM.N	50.00%	0	18.01%	23.07%	58.92%	0,0,5,8,9	ARTICLE	NYSE ORDER IMBALANCE <IBM.N> 156100 SHAR	US LEN RTRS
1/18/09 10:36	IBM.N	12.04%	-1	5.63%	81.61%	12.76%	0,0,2,2,2	ARTICLE	RPT-Wall St Week Ahead: Obama, earnings	BUS ENT US FOD LEI MAC JP ELI ASIA PHAG
1/18/09 13:32	IBM.N	100.00%	0	20.69%	1.16%	78.15%	2,2,2,4,4	ARTICLE	BRIEF-IBM, RIM plan to introduce new lot	SFWR HDWR US DPR ITSE SWIT TECH CA COMS
1/19/09 0:12	IBM.N	50.00%	0	18.01%	23.07%	58.92%	0,1,4,8,10	ARTICLE	NYSE ORDER IMBALANCE <IBM.N> 156100 SHAR	US LEN RTRS
1/19/09 8:52	IBM.N	100.00%	0	23.64%	14.66%	61.70%	0,0,0,0,0	ALERT	SKYPE SAYS WILL INTEGRATE SKYPE FUNCTION	CYCS INCA SHOP BUS US RET LEN RTRS ITSE
1/19/09 8:54	IBM.N	100.00%	0	21.94%	16.85%	61.21%	1,1,1,3,3	ARTICLE	BRIEF-Skype, IBM collaborate on Lotusliv	CYCS INCA SHOP BUS US RET LEN RTRS ITSE
1/19/09 9:00	IBM.N	7.91%	0	17.84%	1.34%	80.82%	0,0,0,0,0	ARTICLE	Irislnk Corporation Migrates Leopold Ke	DPR US LEN
1/19/09 10:09	IBM.N	10.54%	-1	11.03%	69.88%	19.09%	0,0,0,0,0	ARTICLE	INTERVIEW-Nokia says new mobile email of	FI NORD EUROPE WEU WWW COMS ELC TEL
1/19/09 11:00	IBM.N	100.00%	1	82.08%	4.72%	13.19%	1,1,1,1,1	ARTICLE	IBM Helps Businesses Build a Smarter Wo	DPR US LEN
1/19/09 11:00	IBM.N	100.00%	1	82.11%	4.71%	13.18%	1,1,1,1,1	ARTICLE	IBM, RIM Mobilize Business With Lotus S	DPR US LEN
1/19/09 11:01	IBM.N	100.00%	1	83.85%	3.72%	12.43%	2,2,2,2,2	ARTICLE	IBM Lotus Introduces New Portfolio of I	DPR US LEN

to a single-company story). Sentiment analyzes text for positive, neutral, and negative language; quantifies scores for each; and determines the prevailing sentiment of the article. The link counts are a novelty score. They measure repetition among articles and the number of similar articles on a company. Comprehensive metadata includes company identifier, topic codes, item type, and stage of story.

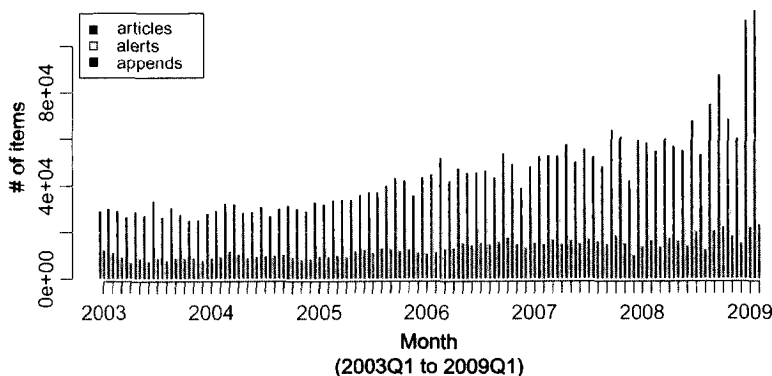
Evidence of Dramatic Change in the News Process

Starting in approximately 2003, Thomson Reuters undertook an extensive modernization of its news process. It exploited very effectively the ideas of intelligence amplification (IA) that allow people to work well with machines. A new technology center in Mumbai systematically used modern web-based information retrieval methods to harvest and present a growing stream of primary source information (what we call pre-news) to a new class of “electronic reporters,” who can quickly pull an item out of the stream, put it in news format, apply metadata for sentiment and tags, and quickly put it on the feed. The same technology was used in newsrooms in New York and London.

EXHIBIT 4

Volume of Thomson Reuters News Items for S&P 1500 Stocks

All RICs: Tally of item types by month



Note: RIC is Reuters Instrument Code, a stable security identifier.

News statistics show that this combination of hardware, software, and wetware functioned together impressively. Operational deployment of these technologies increased rapidly starting in 2006. Exhibit 4 shows over a fourfold increase in monthly count of news items as the systems were adopted.

Similar dramatic increases are seen in the depth of coverage as measured by the number of news items per stock shown in Exhibit 5.

There is also dramatic improvement in the breadth of the news coverage. Many more of the stocks in the

EXHIBIT 5

Depth of Thomson Reuters News for S&P 1500 Stocks Measured by Number of News Items per Stock per Month

S&P 1500: Average number of items of each type per RIC, per month

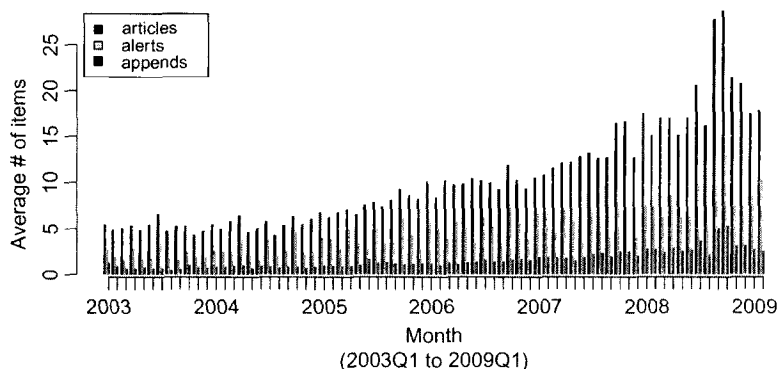
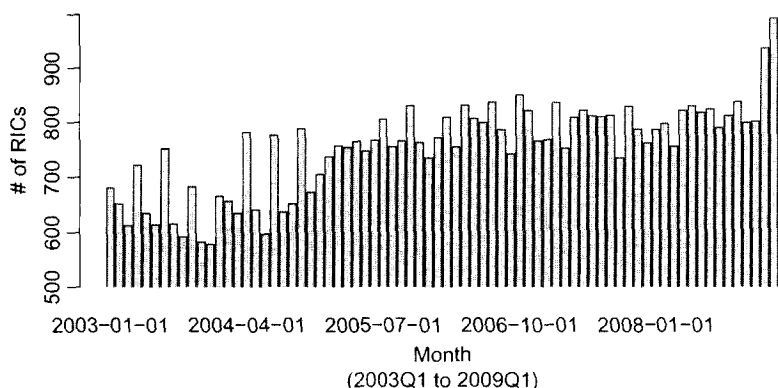


EXHIBIT 6

Breadth of Thomson Reuters News Coverage of S&P 1500 Stocks Measured by Number of Firms with News Each Month

S&P 1500: Monthly tally of RICs for which there is at least one news item in the RNSE archive



S&P 1500 universe appear in the news, which is particularly important in light of other results that show news signals are increasingly valuable as capitalization class is lowered. Exhibit 6 shows the marked improvement in breadth, an approximate doubling of coverage.

Exhibits 4–6 are traffic measures. They include all stories with the full range of sentiments from strong positive to strong negative. The history of the net positive minus negative news sentiment over those often turbulent years is shown in Exhibit 7, an intuitively satisfying picture of the overall sentiment of the news

in that period. The sentiment analytic had the same reactions as most investors.

Refining News Analytics

Event studies are an excellent means of screening for potential alpha. Positive event study results are a necessary (but not sufficient) condition for being able to deliver net alpha in real portfolios. We began our systematic screening of events using news analytics. We were able to set and vary thresholds (both absolute and relative) based on

- *News intensity*: number of news items in a period
 - We tested minimums of one and two items
- *Relevance*: Applicability of the items to a particular stock (0%–100%)
 - Set at greater than 60% based on reading items
- *Sentiment*: Probability that a story is positive, negative, or neutral in tone
 - Set at extreme 5th and 10th percentiles of prior daily distribution
- *Novelty*: Measured by number of links to previously related items by time
 - Require all link counts have to be zero for novelty

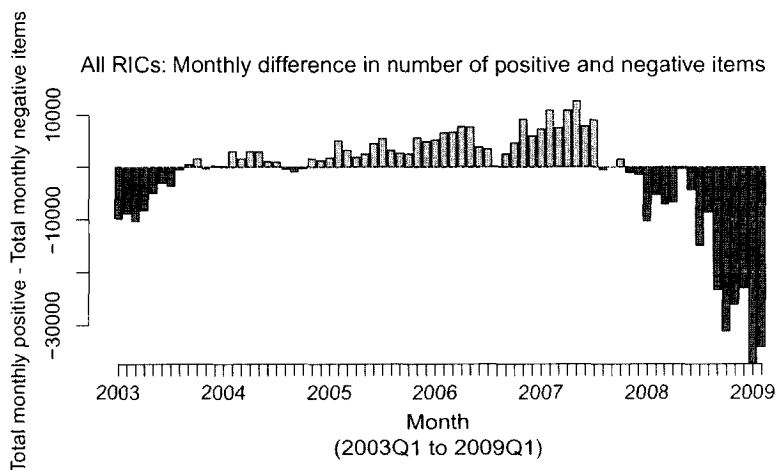
The time period for the event studies discussed here is 2003–2008 with a universe of stocks based on the contemporaneous S&P 1500 over the period. Industry classifications use Thomson Reuters Business Classification (TRBC) sectors. These studies use a daily frequency. The return intervals examined extend out to 60 days.

The news accumulation and trading times used here measure a “day” for news events as a 24-hour period from 3:30 p.m. the previous day to 3:30 p.m. on the current day. Positions used for calculating the returns in the event studies are assumed to be taken as the closing price on the current day, and subsequent returns are also based on closing prices.

These studies are based on “pure news” signals so as not to cloud the issue of where any alpha came from, as are all the news results described here.

EXHIBIT 7

Net News Sentiment, 2003–2009



EVENT STUDY RESULTS

Our first event study was very simple and broad, designed to compare with Tetlock, Saar–Tsechansky, and Macskassy’s [2008] earlier result (shown in Exhibit 2). Our first event study is shown in Exhibit 8 and is very similar to the previous result. In both, the positive sentiment lines (the upper virtual “green” line shown as black) are consistently above the negative sentiment lines (the lower virtual “red” line shown as gray) lines. Timeliness is still an issue with the preponderance of returns observed pre-event. The sentiment signal gets

the direction right, but most of the price move precedes the event. The story day is at the vertical dashed line, and returns are seen 20 days before and 60 days after. Very similar effects are seen in international markets: the U.K., France, Germany, Japan, and Hong Kong.

A reasonable question involving news is, so what is really new? Many stories linger on. Filtering by novelty can be done using the link count metadata, which applies stronger volume filters, and is shown in Exhibit 9. Novel news (with all link counts at zero) is unrelated to previous news, and as expected, shows a much larger potential alpha. Excess return spreads shown in event studies depend on timing, a consideration addressed in the event visualization tool shown in Exhibit 11 in the next section.

Segmentation by sector is a common method in quantitative modeling, which we also apply to news filter design. We segment by sector and observe notable differences. In general, more stringent filters reduce the number of events, but are associated with larger excess returns.

The best sectors for this approach were found to be basic materials, cyclicals, financials, industrials, non-cyclicals, and technology. The event study for financials is shown in Exhibit 10. The small inset table shows the effects of adjusting the item-count threshold, which results in fewer, but larger events.

EXHIBIT 8

An Updated Low-Threshold Event Study Similar to the Tetlock, Saar–Tsechansky, and Macskassy [2008] Observations

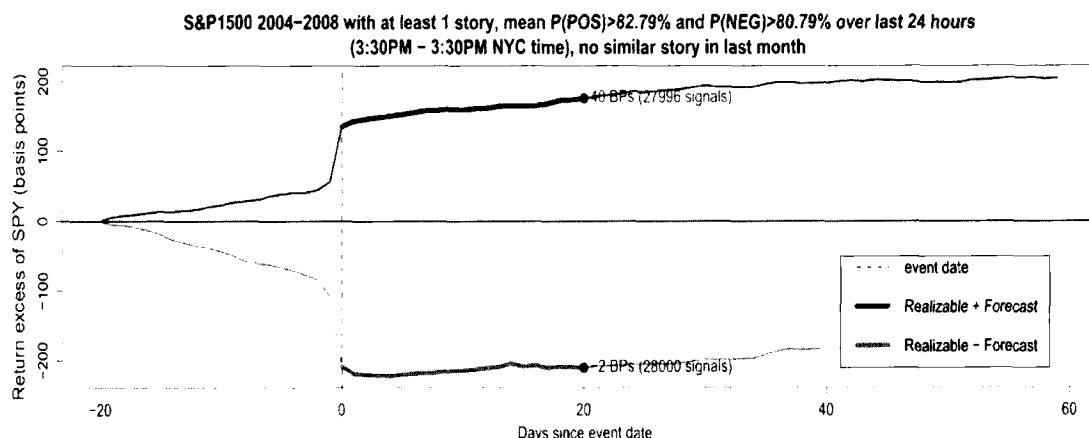


EXHIBIT 9

Stronger News Analytic Filters Show More Potential Alpha

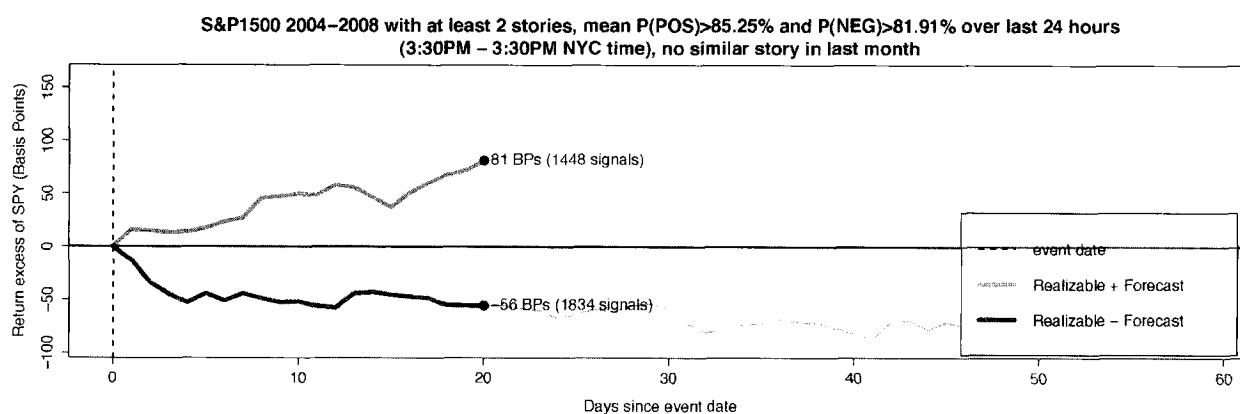


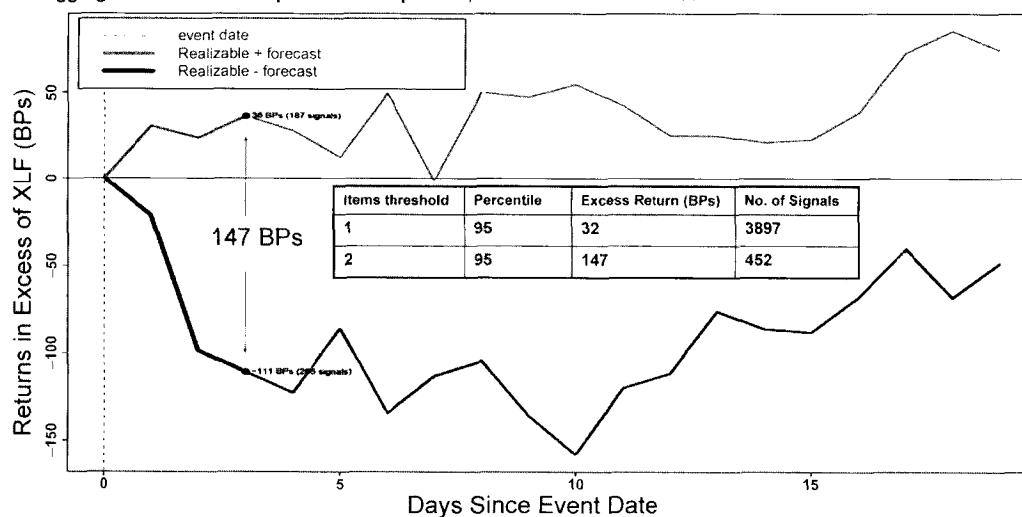
EXHIBIT 10

Financial Sector News Event Study, S&P 1500, 2003–2008

Event Study 4:

FINANCIALS (S&P1500) 2003-2008, ≥ 2 items, P(POS) & P(NEG) in 95th percentile, linked counts 1-5=0

Aggregation window: 3:30pm EST – 3:30pm EST; Position initiated at close



Event Studies on Steroids: Modern Interactive Visualization and Data Exploration

Many ways exist to slice and dice event studies, and for advanced content-based filters, the ability to drill down to individual news events is desirable.

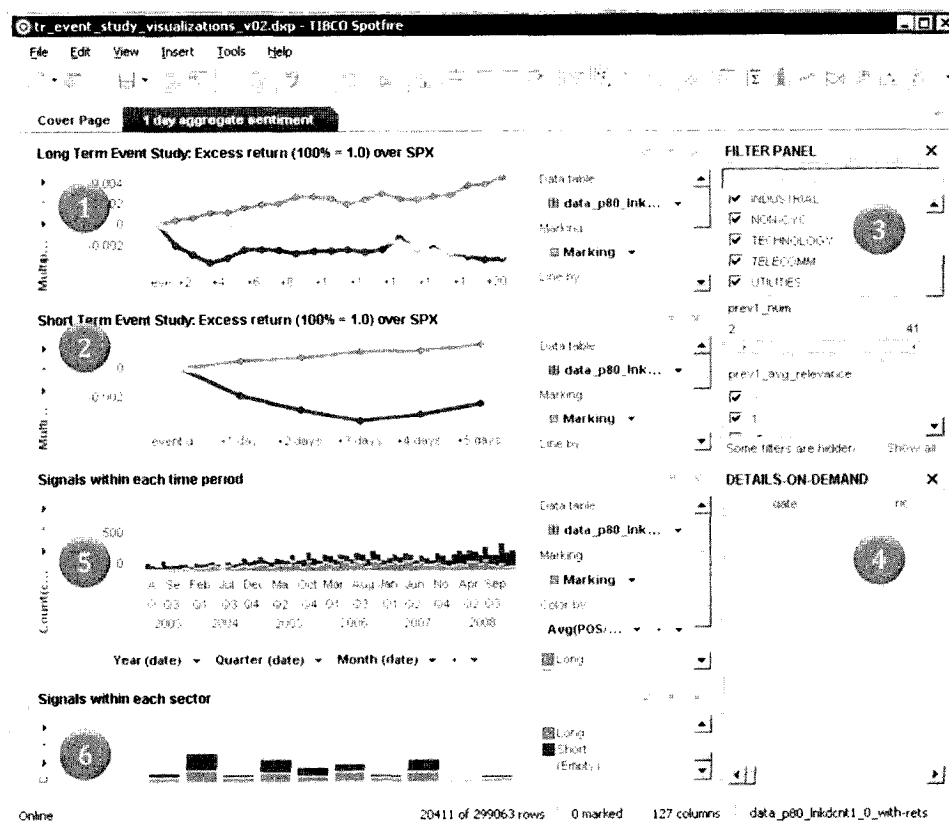
Event studies, such as these, raise additional questions: Are the results stable over time or dependent on

a few periods or sectors? What do we observe about the behavioral expectation that these effects will be larger for lower-cap firms? It is easy to drown in event studies. Therefore, we developed the Event Study Explorer, an interactive visualization research system for news analytics.

As with language, the technology for computer-assisted quantitative research has come a long way. Tukey [1977] illustrated the ideas of visualization with line-printer

EXHIBIT 11

The Event Study Explorer Solves or Reduces Many Problems with Event Studies



ASCII graphic charts, and Tufte [1997, 2001, 2003] has a near cult-like following in this area for good reason. His book titles describe his work well: “The Visual Display of Quantitative Information,” “Envisioning Information,” and “Visual Explanations.”

These ideas were greatly advanced as computational tools over many years of research at the Human Computer Interface Lab (HCIL) at the University of Maryland. Many of the HCIL innovations are described by Schneiderman and Plaisant [2009]. Their website contains video reports going back to the 1990s with ideas that have since spread and mutated as innovative visualizations “beyond the bar chart.” One example is the Map of the Market (Smartmoney.com [2011]), and another is the Spotfire visualization tool (Tibco [2011]) that we used to build the Event Study Explorer, shown in Exhibit 11.

The visual interactive Event Study Explorer addresses many of the complaints about event studies. It shows the distributions in calendar time and along multiple dimensions. It allows great flexibility in filter

selection parameters, study period, sector, capitalization, and pre-event return. It provides the ability to drill down to news content as the basis for further natural language processing (NLP) or machine learning (ML) filtering. The researcher can consider the subsequent cumulative return for specific subsets of events. Events can be subset by time period, firm, sector, market capitalization, or attributes of the news. Due to a large precalculated database, the Event Study Explorer is easily configured with no programming required. The specific components to accomplish this are tagged with numbers in circles in Exhibit 11 and are as follows:

1. *Long-term event study view:* The one-quarter excess return of the current subset of positive and negative events
2. *Short-term event study view:* The one-week excess return of the current subset of positive and negative events

3. *Event filters*: Allows the researcher to dynamically choose for which events she would like to see subsequent excess return calculations
4. *Details on demand*: The user selects a subset of events (e.g., by clicking on the sentiment event line in one of the event study views) and the details for these event days are displayed
5. *Signal counts by period*: Display evaluates consistency over time, including any subperiods selected
6. *Signal counts by sector*: Display shows the subset of events distributed across sectors

INFORMATION EFFICIENCY AND MARKET CAPITALIZATION

An interesting question to investigate using the Event Study Explorer is the relationship between firm capitalization and the market response to news. A reasonable prior is that smaller-capitalization firms with less intensive news coverage would show greater response to extreme sentiment news events. Exhibit 12 overlays

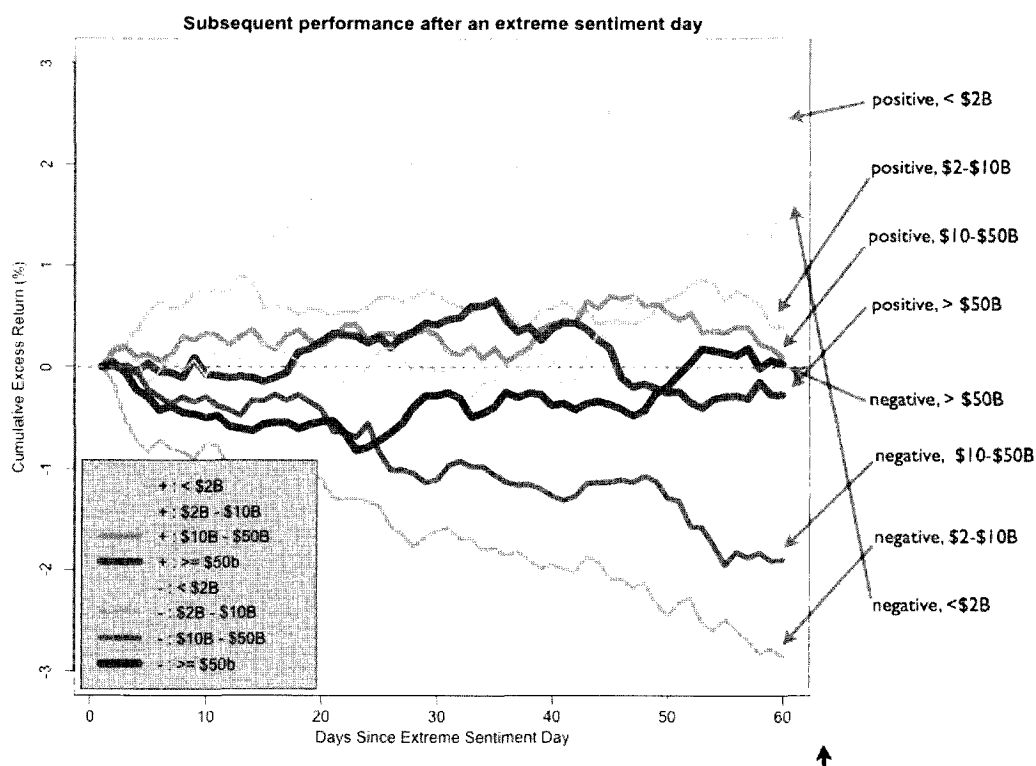
the event study charts, which are segmented into four capitalization groups: Megacap ($\geq \$50$ billion), Large Cap ($\$10$ – $\$50$ billion), Midcap ($\$2$ – $\$10$ billion), and Small Cap ($< \$2$ billion). The news analytic filter was at least two items in 24 hours, 5-day link count equal to zero, and sentiment in top/bottom of 5%.

The excess returns for each group, for both positive and negative events, are shown on the vertical “Cumulative Excess Return” axis, relative to the S&P 1500, scaled at $\pm 3\%$. The post-event period on the horizontal axis is on a 60-day time scale. We found this chart quite striking, showing evidence of long-lasting exploitable alpha signals over periods that allow accumulation of substantial institutional positions.

This conforms strongly to expectations based on behavioral ideas. As seen on the right side of Exhibit 12, seven of the eight sentiment/cap-classed pairs arranged in exact order might be expected, with the thicker (high-cap) event lines showing lower alpha than the thinner (lower-cap) lines. The one exception is negative news for the smallest-capitalization group, which actually goes up. For positive sentiment events (virtual

EXHIBIT 12

Event Studies by Capitalization Class for the S&P 1500, 2003Q1–2009Q3



“green” lines), the lowest-cap group shows a –3% excess return over 60 days.

PURE NEWS-DRIVEN PORTFOLIO SIMULATION

Event studies are screening methods that show potential value in “event time” in contrast to portfolios which are managed in “calendar time.” We simulate a portfolio driven solely by news event data using extreme sentiment days to generate the trading signals. We expected (and found) volatility. No other signals were used to shed light on the question of whether portfolio construction techniques using only news data can outperform.

The investment hypothesis under consideration is that it takes market participants a long time (days) to process a large amount of novel, strongly polar news, particularly outside of the mega-cap names. News and event ambiguity, fact validation, accumulation, and cognitive dissonance are all good reasons to hypothesize that investors can take a longer time to process new information. Behavioral response to information is being observed here. Ideas of herding, cross-validation, overreaction, underreaction, and attention all come into play.

Portfolio Construction and Simulation Rules

For this simulation, we consider an extreme sentiment day for a specific security in the S&P 1500 to be

one on which there were at least four novel news items on the RNSE feed prior to 3:30 p.m. NY time. They were filtered to be the top 5% of average daily positive or negative events. We restricted our investable universe to securities in the technology, industrials, health care, financials, and basic materials sectors. We assumed daily portfolio rebalancing, entering and exiting positions at the market close.

Positions were held for 20 days subject to a stop-loss rule set at 5% and a profit-take rule set at 20%. We did not constrain the portfolio to be dollar or beta neutral. Any single position was constrained to a maximum of 15% of NAV. Transaction costs were simulated at 25 bps of slippage and for commission on the combined entry and exit of each position.

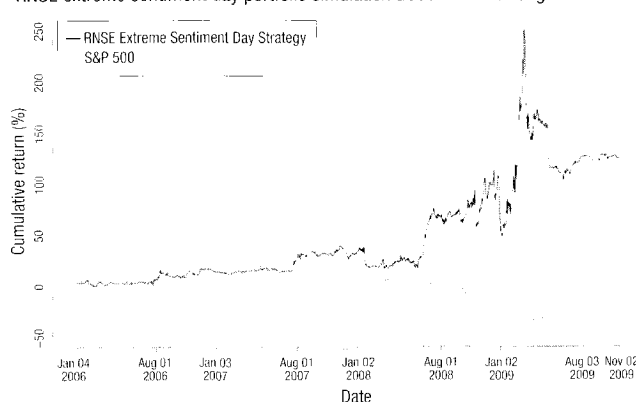
Performance

The extreme sentiment portfolio’s simulated performance is shown in Exhibit 13. It shows extreme volatility between October 2008 and July 2009, but also performs extremely well in that period. The largest alpha events clustered, generating the steps seen in the left panel. A caveat applies to these results: many of the alpha spikes are due to returns on short positions during the financial crisis, a period when it was difficult (and for a portion of time, for financials, prohibited) to take these positions. Alpha is also present, however, in the pre- and post-crisis periods, and importantly, in the out-of-sample test in 2010.

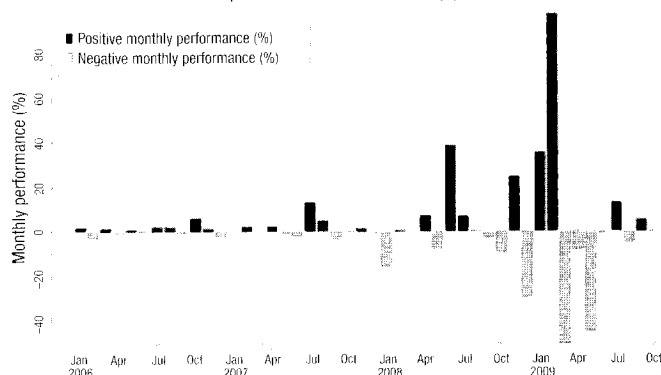
EXHIBIT 13

Cumulative Performance of the News-Driven Portfolio in Left Panel, and Monthly Performance in the Right Panel

RNSE extreme sentiment day portfolio simulation 2006-01-01 through 2009-11-01



RNSE portfolio simulation: Monthly performance



The maximum drawdown of about 60% occurred between February 2009 and July 2009. The strategy was profitable in 24 of 46 months, or about 52% of the time. The mean monthly return was 1.74%, which was 11% in winning months and -8.7% in losing months. The monthly chart in Exhibit 13 shows a serial correlation pattern.

Alpha from a News Technology Makeover?

A striking similarity exists between the time when the news sentiment portfolio produces substantial alpha and the time that the improvements in the Thomson Reuters news process are deployed. These changes were described earlier in this article and are illustrated in Exhibits 4–6. This is seen clearly by aligning the time axis for those spikes in news volume, depth, and breadth with the portfolio performance, shown in Exhibit 14. This aligns the news improvement data from Exhibit 4 with the portfolio performance of Exhibit 13. There are clearly two regimes in each. In a pleasant coincidence,

we found that a Deutsche Bank research group, working independently from us, found a remarkably similar history of returns to news signals (Cahan et al. [2010]).

Effects of Unprecedented Negative News

The simulated period includes the (hopefully) atypical years of 2008–2009. There was a great deal of negative news during this period and it is reflected in the portfolio. Exhibit 15 shows that the preponderance of short positions in the portfolio beta was rarely positive, and dipped as low as -2.5 in 2009Q1.

“All Simulations Are Above Average”: A True Out-of-Sample Test

Presentations of simulated investment systems are all above average, a phenomenon that has been called “the file drawer effect.”

EXHIBIT 14

Aligning the News Improvement and Performance Charts

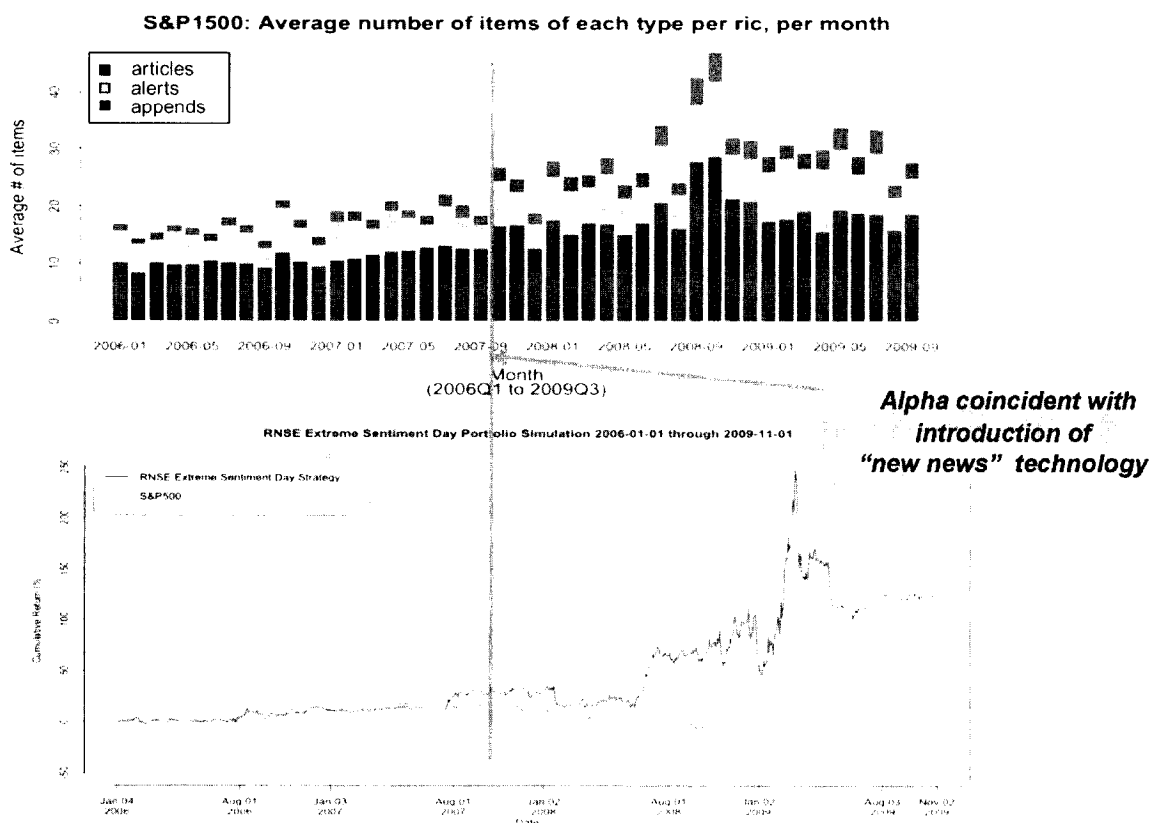


EXHIBIT 15

Monthly Average Percent of NAV Long and Short for Extreme Sentiment Simulation

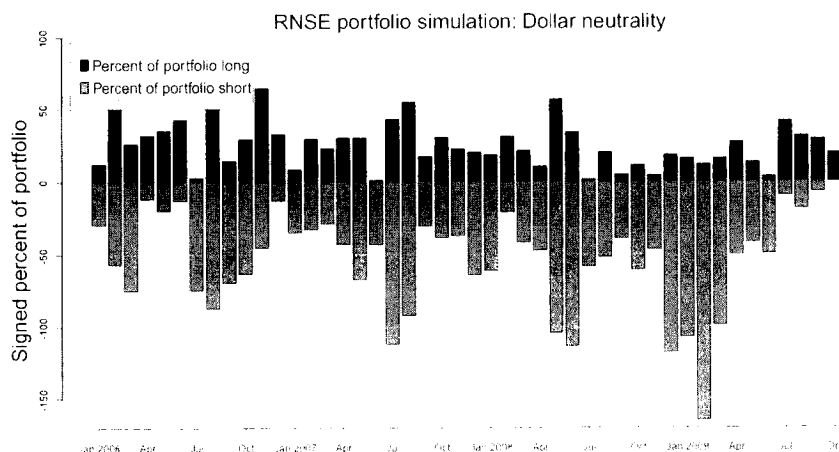
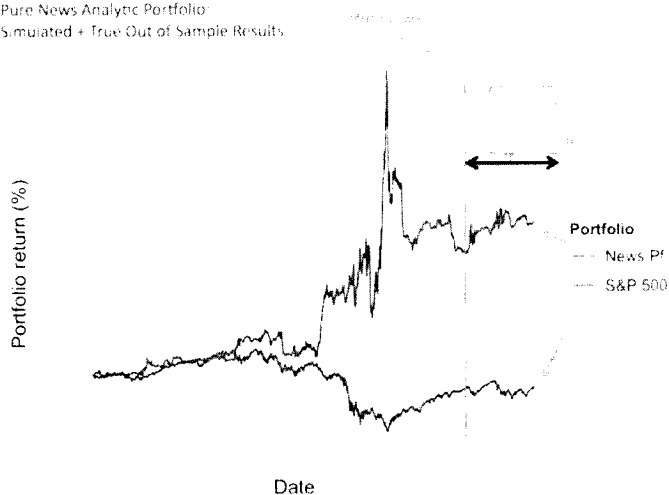


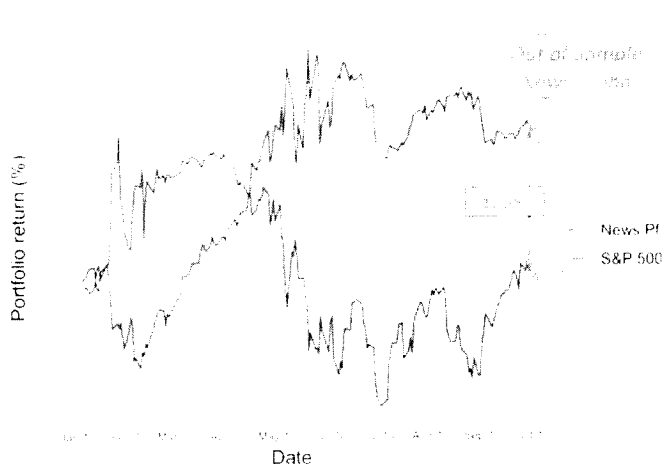
EXHIBIT 16

Simulated Results for an Unseen True Out-of-Sample Period Test

Pure News Analytic Portfolio:
Simulated + True Out of Sample Results



Pure News Analytic Portfolio:
True Out of Sample Results, Jan - Oct 2010



Due to an interval of nearly a year when we focused our research on faster intraday uses of news analytics, this portfolio simulation was effectively in “cold storage.” We were then able to test it on nine months of unseen news driving nine months of trades on unseen prices, from the first three quarters of 2010. This true out-of-sample result, showing 11.5% alpha, is illustrated in Exhibit 16. This result is appended to the previous simulation and is shown in the left panel. The right panel shows the out-of-sample period alone, resetting the portfolio and benchmark.

Summary of News Portfolio Results

Many news sentiment systems have proven disappointing in practice. The large pre-event returns often prove to be the only returns, net of trading costs. We thus approached this work with humble expectations. For much of the simulated period of this analysis, the results were equally humble.

But along with an independent group, we found a regime shift in the nature of Thomson Reuters news and news analytics starting in 2007 when the news analytic

“extreme event” filters started producing alpha at the same time that the measured output of the news process increased many fold in terms of breadth, depth, and volume. That this performance continued in a true out-of-sample test was particularly gratifying.

The largest exploitable signals, persisting for the longest time, are in firms not in the top of the S&P 1500. They also tend to be negative signals.

In addition to the long-short strategy described, investing sweet spots for exploiting these signals might be a broad enhanced index, 130/30 portfolio where effective bets could be made with a reduced need for short liquidity.

BACK TO WATSON AND LANGUAGE IN FINANCE

The financial world will continue to have room for people who make a living on events that play out in times longer than microseconds, even days. This article has dealt with how they can harness current and emerging technologies to best advantage, integrating persistent access to an expanding set of sources in more sophisticated ways.

News analysis is part of a technological wave of deeper language and relational concepts demonstrated by the IBM computer Watson and others. The news technologies and analytics we have used in our examples are state-of-the-practice commercial tools. When machine approaches to language and relationships move toward the “state of the art,” a greatly expanded toolset (e.g., Hernandez et al. [2010]) can be brought to bear on new paths to find alpha and understand complex risks.

What constitutes news is a moving target. Advanced information retrieval techniques automate collection from primary and proprietary sources, reflected in richer vendor and internal information resources. Many large firms are themselves overwhelming sources of information. Previous generations of alerts and filters have often been “trigger-happy” and more annoying than useful. Progress along the lines that we have described here is changing that.

Social Media and Language Analytics

Channeling these alerts to social media channels is a means for wealth managers and retail firms to stimulate discussion and interest among interested clients. New, younger customers are increasingly engaged with

these media. The same signal-to-noise improvement that amplifies intelligence for professionals can work for any group. Given the low signal content of so much net noise, a Twitter or Facebook bot with the current capabilities as we have described and the future abilities suggested by Watson would be impressive and valuable.

ENDNOTE

At Thomson Reuters, we thank, Richard W. Brown and Mike Powell for their support and for organizing symposia in this area. William Fang, Jason Sluciak, and the data group did excellent work in providing the data needed for this research. We had many helpful discussions with other participants in the news research program, especially Peter Jackson and James Powell at TR, Andrew Lo from AlphaSimplex and MIT, and Paul Tetlock from Columbia.

REFERENCES

- Bollen, J., H. Mao, and X. Zeng. “Twitter Mood Predicts the Stock Market.” *Journal of Computational Science*, (2011), pp. 1-8.
- Cahan, R., Y. Luo, J. Jussa, and M. Alvarez. “Beyond the Headlines: Using News Flow to Predict Stock Returns.” Deutsche Bank Quantitative Strategy Report, July 2010.
- Chan, W.S. “Stock Price Reaction to News and No-News: Drift and Reversal after Headlines.” *Journal of Financial Economics*, 70 (2003), pp. 223-260.
- Das, S. “News Analytics: Framework, Techniques and Metrics.” In *Handbook of News Analytics*, G. Mitra and L. Mitra, eds. Hoboken, NJ: Wiley, 2011.
- Hernandez, M., H. Ho, G. Koutrika, R. Krishnamurthy, L. Popa, I. Stanoi, S. Vaithyanathan, and S. Das. “Unleashing the Power of Public Data for Financial Risk Measurement, Regulation and Governance.” IBM Technical Report RJ10475, November 10, 2010. Available at <http://domino.research.ibm.com/library/cyberdig.nsf/papers/5DCE8803FA22C5BC852577E000575A10>.
- Leinweber, D. “Stupid Data Miner Tricks: Overfitting the S&P 500.” *The Journal of Investing*, Vol. 16, No. 1 (2007), pp. 15-22.
- . *Nerds on Wall Street: Math, Machines and Wired Markets*. Hoboken, NJ: John Wiley & Sons, 2009.

Lo, A., and A. Healy. Thomson Reuters News Research Roundtable, August 2009.

Mitra, G., and L. Mitra, eds. *Handbook of News Analytics*. Hoboken, NJ: Wiley, 2011.

Schneiderman, B., and C. Plaisant. *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, 5th ed. Reading, MA: Addison Wesley, 2009.

Smartmoney.com. "Map of the Market," 2011. Available at <http://www.smartmoney.com/map-of-the-market>.

Strachan, M. "Hedge Fund Bets \$40M That Twitter Can Predict the Stock Market." [huffintonpost.com](http://www.huffingtonpost.com/2011/03/21/hedge-fund-twitter-stock-market_n_838497.html?ir=Technology), March 22, 2011. Available at http://www.huffingtonpost.com/2011/03/21/hedge-fund-twitter-stock-market_n_838497.html?ir=Technology.

Tetlock, P., M. Saar-Tsechansky, and S. Macskassy. "More Than Words: Quantifying Language (in News) to Measure Firms' Fundamentals." *Journal of Finance*, 63 (2008), pp. 1437-1467.

Thomson Reuters. "Reuters NewsScope Sentiment Engine: Guide to Sample Data and System Overview." IP Manager V3.0, 2009.

Tibco. Spotfire Visualization System, 2011. Available at <http://spotfire.tibco.com/>.

Tufte, E. *Visual Explanations: Images and Quantities, Evidence and Narrative*. Cheshire, CT: Graphics Press, 1997.

———. *The Visual Display of Quantitative Information*, 2nd ed. Cheshire, CT: Graphics Press, 2001.

———. *Envisioning Information*. Cheshire, CT: Graphics Press, 2003.

Tukey, J. *Exploratory Data Analysis*. Reading, MA: Addison-Wesley, 1977.

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plexity of most robust risk allocation algorithms. It is, to the best of the authors' knowledge, the first robust risk budgeting algorithm that can be solved in closed form on the back of an envelope. The algorithm inherits its closed-form solvability from a pragmatic compromise the authors make—they keep one foot in the “old world” by beginning with using variance as the measure of risk, and then plant the other foot firmly in the “new world” by switching at an appropriate point to using expected shortfall as the measure of risk. It works well in practice in spite of its simplicity and yields fixed-income risk allocations that reflect both a portfolio manager's and a risk manager's intuition better than does a standard mean-variance risk budget.

EQUITY VALUATION

STOCK RETURN EXPECTATIONS AND P/E10 91

EARL D. BENSON, BEN D. BORTNER, AND SOPHIE KONG

Benson, Bortner, and Kong estimate the return on equities using the matrix approach suggested by Bogle in 1991. In addition to Bogle's approach, the authors incorporate share repurchases as suggested by Grinold and Kroner in 2002 and by Shiller's P/E10. They demonstrate that this relatively simple approach provides reasonable estimates of subsequent 10-year returns for the S&P 500 Index. The authors also focus on the relationship between the P/E10 ratio and the market's subsequent return. The authors demonstrate that when P/E10 is at low (high) levels in its historic range, the subsequent average 10-year market returns are relatively high (low or negative). When subsequent 3- and 5-year returns are examined, the relationship between P/E10 and subsequent average annual returns is even stronger. Finally, the authors' analysis suggests that the demonstrated approach may be used to estimate returns for various market sectors or indices by applying the approach to estimating the returns on three Russell indices.

A HYBRID APPROACH TO COMBINING CART AND LOGISTIC REGRESSION FOR STOCK RANKING 100

MIN ZHU, DAVID PHILPOTTS, ROSS SPARKS,
AND MAXWELL J. STEVENSON

The performance of a stock relative to a suitable peer group is often influenced by a multitude of factors and their interactions. Traditional parametric models, albeit very useful, are often inadequate in capturing complicated relationships. In contrast, the nonparametric decision tree technique, such as classification and regression trees (CART), is more capable of capturing any nonlinearities and high-order interactions among stock characteristics, with the additional convenience of graphically representing the model, but discontinuous and coarse-grained responses produced by CART are potentially undesirable. In contrast, traditional regression models such as logistic regression produce a smooth response surface, which is more tractable in practice. The authors use a hybrid approach that takes advantage of the strengths in both parametric (logistic regression) and nonparametric models (CART). An application of this sophisticated technique to North American defensive stocks demonstrates its usefulness.

THE MARKET

EVENT-DRIVEN TRADING AND THE “NEW NEWS” 110

DAVID LEINWEBER AND JACOB SISK

Two information revolutions are underway in trading and investing. Most headlines focus on structured quantitative market information at ever higher frequencies, but the other technology revolution in trading and investing is driven by qualitative, textual, and relationship information. The IBM computer Watson's overwhelming Jeopardy victory demonstrated how good machines can get at this. News

analysis is a focus of language technology in finance. In this article, Leinweber and Sisk include event studies and show U.S. portfolio simulation results for “pure news” signals applied over the period 2006–2009 as well as a true out-of-sample period in 2010, which indicates alpha in excess of 10% a year. The authors also describe other applications of automated qualitative analysis for information-driven social media client relations.

IS THERE A BUBBLE IN LINKEDIN'S STOCK PRICE? 125

ROBERT JARROW, YOUNES KCHIA, AND PHILIP PROTTER

Recent academic work has developed a method to determine in *real time* if a given stock is exhibiting a price bubble. Currently, speculation exists in the financial press concerning the existence of a price bubble in the aftermath of the recent IPO of LinkedIn. The authors analyze stock price tick data from the short lifetime of LinkedIn stock through May 24, 2011, and find that LinkedIn stock has a price bubble.

DOES ACTIVE MANAGEMENT PROVIDE INVESTOR SURPLUS? 131

BRIAN J. JACOBSEN

A consumer experiences *consumer surplus* when she pays less than her reservation price for a product. Similarly, an investor experiences *investor surplus* when he would be willing to pay more than the charge to invest in a particular instrument or portfolio. Typically, a portfolio manager generates investor surplus by delivering alpha. Jacobsen formally shows in this article that a portfolio manager can also generate investor surplus by having asymmetric betas, that is, when the beta in up markets is different than the beta in down markets. Because no one forces investors to buy active management, they must perceive benefits that exceed the cost. Some of these benefits (custody, diversification, accounting, partial share ownership) are also available from passive strategies; others (expected differences in up and down market betas, alphas, optionality, cocktail party conversation) are only available from active management.

Remembering Barbara S. Bernstein



When taking over as Publisher of *The Journal of Portfolio Management* in 2001, I was given a small list of instructions by my predecessor, Gauri Goyal. Towards the top of the list was to make sure that I was always in good favor with Barbara Bernstein. Barbara served as Assistant Editor to *The Journal of Portfolio Management* for over 30 years. She was a tough negotiator and always had Peter's best interests at heart. If you received a call from Barbara, you immediately prepared yourself to make the stars and moon align to get her back on your side. Right after Peter passed away, Barbara and I worked closely together on *The Journal of Portfolio Management* Memorial Section dedicated to Peter Bernstein. Barbara and I quickly became friends. We had a mutual appreciation of New York and its history. When I smugly mentioned that my family had a farm on what is now 7th Avenue in the mid-1860s, she quickly trumped me by letting me know that her family arrived as Sephardic Jews in the 1600s. Barbara was a quintessential New Yorker. When she

passed, she was working on her memoirs which included stories about her father's movie costume business during the 1930s and her days as a reporter at Collier's. Barbara had a heart of gold, always putting family first, encouraging those around her to reach for the stars and pushing us all to never take “no” for an answer. At her Memorial Service, a close family member said that “Barbara's greatest strength was her strength.” I remember a tough businesswoman, a mentor, and a dear friend.

Allison Adams
Publisher

Photo credit: John Mauldin, Millenium Wave Investments