

News Sentiment and Cash-flow News Returns

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Josie Gerken

Analyst
Tel: +44 20 7568 3560
josephine.gerken@ubs.com

Nick Baltas

Analyst
Tel: +44 20 7568 3072
nick.baltas@ubs.com

Claire Jones

Analyst
Tel: +44 20 7568 1873
claire-c.jones@ubs.com

David Jessop

Analyst
Tel: +44 20 7567 9882
david.jessop@ubs.com

Paul Winter

Analyst
Tel: +61 2 93 242 080
paul-j.winter@ubs.com

Desi Ivanova

Analyst
Tel: +44 20 7568 1754
desi.ivanova@ubs.com



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Overview

- The use of **high-frequency news data** in various forms for financial purposes continues to grow.
- **Twitter funds** are one example of its application:
 - "*Twitter mood predicts the stock market*", Bollen, Mao & Zeng (2010).
- Other examples include scraping **Blogs and Forums**:
 - Plugra AI Fund – Japanese asset managers' fund, which invests in Nikkei 225 futures based on a computer model that analyses the content of Japanese blogs.



What can we use news data for?

- Sentiment analysis
- News volume patterns
- Portfolio construction

What can news data tell us?

- News frequency
- News types
- Market impact of news

- News data contains fundamentally driven information on a continuous basis;
- News data is less noisy than Twitter.

News Data Analytics in the Literature

- Literature:

- *"What's in the News? Using News Sentiment Momentum for Tactical Asset Allocation"*, Uhl, Pedersen & Malitius (2015);
 - *"Relating News Analytics to Stock Returns"*, Leinweber & Sisk (2010);
 - *"The Handbook of News Analytics in Finance"*, Mitra & Mitra (2011);
 - *"News Sentiment and Momentum"*, Huynh & Smith (2013);
 - *"All That Glitters: The Effect of Attention and News on the Buying Behaviour of Individual and Institutional Investors"*, Barber & Odean (2007);
 - *"News Momentum"*, Jiang, Li & Wang (2015).
- News (Sentiment) Data Providers – e.g., Alexandria (Alexibility), RavenPack, Thomson Reuters News Analytics.

Section 1

News Sentiment Data

News Sentiment Data

- We use News Sentiment Data provided by (ACTA)

Alexandria Contextual Text AnalyticsTM Engine

- News stories are collated at the **millisecond frequency** on a **real-time basis**.
- News Stories are categorised depending on the **subject** or event the content is associated with, the country in which the company is listed and the **source** to which the story originates from.
- **Sentiment scores** are assigned to each new story via a set of proprietary algorithms that process news stories from several news sources.

TIME_STAMP	SOURCE	SUBJECT	ISIN	TICKER	SENTIMENT	CONFIDENCE	NOVELTY	RELEVANCE	MKTIMPSCORE
15/11/2016 17:11:34.876000	DJN	AA@MGT	US8936411003	TDG	0	0.998941	1	1	-0.0195722
15/11/2016 17:13:55.310000	TPC	AA@INS	US5893781089	MRCY	-1	0.97	1	1	-0.1087629
15/11/2016 17:14:07.982000	TPC	AA@INS	US3207341062	FLIC	0	0.97	1	1	0.4358005
15/11/2016 17:14:17.048000	TPC	AA@INS	US0009571003	ABM	-1	0.97	1	1	-0.2797198
15/11/2016 17:15:43.787000	LSE	AA@MGT	US1108281007	BTLCY	0	0.9886591	1	1	0.7767713
15/11/2016 17:15:43.787000	LSE	AA@MGT	GB0001367019	BLND	0	0.9886591	1	1	0.7767713
15/11/2016 17:17:10.828000	LSE	AA@IPO	GB0009580571	HHI	0	0.946275	1	1	-0.756272
15/11/2016 17:17:29.401000	TPC	AA@INS	US98933Q1085	ZLTQ	-1	0.97	1	1	-0.4454676
15/11/2016 17:17:58.769000	DJN	AA@REG	US87233Q1085	TCP	0	0.9985559	1	1	0.0341351
15/11/2016 17:18:25.539000	LSE	AA@MGT	US05964H1059	SAN	0	0.9950544	1	1	-0.8972131
15/11/2016 17:18:25.539000	LSE	AA@MGT	ES0113900J37	SAN	0	0.9950544	1	1	-0.8972131
15/11/2016 17:18:24.806000	TPC	AA@INS	US2765261080	GOOD	1	0.97	1	1	0.8858117

News Sentiment Data: Events

➤ Categorisation

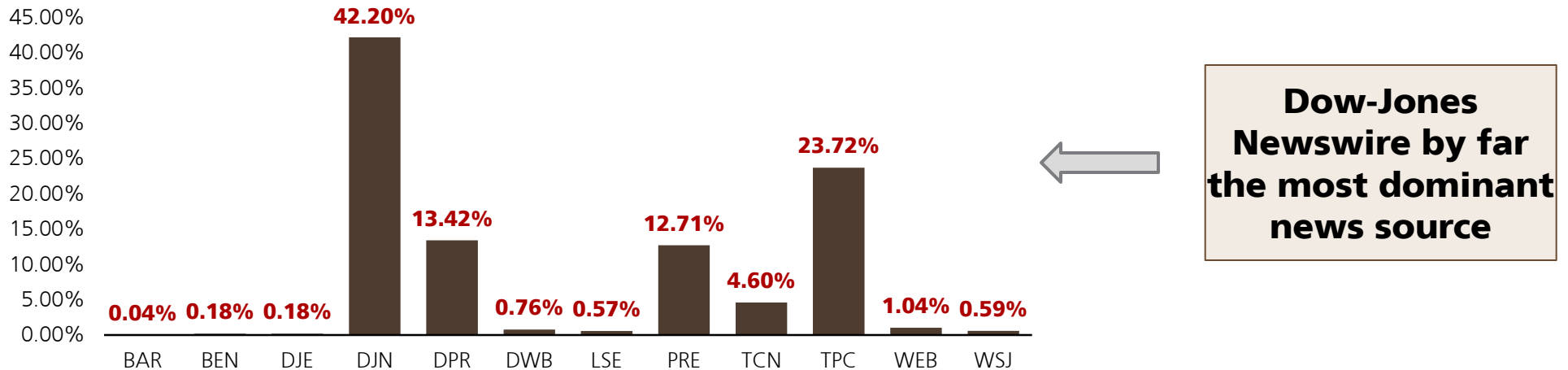
- News Stories are assigned to one of 31 events

Earnings

Event/Subject	Description
Accounting	Accounting issues, reporting , restatements
Asset Purchases/Sales	The purchase or sale of a company's assets
Bankruptcy	Bankruptcy files, cases, petitions, liquidations
Buy Backs	Stock buy backs
Bond Ratings	Ratings of corporate bonds
Corporate Actions	Corporate actions, changes, divestitures, restructurings, stock splits, spin offs
Corporate Governance	Annual meetings, proxy filings, shareholder rights plans
Debt Financing	Corporate debt news
Dividends	Dividend news, pay dates
Dissolved Mergers	Failed or terminated company mergers or acquisitions
Equity Derivative	Transactions of derivatives, options, swaps
Earnings	SEC filings, earnings announcements, earnings restatements, sales figures
Estimates	Analysis, Forecasts, analyst polls, analyst estimates
Index Reconstitution	ETF buying, selling, inclusion
Clinical Trials	Clinical Drug Trials and Announcements
Guidance	Earnings guidance
Government Interaction	Senate and house inquiries or opinions
Hedge Fund Trades	Hedge fund buying, selling, recommendations
Trade Imbalances	Trade imbalances for securities at open/close
Insider Transactions	Insider buying, selling, registration
IPOs	IPOs, secondary offerings, Venture financing
Legal	Compliance, patents, lawsuits, antitrust news
Mutual Fund Trades	Mutual fund buying, selling, positions
Management	Management issues, profiles, movement, compensation
Mergers & Acquisitions	Mergers, acquisitions, take overs, tender offers, LBOs
Operations	Contracts, financing agreements, franchises, JVs, labor, licensing agreements, R&D, product distribution, Strategic partnerships
Equity Ownership	Corporate Stock Trades, 5% ownership, 13-F filings, 13-D filings, Short Interest, SMA ownership, Shelf Registrations
Private Equity	Private companies, private placements
Research Ratings	Research firm/analyst ratings
Regulatory Affairs	Securities, Financial, Operational regulations
Trade Activity	Trading recommendations, analysis, commentary

- For example, a news story assigned to the subject "Earnings" will include earnings announcements, restatements and related content

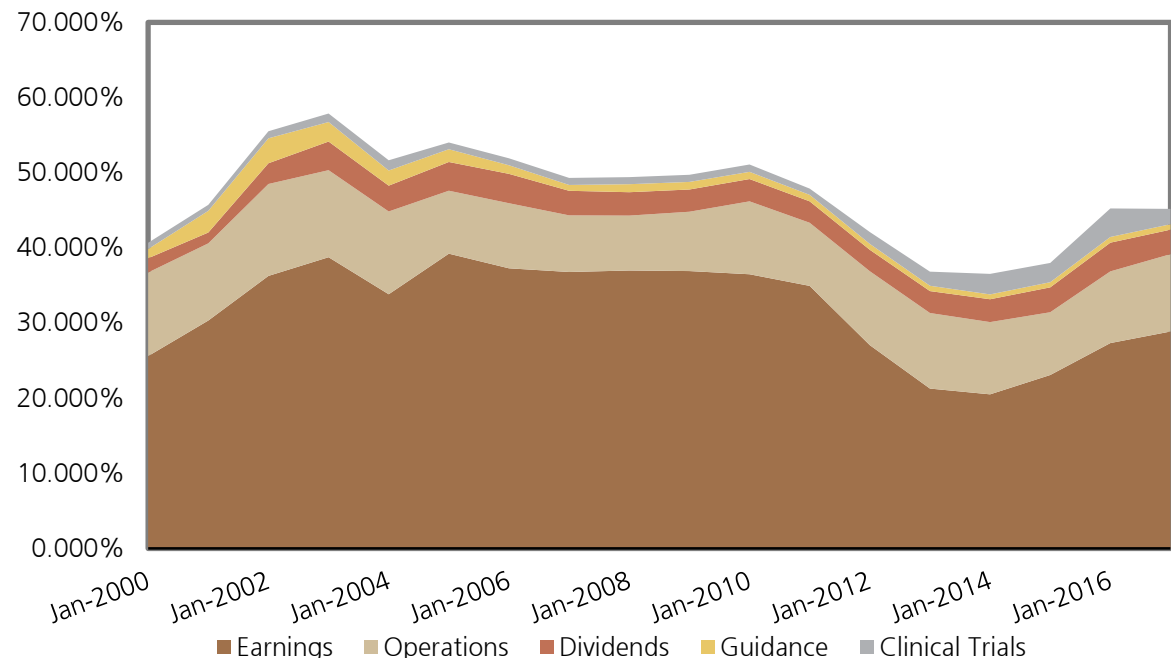
News Sentiment: Subjects and Sources



Source: UBS. Distribution of news according to news sources:
Jan 2000 – Dec 2016

% of Stories associated with Cash-flow-related News

Cash-flow-related news stories represent 35-60% of news flow for stocks in the US



Source: UBS. Cash flow news occurrences 2000-2016

What does one record look like?

TIME_STAMP	ISIN	TICKER	COUNTRY	SENTIMENT	CONFIDENCE	NOVELTY	SUBJECTS
04/01/2000 14:03:09.000000	US0378331005	AAPL	USA	0	0.9769893	1	AA@ALEX
04/01/2000 14:25:31.000000	US0378331005	AAPL	USA	0	0.9446907	1	AA@ALEX
06/01/2000 16:20:00.000000	US0378331005	AAPL	USA	0	0.9991128	1	AA@ALEX,AA@TRD
06/01/2000 20:18:00.000000	US0378331005	AAPL	USA	0	0.9991128	1	AA@ALEX,AA@TRD
04/01/2000 14:50:36.000000	US0378331005	AAPL	USA	0	0.9446907	1	AA@ALEX
04/01/2000 15:20:10.000000	US0378331005	AAPL	USA	0	0.9849792	2	AA@ALEX
04/01/2000 15:30:34.000000	US0378331005	AAPL	USA	1	0.8976754	3	AA@ALEX
07/01/2000 01:14:34.000000	US0378331005	AAPL	USA	1	0.4860728	1	AA@ALEX
03/01/2000 20:39:10.000000	US0378331005	AAPL	USA	0	0.7428803	1	AA@ALEX
03/01/2000 21:25:19.000000	US0378331005	AAPL	USA	1	0.9594776	2	AA@ALEX
03/01/2000 21:58:36.000000	US0378331005	AAPL	USA	0	0.7626024	1	AA@ALEX,AA@DRV
03/01/2000 22:23:24.000000	US0378331005	AAPL	USA	0	0.7428803	1	AA@ALEX
03/01/2000 22:23:50.000000	US0378331005	AAPL	USA	1	0.9594776	2	AA@ALEX
03/01/2000 22:24:13.000000	US0378331005	AAPL	USA	0	0.7626024	1	AA@ALEX,AA@DRV

- 31 Subjects
- Sentiment -> {-1,0,1}

- 12 News Sources

- Market Impact Score is a risk-adjusted measure of the 1-minute forward return, winsorised to [-5,5]

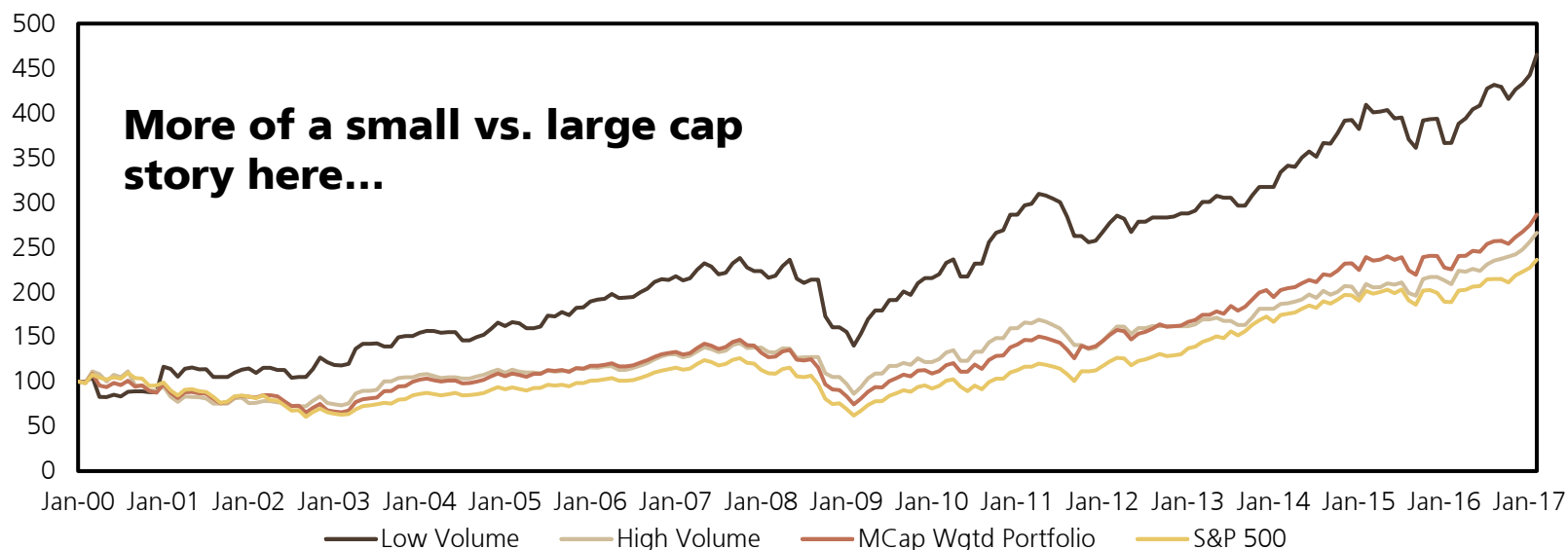
RELEVANCE	HEADLINE_ONLY	AUTOMESSAGE	SOURCE	MKTIMPSCORE	PROB_POS	PROB_NTR	PROB_NEG
0.33333	T	F	DJN	0.1204616	0.0100746	0.9846595	0.0052659
0.5	F	F	DPR	-0.4946358	0.0157997	0.9631271	0.0210732
1	F	F	DJN	-0.5750855	0.0002832	0.9994085	0.0003083
1	F	F	DJN	-0.5750855	0.0002832	0.9994085	0.0003083
0.5	F	F	DPR	-0.4946358	0.0157997	0.9631271	0.0210732
0.25	F	F	DJN	-0.9983019	0.0077823	0.9899862	0.0022315
0.25	F	F	DJN	-0.2269615	0.9317836	0.066745	0.0014714
0.02041	F	F	WSJ	0.2707932	0.6573819	0.0867262	0.2558919
1	T	F	DJN	-0.0582491	0.1189291	0.8285869	0.0524841
1	F	F	DJN	-0.156939	0.972985	0.0133836	0.0136314
0.2	F	F	DJN	-1.6122677	0.0369516	0.841735	0.1213135
1	T	F	DJN	-0.0582491	0.1189291	0.8285869	0.0524841
1	F	F	DJN	-0.156939	0.972985	0.0133836	0.0136314
0.2	F	F	DJN	-1.6122677	0.0369516	0.841735	0.1213135

News Sentiment Portfolios

S&P News **Volume** Portfolios:

- Universe -> S&P 500 Index
- Sample period: Jan 2000 – Mar 2017
- Methodology -> sort stocks into high/mid/low portfolios according to news volume over the past month

	Low Volume	Mid Volume	High Volume	MCap Wgtd Portfolio	S&P 500
Geom. Mean (%)	11.26	7.28	7.03	8.37	7.36
Arith. Mean (%)	12.30	8.37	8.08	9.27	8.17
Volatility (%)	18.00	16.15	15.90	15.51	14.40
Skewness	0.48	-0.73	-0.28	-0.42	-0.60
Kurtosis	12.06	4.94	4.27	4.30	4.40
MaxDD (%)	41.18	41.96	39.61	41.35	43.32
Sharpe Ratio	0.20	0.00	-0.02	0.07	-
Sortino Ratio	1.12	0.74	0.77	0.91	0.84
Calmar Ratio	0.27	0.17	0.18	0.20	0.17



Back testing sentiment

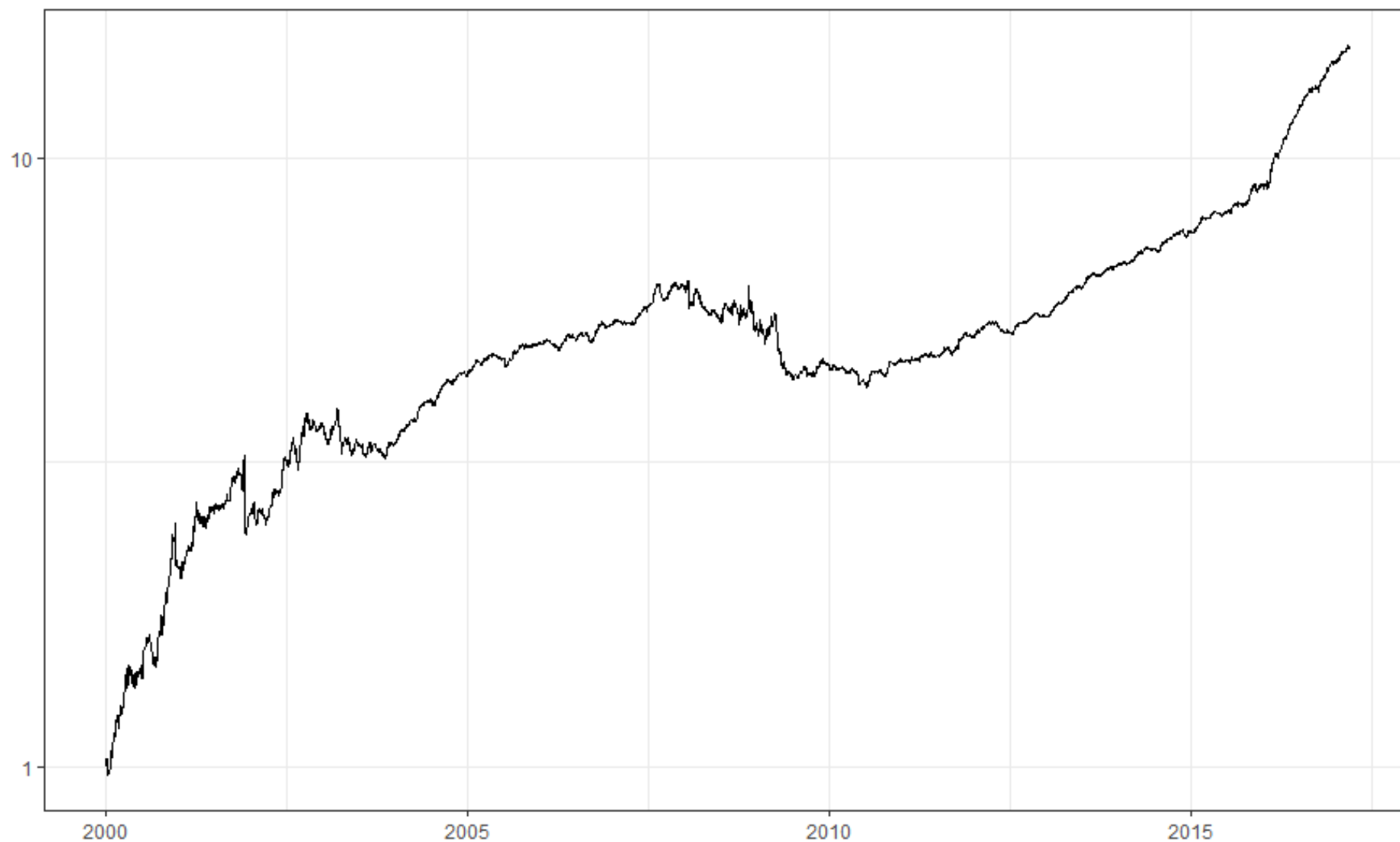
- Our starting point was to filter the news data for stories where the relevance was 1 (which means the story is of primary relevance) and the confidence was greater than 0.75 (meaning the probability that the sentiment score assigned to that story is correct with probability greater than 75%).
- After doing this we aggregated the news in 24-hour blocks, stopping for example in the US at 4pm, counting the number of positive news stories and the number of negative news stories.
- We created three portfolios: one where the number of positive news stories outweighed the negative; one where the negative outweigh the positive; and one for stocks either with neutral news or no news.
- These were equal weighted and the total returns calculated in USD.

Daily rebalancing – MSCI US



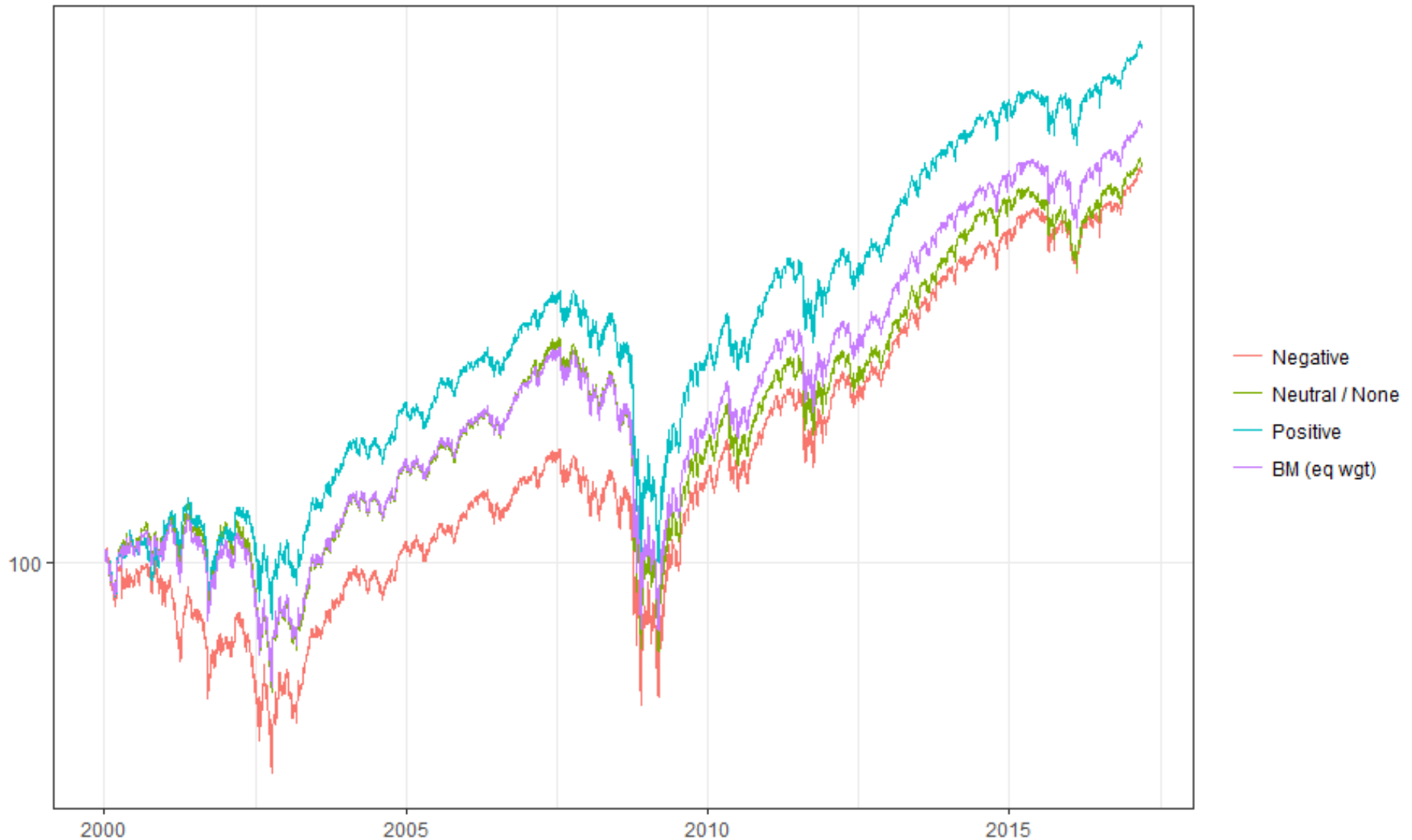
Source: UBS. The universe is MSCI US. The portfolios are rebalanced daily.

Daily Rebalancing – MSCI US – Long / short



Source: UBS. The universe is MSCI US. The portfolios are rebalanced weekly.

Weekly rebalancing – MSCI US



Source: UBS. The news signal is a simple aggregation of the news over the week with no decay function. The universe is MSCI US. The portfolios are rebalanced weekly.

Weekly rebalancing – MSCI US Long / Short



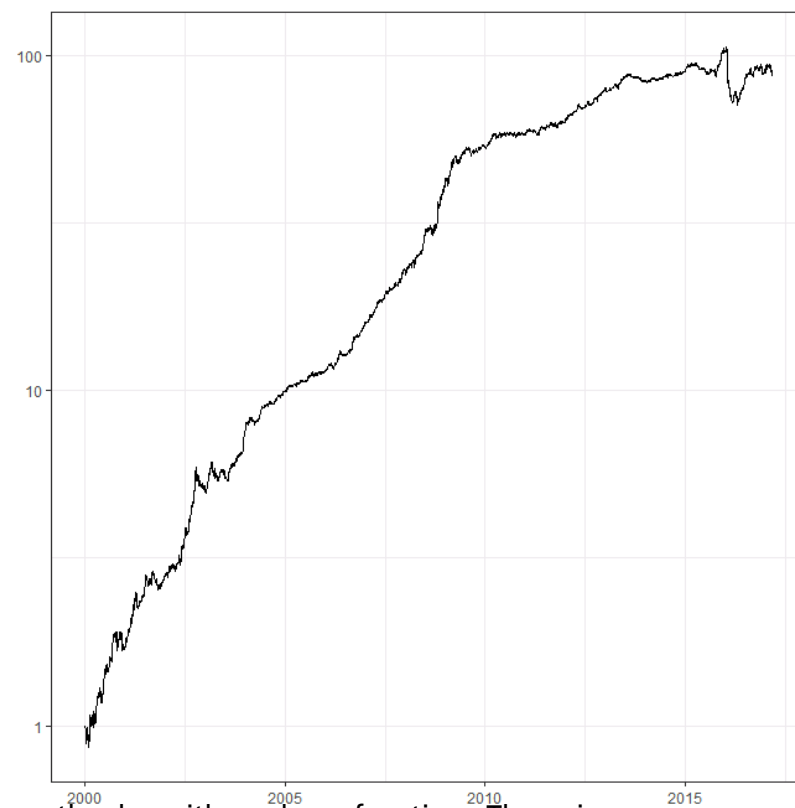
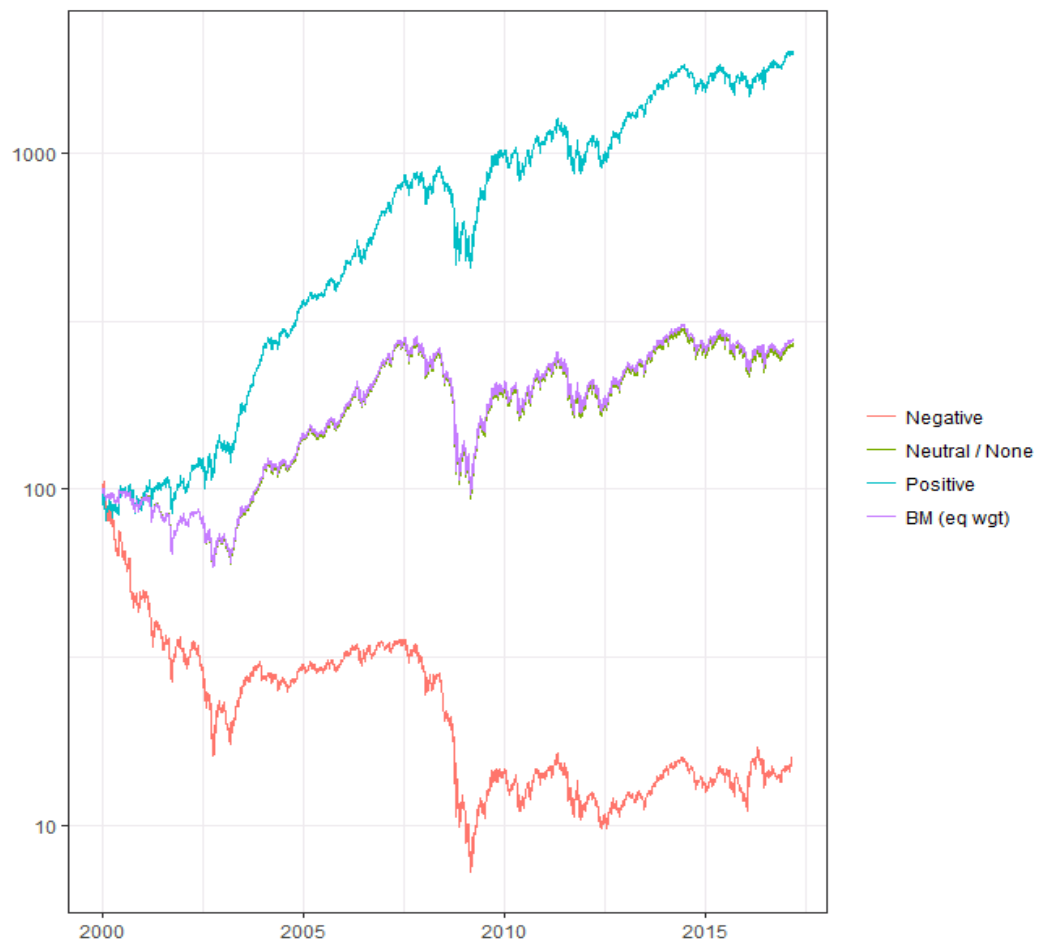
Source: UBS. The news signal is a simple aggregation of the news over the week with no decay function. The universe is MSCI US. The portfolios are rebalanced weekly.

Why the difference in returns after 2010?

- We theorised that the lack of a positive return using (unweighted) weekly data was down to either the signal decay increasing or short-term reversals. To investigate, we re-ran the daily analysis, except using news lagged by one weekday.

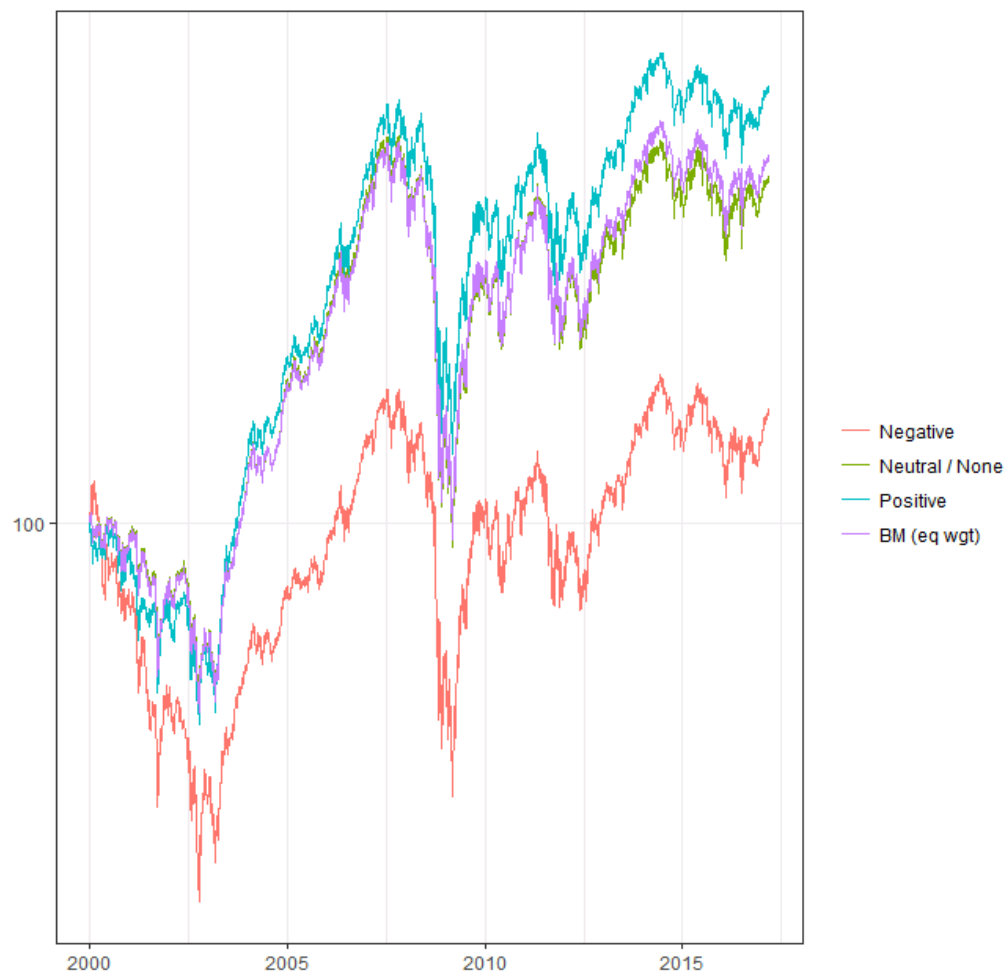


Other regions - Europe



Source: UBS. The news signal is a simple aggregation of the news over the day with no decay function. The universe is MSCI Europe. The portfolios are rebalanced daily.

Other regions – Europe weekly



Source: UBS. The news signal is a simple aggregation of the news over the week with no decay function. The universe is MSCI Europe. The portfolios are rebalanced weekly.

Section 2

Cash Flow vs. Discount Rate News

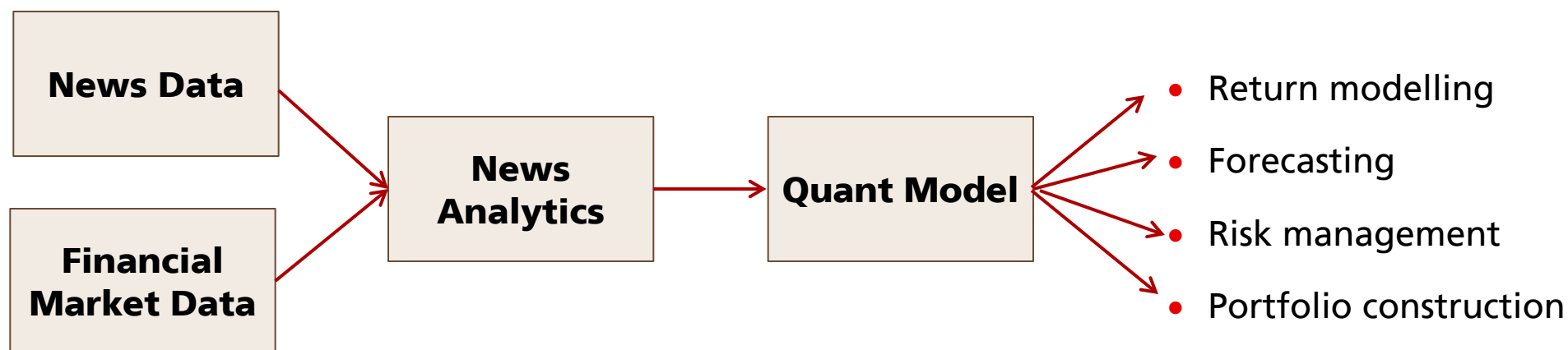
A New Application of News Analytics

Empirically observed facts regarding news:

- Trading volume increases on days with information releases
- Important news frequently results in large returns (positive or negative)

Several applications of news analytics in finance:

- Prediction of abnormal returns
- Constructing trading strategies
- Risk control



Decomposing Returns

- A discounted cash flow model (of any sort) will tell you that a change in the price must be due to a change in either:
 - Cash flows (a change in the top line), or
 - Discount Rates (a change in the bottom line).

Campbell & Schiller (1988) Approximation

- Campbell and Schiller (1988) approximate the log return on a dividend-paying asset $r_{t+1} = \log(P_{t+1} + D_{t+1}) - \log(P_t)$ using a Taylor series expansion around the long-term mean log dividend-price ratio $\overline{(d_t - p_t)}$ where P and D are the price and dividend and p and d are their logs.

$$r_{t+1} \approx k + \rho p_{t+1} + (1 - \rho)d_{t+1} - p_t$$

where $\rho = 1 / (1 + \exp(\overline{d_t - p_t})) \approx 0.96$ and $k = -\log(\rho) - (1 - \rho)\log(1/\rho - 1)$.

Decomposing Returns (continued)

Campbell (1991)

- Campbell (1991) took this representation of returns and provided the following (approximate) decomposition of unexpected returns

$$\begin{aligned} e_{t+1} &= r_{t+1} - E_t r_{t+1} \\ &= (E_{t+1} - E_t) \sum_{j=0}^{\infty} \rho^j \Delta d_{t+1+j} - (E_{t+1} - E_t) \sum_{j=0}^{\infty} \rho^j r_{t+1+j} \\ &= e_{CF,t+1} - e_{DR,t+1} \end{aligned}$$

where r_{t+1} is the equity return and E_t is the expectation at time t . ρ is the constant from above, and Δd_t is the dividend growth rate. e_t is the unexpected market return, and $e_{CF,t}$ and $e_{DR,t}$ are its cash flow and discount rate news components.

What is deduced from this?

This tells us that unexpected returns are a function of changes in expectation about future dividends ("cash flow news") and changes in future expected returns ("discount rate news").

Return Decomposition Identity

So what drives the return: cash flow news or discount rate news?

- The return decomposition in Campbell & Schiller (1988) and Campbell (1991) gives us an identity:

$$\textit{Return} \equiv \textit{Discount Rate News} + \textit{Cash Flow News}$$

- Given two components of this identity, the other component can be computed.
- For example, given a time series of returns and cash-flow news, we can compute discount rate news.

Where does news data fit into this?

- We proxy cash flow news using news data associated with cash flow-related subjects.
- We base our analysis on constituents in S&P 500 Index over the period Jan 2009-Dec 2016.

Cash Flow News: S&P 500

Cash flow news: How do we define it?

- Universe -> **S&P 500 Index**
- **Cash flow news** is given by:
 - **Subjects** $\in \{Dividends, Earnings, Clinical Trials \& Announcements, Earnings Guidance\}$
 - Relevance = 1
- We include all sources and do not filter on sentiment; we simply want to capture all occurrences of cash flow-associated news.
- **Timestamps** from this dataset then identify earnings-related announcements.
- We collect **tick prices** at the 1-minute frequency for each stock (excluding non-trading hours) and compute their **1-minute returns**.
- We then assume that the **15 minute-returns** following each news occurrence are due to cash flow news.
- Daily cash flow returns are then just the cumulative 1-minute returns, identified by all of the 15-minute returns following each news occurrence.

Case Study #1: J.P. Morgan

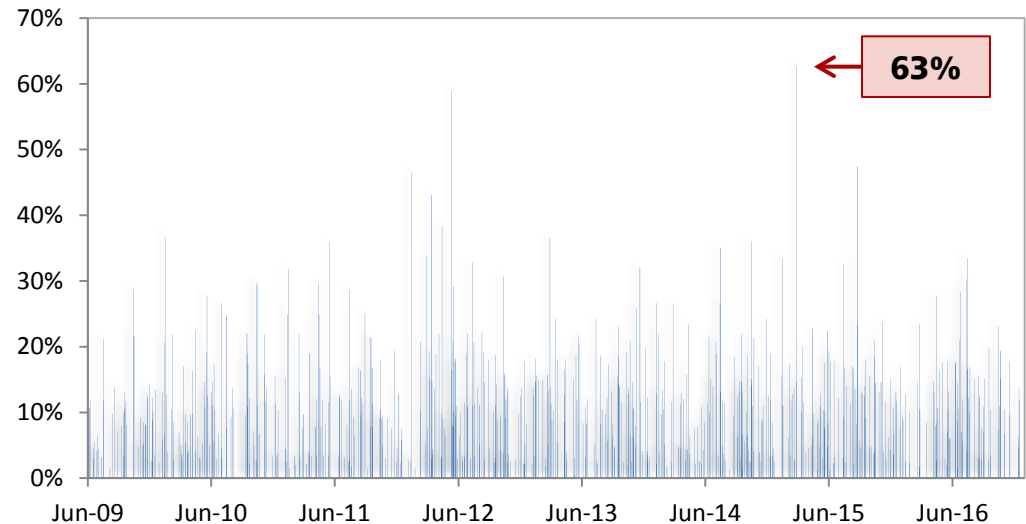
- We measure the total variation in returns due to cash flow news as:

$$TV_t = \frac{\sum_{\tau} |r_{cashflow\ news}|}{\sum_m |r|}$$

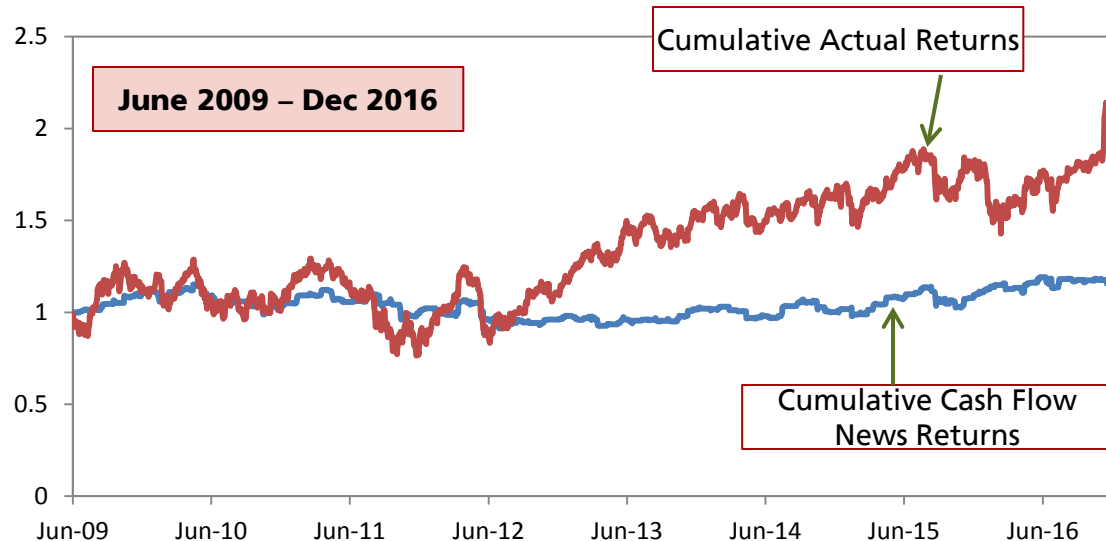
- This quantifies the proportion of price movement due to cash flow news.

- The correlation between returns is 38%.

Proportion of the Magnitude of Returns Explained by Cash Flow News

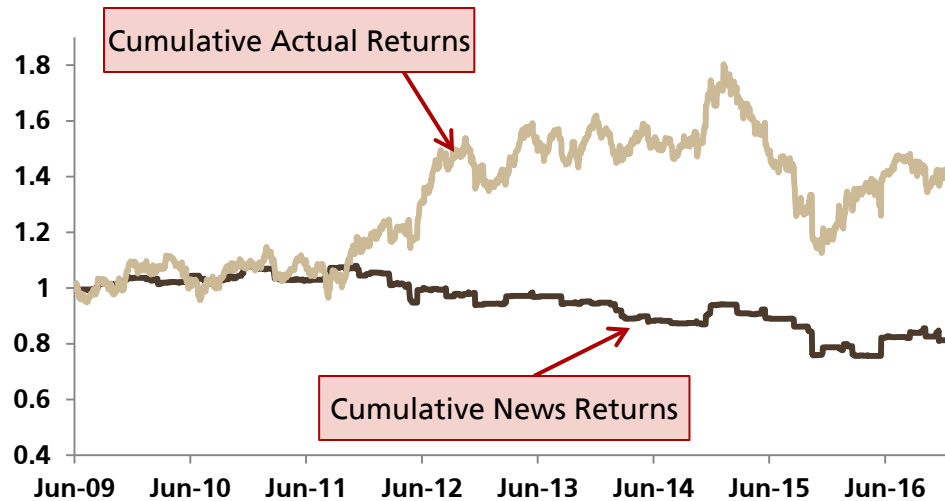


Source: UBS Quantitative Research. Note: Proportion of (the magnitude of) J.P. Morgan's daily returns explained by cash flow news returns (June 2009 – Dec 2016).



Source: UBS Quantitative Research. A case study of J.P. Morgan cash flow news returns vs. actual returns (June 2009 – Dec 2016).

Case Study #2: Walmart



- 24.3% of the variation of returns is due to cash flow news.
- This comes from accounting for ~15% of prices over trading hours.

Source: UBS Quantitative Research.
Note: Proportion of (the magnitude of) Walmart's daily returns explained by cash flow news returns (June 2009 – Dec 2016).

- Correlation between actual returns and cash flow news returns is 49.3%.

80%

Proportion of the Magnitude of Returns Explained by Cash Flow News

70%

60%

50%

40%

30%

20%

10%

0%

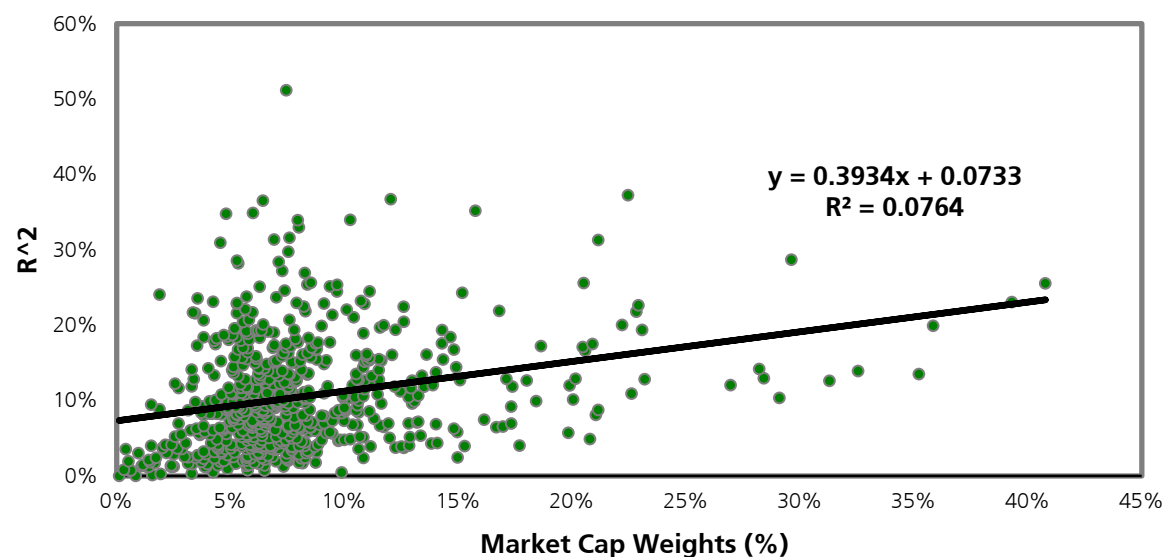
71%

Jun-09 Jun-10 Jun-11 Jun-12 Jun-13 Jun-14 Jun-15 Jun-16

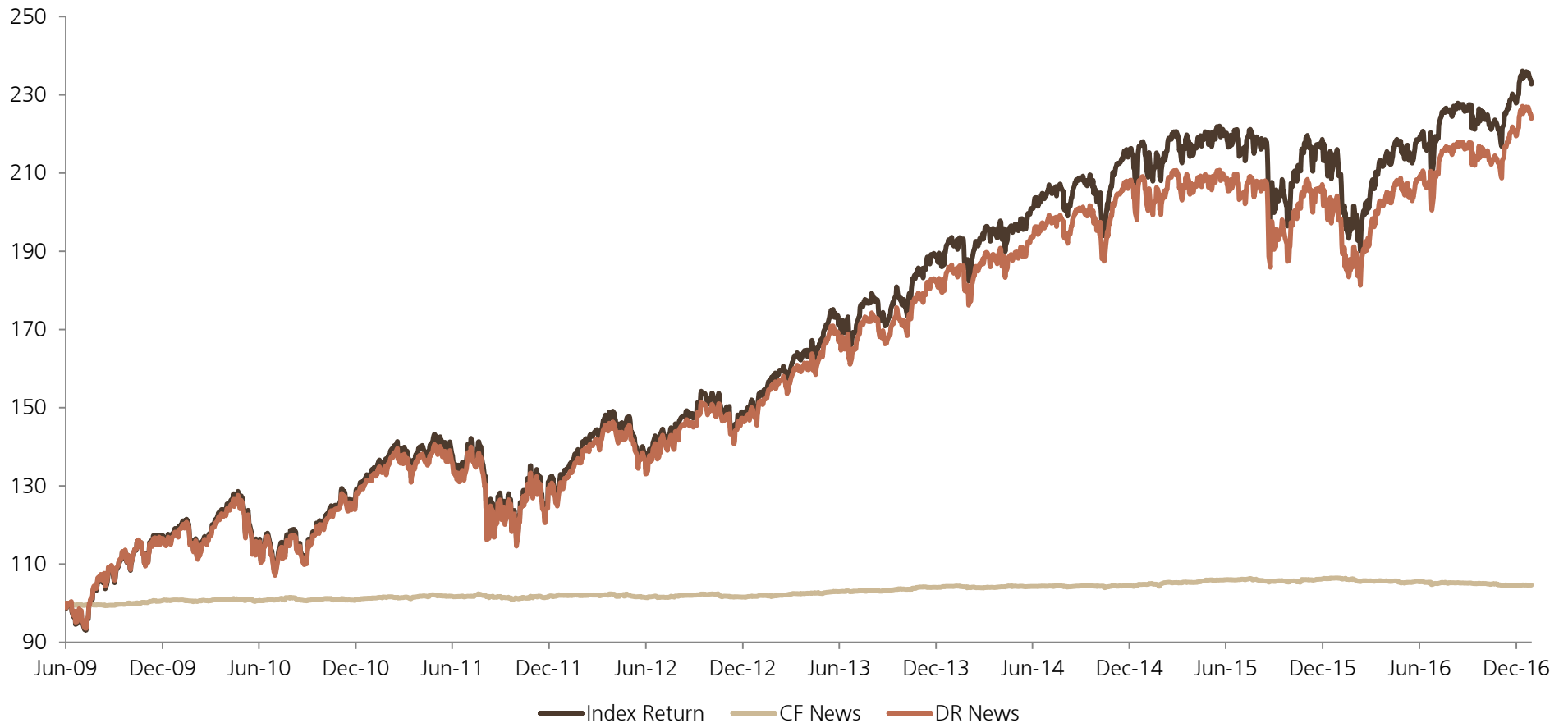
Variance Explanations

- Regressing daily (actual) returns on daily cash flow news returns for all stocks gives us a regression coefficient of 1.03* with an R^2 of 12.8%.
- Cases where a high percentage of cash flow news explains daily returns are not necessarily due to high news coverage over each day.

SecName	Sector	R^2	Correlation Between Returns	% of Trading Day Attributed to Cash Flow News
Pepsi Bottling Group Inc	Consumer Staples	51.18%	71.54%	7.45%
Cisco Systems Inc	Information Technology	37.25%	61.03%	22.45%
Gap Inc/the	Consumer Discretionary	36.72%	60.60%	12.04%
Hj Heinz Co	Consumer Staples	36.52%	60.43%	6.42%
Computer Sciences Corp	Information Technology	35.18%	59.31%	15.75%
Lexmark International Inc-a	Information Technology	34.90%	59.08%	5.99%
Michael Kors Holdings Ltd	Consumer Discretionary	34.78%	58.98%	4.81%
Pitney Bowes Inc	Industrials	33.97%	58.28%	10.26%
Abercrombie & Fitch Co-cl A	Consumer Discretionary	33.94%	58.26%	7.95%
Intuitive Surgical Inc	Health Care	32.99%	57.44%	8.00%
Whole Foods Market Inc	Consumer Staples	31.59%	56.21%	7.59%
Family Dollar Stores	Consumer Discretionary	31.37%	56.01%	6.91%
Amazon.com Inc	Consumer Discretionary	31.31%	55.95%	21.14%
Advance Auto Parts Inc	Consumer Discretionary	30.94%	55.62%	4.55%
Kohls Corp				
Intl Business Machines				
Apella Education Gro				



What happens at the index level?



So what?

- For investment purposes, how news flows into returns is of paramount interest.
- Between discount rates and cash flows, it is only the latter which analysts can (attempt to) forecast.
- Historically, large estimation errors have been documented with Campbell et al.'s model.
- We, instead, try to model cash flow news more directly and estimate discount rate news.
- Analysts/investors care about how news impacts returns at the stock level.

Concluding Remarks and Future Research

On Sentiment Scores...

- We have shown there is a premium to be extracted from news sentiment data.
- Several ways of utilising sentiment scores to construct profitable quant strategies.
- Any alpha opportunities must be taken at the shorter end of the time scale though.
- Alpha decays very quickly (1-day lag sentiment portfolios...).

On Cash flow News...

- Cash flow news can explain a decent proportion of the variation of returns at the stock level, even when the proportion of returns accounted for during trading hours is low.
- At the stock level, the story is more about discount rate news (in agreement with Campbell et al.)
- Interesting preliminary result, but we need to think more about the news data we're using and price movements overnight.

Valuation Method and Risk Statement

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12-Month Rating	Definition	Coverage ¹	IB Services ²
Buy	FSR is > 6% above the MRA.	45%	29%
Neutral	FSR is between -6% and 6% of the MRA.	39%	27%
Sell	FSR is > 6% below the MRA.	15%	16%
Short-Term Rating	Definition	Coverage ³	IB Services ⁴
Buy	Stock price expected to rise within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%
Sell	Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%

Source: UBS. Rating allocations are as of 31 December 2016.

1:Percentage of companies under coverage globally within the 12-month rating category.

2:Percentage of companies within the 12-month rating category for which investment banking (IB) services were provided within the past 12 months.

3:Percentage of companies under coverage globally within the Short-Term rating category.

4:Percentage of companies within the Short-Term rating category for which investment banking (IB) services were provided within the past 12 months.

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Contact information

UBS Limited

5 Broadgate
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EC2M 2QS

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