Quantitative Monographs
Can we trade on news sentiment in China?

A direct measure to quantify news sentiment

We quantify news sentiment in China by using the *DataYes News Sentiment Dataset,* which leverages Natural Language Processing (NLP) tuned specifically for Chinese language to detect, sort and score more than 30,000 Chinese news reports every day. We demonstrate that the News Sentiment Score provides an alternative source for alpha, even after regressing out the contributions from traditional risk premia, such as Size, Value, Momentum and Liquidity. The monthly-rebalanced single-factor back test has generated a Long-Short return of 12% per annum since 2016, after trading costs.

Higher sentiment, higher retail trading, so more alpha for smart money

We find evidence that retail investor trading has been highly driven by news flow in China. News sentiment can act as a proxy for retail investor trading, as retail investors are more active in sectors where news sentiment is higher. Moreover, from interactions between individual and institutional investors, we observe more alpha opportunities available for institutional investors to harvest where news sentiment is higher and retail investors are trading more actively.

Screens based on smart money and news sentiment

In 2020, we launched the China Smart Money screens, based on the positions of institutional investors. In this report, we nearly double the performance of the original model by incorporating additional insights from news sentiment. Back tests show that a top basket of "high-holding, high-sentiment" stocks would have outperformed the benchmark by 23% per annum, after trading costs, since 2017, and a short basket of "low-holding, low-sentiment" underperformed by 10%.

Figure 1: Top screens from our model

Ticker	Company Name	Sector	Market Cap (Rmb bn)	Northbound Score	Northbound Rank	Sentiment Score	Sentiment Basket
000725	BOE	Tech	215.6	1.94	1	11.05	high
002027	FOCUS MEDIA	Cons Disc	160.3	1.92	2	2.81	mid
000002	VANKE-A	Real Estate	285.0	1.90	3	18.02	high
000661	CCHN	Health Care	184.4	1.88	4	0.72	low
002271	ORIENTAL YUHONG	Materials	76.5	1.86	5	2.89	mid
300136	SUNWAY COMM	Tech	29.8	1.79	6	5.01	high
002475	LXJM	Tech	419.5	1.79	7	9.19	high
600019	BAOSTEEL	Materials	145.3	1.78	8	2.21	mid
603501	WILLSEMI	Tech	208.7	1.77	9	0.28	low
600009	SIA	Industrials	83.1	1.77	10	0.24	low

Note: This screen is based on the holding positions and fund flow of Northbound hedge funds, as well as News Sentiment Scores; the portfolio is rebalanced monthly, with data as of Dec 2020; the screen is valid for Jan 2020.
Source: DataYes, Wind, UBS Quant Research

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Executive summary

In this report, we investigate a novel proxy to quantify news sentiment in China. Although news sentiment is well acknowledged as a high-frequency signal, we observe a sustained pricing effect at longer horizons. We incorporate the signal into our stock-selection models, with a moderate impact on turnover ratios while significantly improving performance.

To better understand the news media in local China markets, we use the **DataYes News Sentiment Dataset** (https://www.datayes.com/en/), which is driven by the Natural Language Processing (NLP) engines trained specifically for Chinese language. We calculate the **News Sentiment Score**, as the sum of all sentiment scores across every piece of news report, for each stock, on each day. The new factor integrates both the level of media attention (ie, the number of news reports per stock per day), and the direction of sentiment as well.

News Sentiment Score

We then investigate if it is profitable to trade on news sentiment. News sentiment is a high-frequency signal and tends to be very volatile. Indeed, we find that a short-term rebalanced strategy following the signal will lead to high returns, but high turnover and elevated transaction costs wipe out all excess returns (Figure 24). However, once aggregated over a longer look-back period and traded over a longer horizon, the strategy stabilizes. A monthly rebalanced strategy has generated much lower turnover and is, therefore, less impacted by transaction costs. Our back test has returned significant Long-Short performance of 12% per annum, after t-cost, since 2016.

Can we trade on news sentiment?

Consistent with the behavioural bias that the market tends to react stronger towards negative news events than to positive ones, we document more alpha on the short side of news sentiment than the long side (Figure 27).

Finally, we observe more interesting evidence: news sentiment in China has been highly correlated with retail investor trading (Figure 14). It indicates that retail investors' investment decisions have been largely influenced by media news reports. Therefore, the higher the news sentiment, the more active retail investors would be (Figure 35). Moreover, within sectors with higher news sentiment and more retail participation, we also document more alpha for institutional investors to harvest (Figure 36-Figure 39). Therefore, our final model trades on the intersection of news sentiment and Northbound investor insights.

Higher sentiment, more alpha

Strategy 1: High-conviction signals only

- Long: High-Northbound, High-Sentiment basket

- Short: Low-Northbound, Low-Sentiment basket

Strategy 2: Exclude high-conviction contrarian signals

- Long: High Northbound, ex. Low Sentiment

- Short: Low Sentiment, ex. High Northbound

By incorporating news sentiment into the original smart-money model, we are able to significantly improve the performance of the original model, from 16% to 33% pa, after t-costs, since 2017 (Figure 34 and Figure 41).

A closer look at media coverage

The use of high-frequency news data to forecast stock returns continues to grow in popularity. Twitter funds are one example of its application, based on interesting evidence that "Twitter mood predicts the stock market" (Bollen, Mao & Zeng, 2010). Other examples include Pluga AI Fund, launched in 2011, investing in Nikkei 225 futures using a web-mining model to analyse the content of Japanese blogs and forums, and GF Baifa Big Data Fund, launched in 2015, leveraging on the theory of investors' limited attention using the Baidu Search Index, etc.

Academic literature has also proposed a variety of proxies to quantify media attention, including extreme returns (Barber and Odean, 2008), trading volume (Gervais, Kaniel, and Mingelgrin, 2001, and Barber and Odean, 2008), news and headlines (Barber and Odean, 2008 and Yuan, 2015), or Google Trends Search (Da, Engelberg, and Gao, 2011, and Preis, Moat, and Stanley, 2013). This body of research has broadly conjectured that news sentiment predicts investor trading behaviour and, in turn, stock prices.

To directly quantify news sentiment, data providers such as Alexandria, RavenPack, and Thomson Reuters News Analytics developed Natural Language Processing (NLP) engines to detect, classify, and process news feeds. For more details, see our report, News Sentiment and Cash-flow News Returns on news sentiment in global markets.

DataYes News Sentiment Dataset

In the above literature, studies are mostly driven by English language news flow. Therefore, to better gauge the domestic media coverage in Chinese markets, we use *DataYes News Sentiment Dataset* (https://www.datayes.com/en/), which is driven by Natural Language Processing (NLP) tuned specifically for Mandarin Chinese characters, and based on news flow of more than 30,000 each day from local Chinese media.

The DataYes NLP engine[1] covers all the tasks in the sentiment scoring process, from: 1) news detecting and source tagging, at every three-minute interval; to 2) duplicated news removal, entity flagging, and news-entity connection evaluation; and ultimately to 3) sentiment scoring for each news report.

Figure 2: Data coverage

	% of stock coverage in China A-shares	% of stock coverage in CSI300 Index	Total # of news per day	# of unique news reports* per day
2016	84%	96%	35,985	11,416
2017	79%	97%	37,331	12,682
2018	76%	98%	33,286	14,413
2019	78%	100%	37,991	17,401
2020	81%	100%	45,228	20,490

* The first news feed in the timeline among all duplicated news flow from different sources.
Source: DataYes, Wind, UBS Quant Research

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[1] Their NLP algorithm runs on Convolutional Neural Network models and training is based on a sample of 40,000 news reports, using manually-labelled News Sentiment Scores, to learn the difference between positive and negative sentiment in Chinese language.

The dataset covers around 80% of all China A-share listed companies since 2016, and provides almost full coverage of the constituents of the CSI300 Index (Figure 2). As of 2020 Dec, the total number of news reports per day is as large as 45,228, among which around half are non-duplicate feeds. In following sections, we only consider the non-duplicate unique news detected in the dataset.

The dataset is on the news-stock-time level. It provides a sentiment score for every news event, regarding a specific stock, at a specific time.

Based on the scores, we can proxy sentiment from three perspectives:

News Sentiment Score

(1) **Popularity:** The number of news feeds, per stock, per day

(2) **Average Sentiment:** The average score across all of the news per stock per day, ranging from -1 (most negative) to +1 (most positive)

(3) **News Sentiment Score:** The total score for a specific stock, on a given day, as the sum of all the sentiment scores across all news flow regarding the stock.

In Figure 3, we see that on average, large-cap stocks in the CSI300 Index have consistently enjoyed more popularity than small caps across the broader A-share market (5.7 news reports per day for each stock in the broader China A-share market vs. 16.6 for stocks in the CSI300).

Figure 3: Summary statistics of news sentiment

	Popularity: Count of news per stock per day	Sentiment: Avg. of sentiment scores across news	Total score
China A-shares	5.73	0.12	0.73
CSI300 Index	16.55	0.13	1.98

Source: DataYes, Wind, UBS Quant Research; average since 2016, based on non-duplicated unique news feeds.
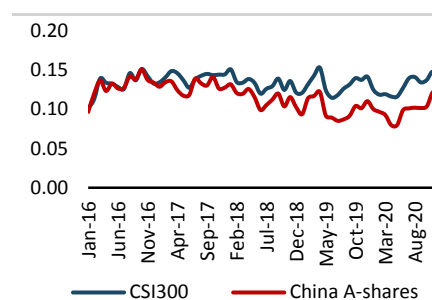
Moreover, both the average and total sentiment scores have been more positive among large caps than small caps, and the difference has become more significant in recent years (Figure 4-Figure 6).
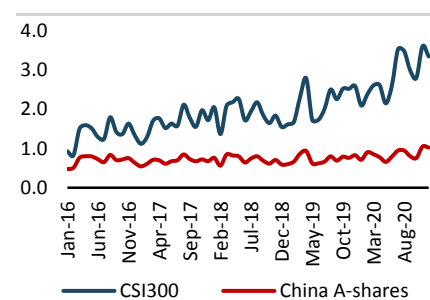
Figure 4: Popularity
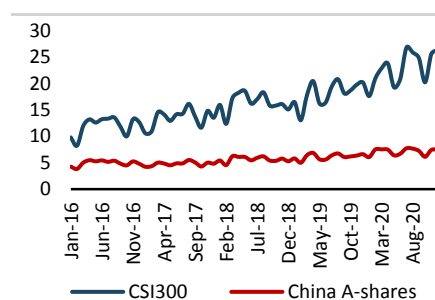
Source: DataYes, Wind, UBS Quant Research

Figure 5: Average sentiment

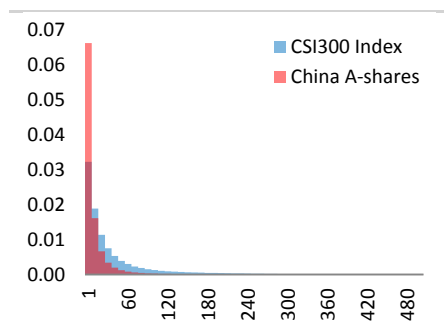Source: DataYes, Wind, UBS Quant Research

Figure 6: News Sentiment Score
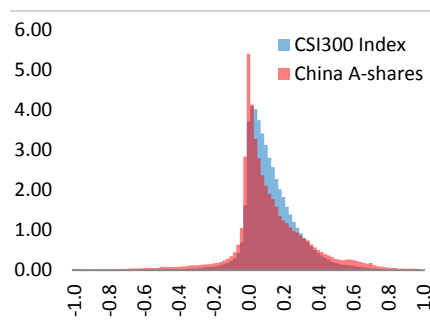

Source: DataYes, Wind, UBS Quant Research

From Figure 7 to Figure 9, we show the distribution of sentiment scores since 2016 for the CSI300 Index and the broader China A-share market. In general, the distribution is more positively skewed in the CSI300 universe. Consistent with previous charts, it indicates a higher level of attention and more positive news for larger market-capitalization companies.
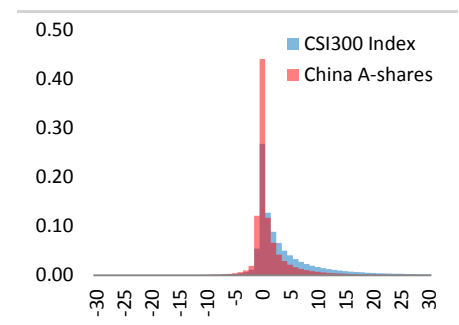
Figure 7: Distribution of popularity

CSI300 Index
China A-shares

Source: DataYes, Wind, UBS Quant Research

Figure 8: Dist. of avg. sentiment

CSI300 Index
China A-shares

Source: DataYes, Wind, UBS Quant Research

Figure 9: Distribution of total score

CSI300 Index
China A-shares

Source: DataYes, Wind, UBS Quant Research

Among the above three measures of news sentiment, our back tests show that the total News Sentiment Score is the most informative factor, as it includes both the level of media attention and the direction of sentiment. Consequently, we will focus on the total score in the following section.

News: A proxy for retail investor trading?

In the following section, we use News Sentiment Score to quantify media attention on equity markets in China, and we find evidence that news sentiment and retail investor trading have been highly correlated.

In other words, we conjecture that retail investors' investment decisions have been highly influenced by media news reports and, therefore, the news proxy can also serve as a proxy for retail investors' trading activities in China.

As retail investor ownership and trading participation is high in the Chinese market, it is critical to understand the retail market. Yet, the positioning and flow of retail investors are not available in a transparent dataset, as it is the case for institutional investors. Therefore we believe that our finding that the news sentiment dataset can proxy retail sentiment in China is particularly interesting.

In Figure 10 and Figure 11, we can see that out of all China A-share free-float market capitalisations, more than 30% are held by retail investors, with retail and high-net-worth-individual investors combined. In terms of trading activities, they contribute to more than 80% of daily value traded in China, while retail trading only accounts for 20% in Hong Kong.

High retail participation ratio

Figure 10: Retail investors* own more than 30% of total free-float market capitalisation
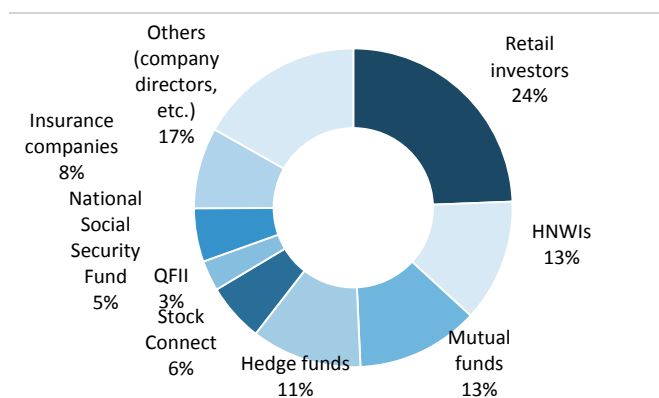
* Retail investors and high-net-worth-individual investors combined; data as of Dec 2020. Source: Wind, CSRC, CIRC, NSSF, UBS Securities estimates

Figure 11: Retail investors contribute more than 80% of total market trading
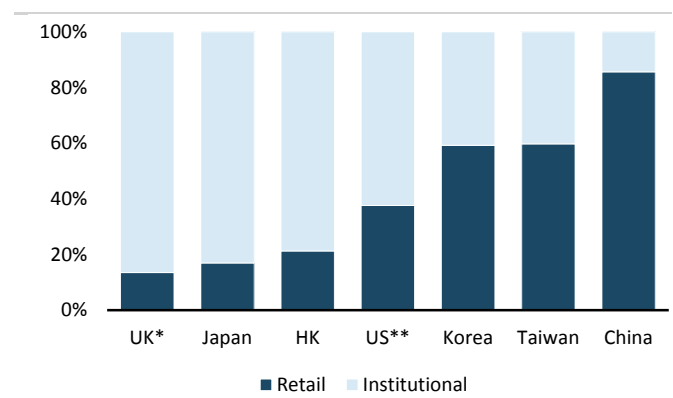
* Office of National Statistics (2018); ** SIFMA (2019).
Source: CEIC; UBS Quant Research

In Figure 12, we report four traditional measures for retail investor trading. The measure of annualised turnover is aggregate across all investors, among which more than 80% (Figure 11) is contributed by retail investors.

Over time, the turnover ratio among retail investors has been very volatile and as high as ~1,000% during booming markets in 2007 and 2015. It was much lower, at around 200%, during bear markets.

Consistent with a turnover ratio, newly-launched mutual fund products, net inflow from small-sized trades, and the number of newly opened individual investor stock accounts all peaked in 2015.

However, the above traditional measures are mostly on the market level instead of the stock level, and they do not provide a direct measure for retail investor trading.

Figure 12: Traditional measures for retail investors' activities in equity market
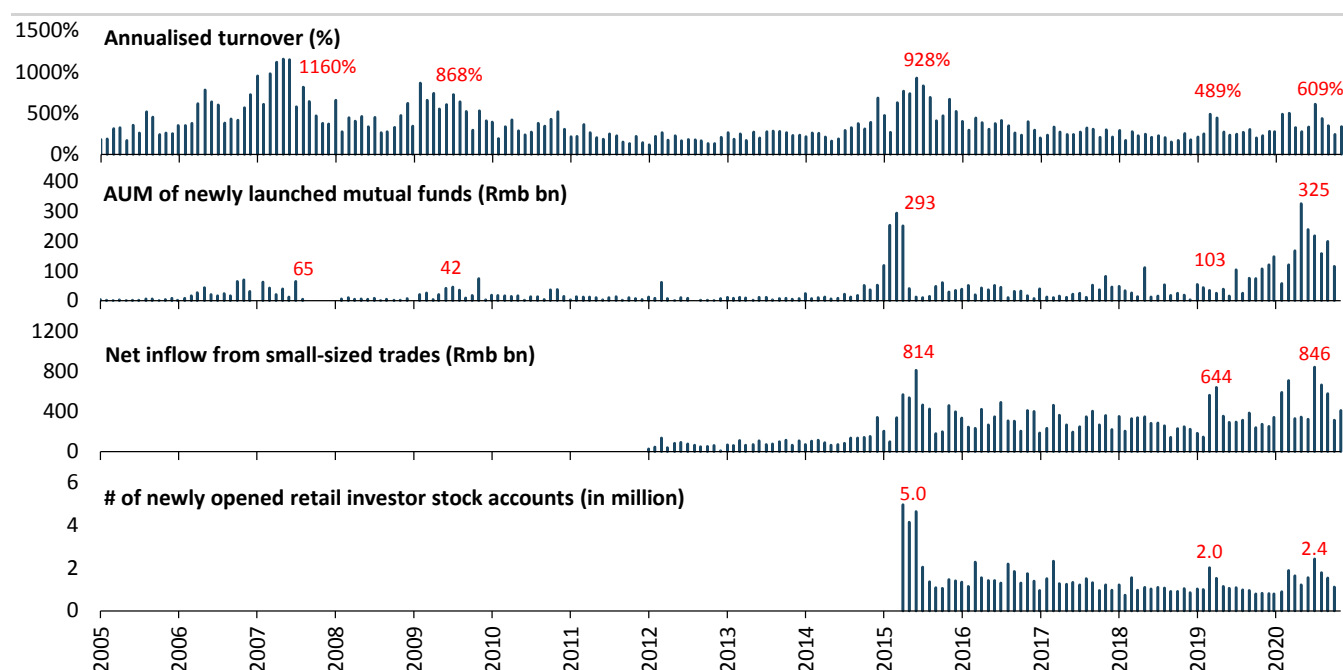
Note: * Individual investor trading is measured by small-sized trades with less than Rmb 40,000 per each trade, according to definition from Wind; ** Individual investor stock accounts are based on the classification from China Securities Depository and Clearing Corporation Limited (CSDC).
Source: CSDC, Wind, UBS Quant Research

Compared with traditional measures, news sentiment acts as a more granular and more informative proxy of retail sentiment.

As shown Figure 13, the average level of news sentiment on the market (LHS) has been mostly consistent with the level of net inflow from individual investors (RHS). It indicates that retail investors in China might be highly news driven.

To the contrary, Northbound institutional investor flow does not seem to be tracking the effect of news sentiment for the first half of our history. In recent years, by contrast, a high level of news sentiment has sometimes led to net outflow over the corresponding time period. This leads us to hypothesise that retail investors may be taking the other side of the trade of institutional investors.

Figure 13: News sentiment and investor trading activities historically
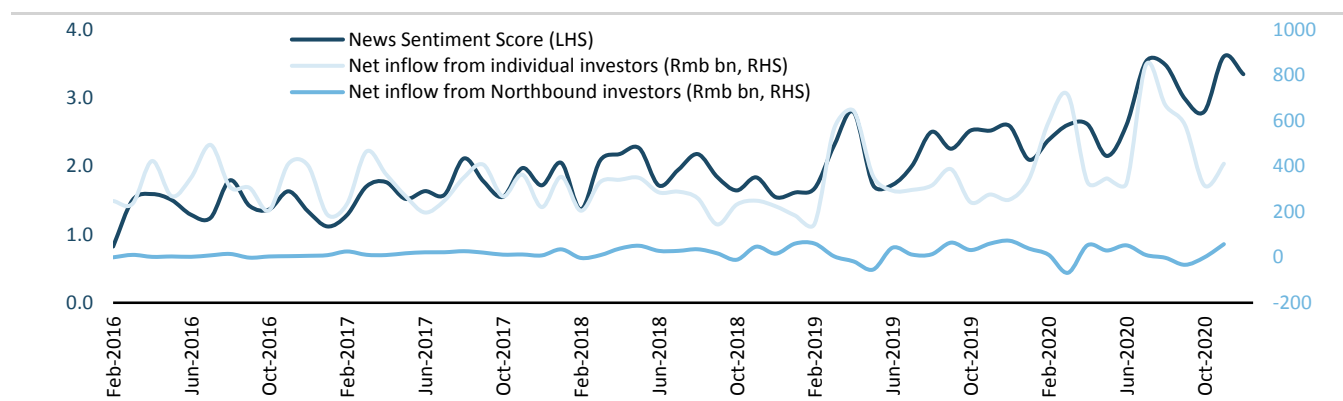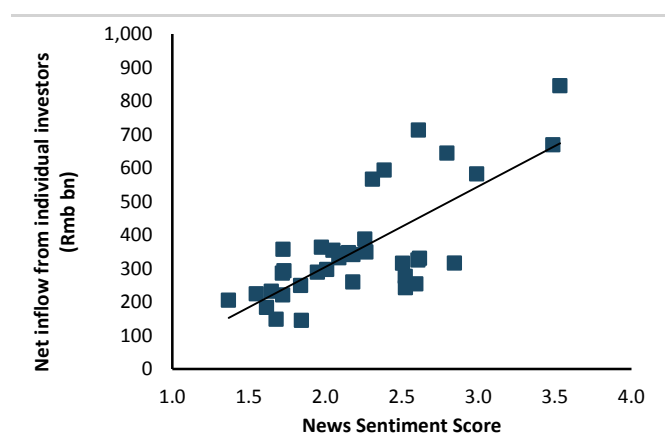

Source: DataYes, Wind, UBS Quant Research; the news sentiment in the above chart is the monthly average score across the broader China A-share market.

Moreover, in Figure 14-Figure 16, we document a significantly positive correlation between news sentiment and retail investor fund flow, and a negative correlation between news sentiment and institutional investor fund flow.

Positive correlation with retail investors; negative with institution

Figure 14: News sentiment vs. retail investors

Source: DataYes, Wind, UBS Quant Research; the news sentiment in above chart is the monthly average score across the broader China A-share market; the net inflow from individual investors is measured by small-sized trades with less than Rmb 40,000 per each trade, according to definition from Wind; see Figure 4.

Figure 15: News sentiment vs. institutional investors
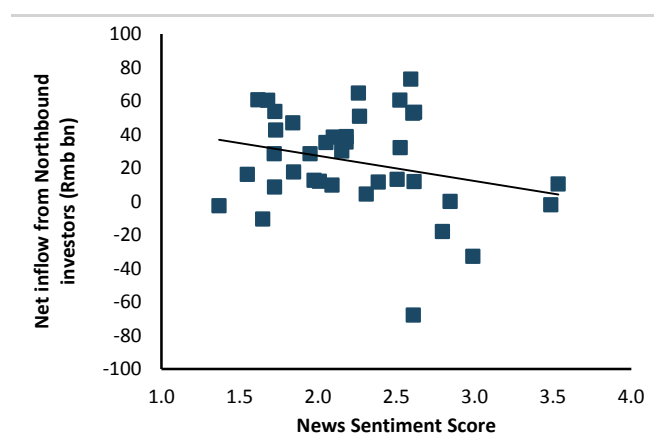
Source: DataYes, Wind, UBS Quant Research; the news sentiment in above chart is the monthly average score across the broader China A-share market; see Figure 13 for the net inflow from Northbound investors.

Figure 16: Correlation between *News Sentiment Score* and the measures for investor participation in equity markets

Source: DataYes, Wind, UBS Quant Research

As we previously mentioned, news sentiment is provided at the stock level, so we can better understand the sentiment across different levels of aggregation, such as sectors and styles, which are provided in Figure 17 and Figure 18.

Figure 17: Sentiment Score in each sector
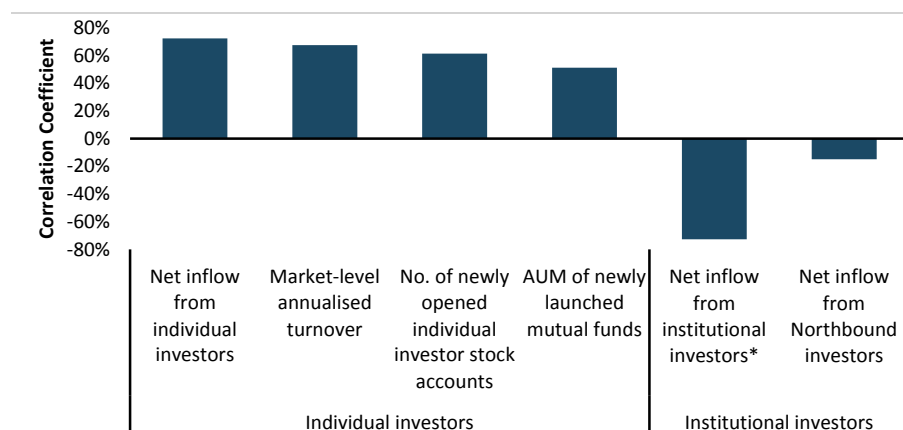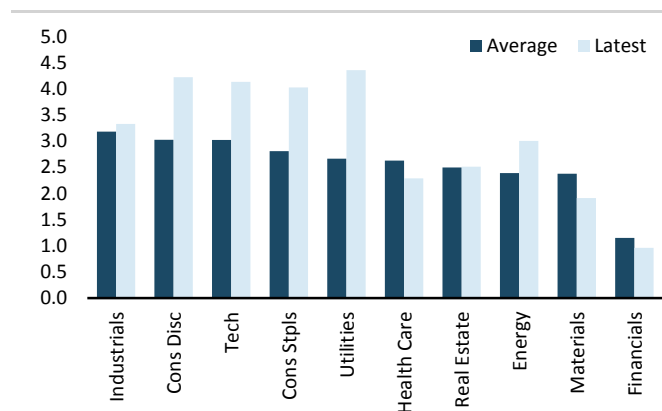

Source: DataYes, Wind, UBS Quant Research

Figure 18: Style exposure in Sentiment Score
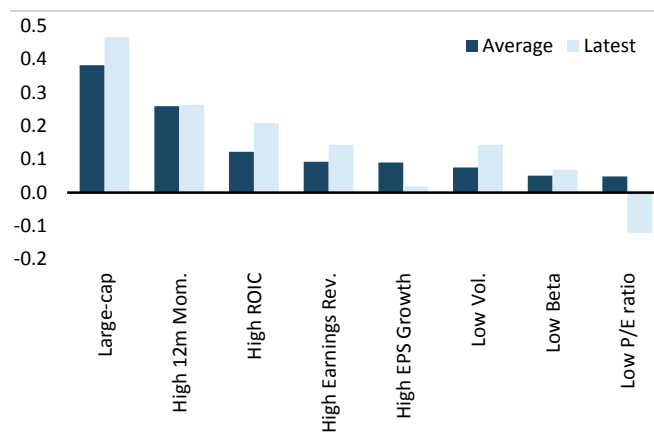
Source: DataYes, Wind, UBS Quant Research; rank correlation

Figure 17 documents the average sentiment score across different sectors. Over the time period since 2016, the top three sectors with the highest news sentiment have been Industrials, Consumer Discretionary and Information Technology; while as of 2020 December, the media sentiment has shifted towards Utilities, Consumer Discretionary and Information Technology.

In Figure 18, we calculate the rank correlation between sentiment scores and style scores across the market. Consistent with Figure 6 and Figure 9, we find evidence that media attention has a strong tilt towards large-cap stocks, as well as high-momentum and high-quality stocks.

Can we trade on news sentiment?

In previous sections, we quantified media coverage using the News Sentiment Score. What's more interesting is that we find evidence that news has been a key driver for retail investor behaviour. As retail investor participation is high in China's stock markets, the question that naturally follows would be: *is news sentiment driving stock prices, or in other words, can we trade on news?*

In the following section, we test the News Sentiment Score as a vanilla single factor. Against the literature, we find evidence that the sentiment score is not necessarily a high-frequency signal. We demonstrate that news sentiment also exhibits a long-term pricing effect and can be incorporated into a multi-factor model, with a moderate impact on turnover, and generate significant alpha at mid- to long horizons.

Daily rebalance results

The News Sentiment Score is a high-frequency signal, so to start with, we investigate a vanilla single factor model that rebalances daily. Our back-test is within run on the CSI300 Index.

Trading strategy:

    (1)   Sort the universe into three baskets using the News Sentiment Score

    (2)   Long stocks in the top 1/3, ie, the High-Sentiment basket

    (3)   Short the bottom 1/3, ie, the Low-Sentiment basket

Figure 19: Information coefficient (IC, average since 2016 = 2.9%) of the News Sentiment Score
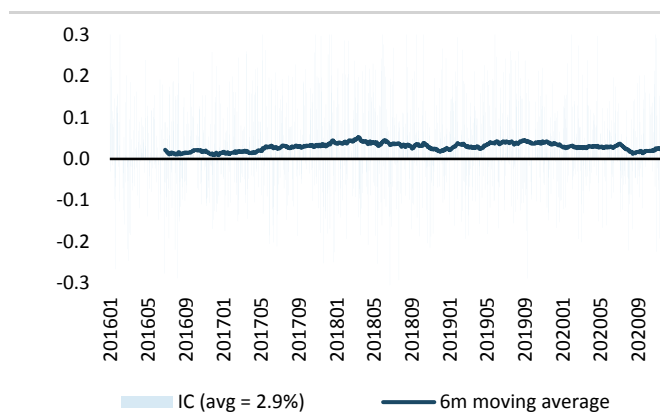
Source: DataYes, Wind, UBS Quant Research

Figure 20: Performance of high-sentiment (AnnRtn = 8.1%) vs. low-sentiment (AnnRtn = 8.1%) baskets
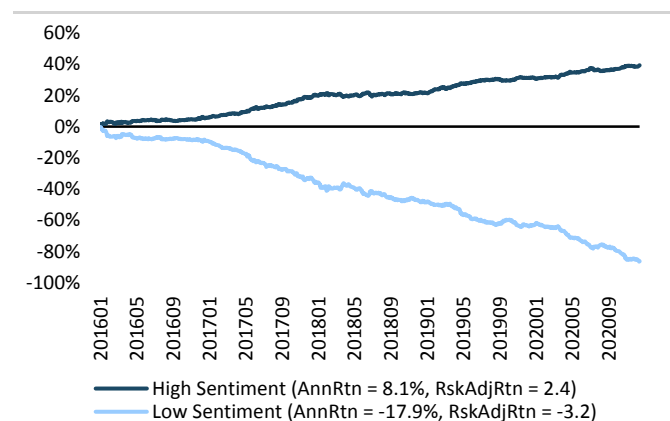
Source: DataYes, Wind, UBS Quant Research: excess return is before t-costs.

Do trading costs destroy returns?

For all high-frequency signals, the common concern would be whether turnover and trading costs will destroy excess returns. So in the following section, we extend the one-day rebalance to longer terms and check the corresponding turnover ratios and trading costs[2].

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[2] We assume 20 bps of transaction costs in each way.

We calculate the average score over a range of look-back periods and trading horizons, from 1-1 day to 60-60 days. We find evidence that the News Sentiment Score not only exhibits a fast-burn effect in the short term, but also exhibits a long-term pricing effect (Figure 21).

Figure 21: IC in different rebalance frequency

Note: IC is the rank correlation between average of the sentiment score during prior 1-60 days and stock-level returns during the subsequent 1-60 days.
Source: DataYes, Wind, UBS Quant Research

Figure 22: Turnover ratios by rebalance frequency
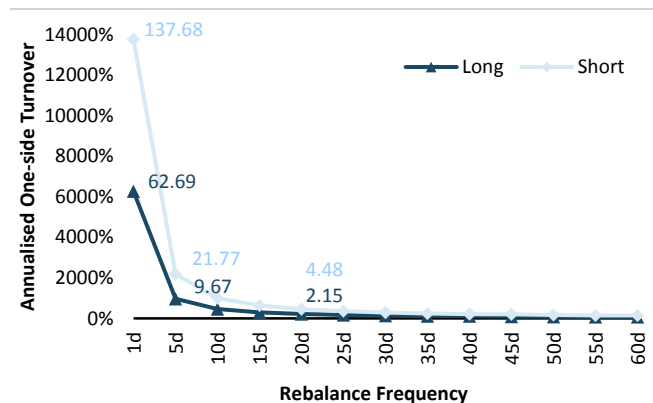
Source: DataYes, Wind, UBS Quant Research

Over a short horizon of less than 5 days, excess returns are mostly wiped out by high turnover ratios and trading costs (Figure 22-Figure 24). Over longer horizons, especially longer than 15 days, the performance of the sentiment signal stabilizes and turnover ratios and trading costs decrease. At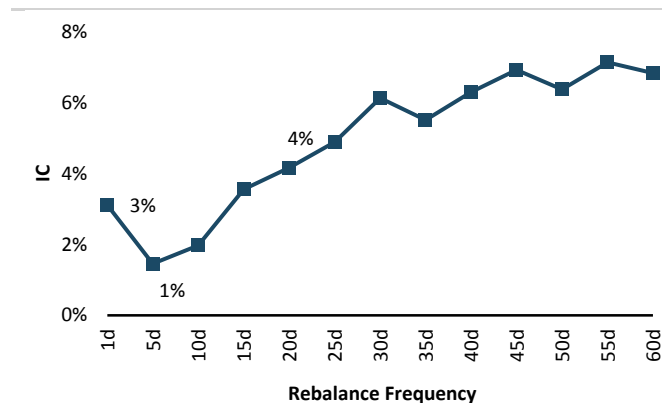 a 20-day trading horizon, the Long-Short return between the baskets of stocks with high and low news sentiment reached ~10% (Figure 24).

Figure 23: Strategy performance in different frequency, after t-costs
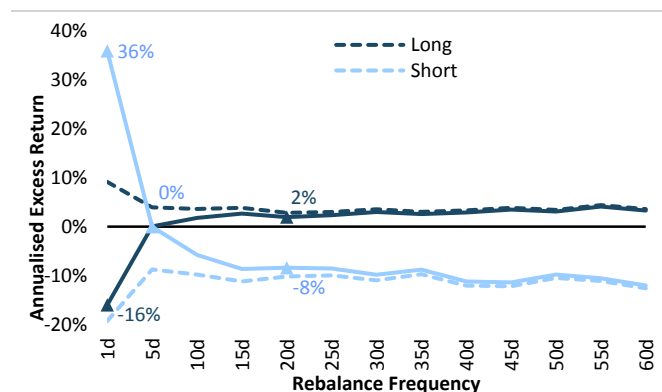
Source: DataYes, Wind, UBS Quant Research

Figure 24: Long-short performance in different frequency, after t-costs
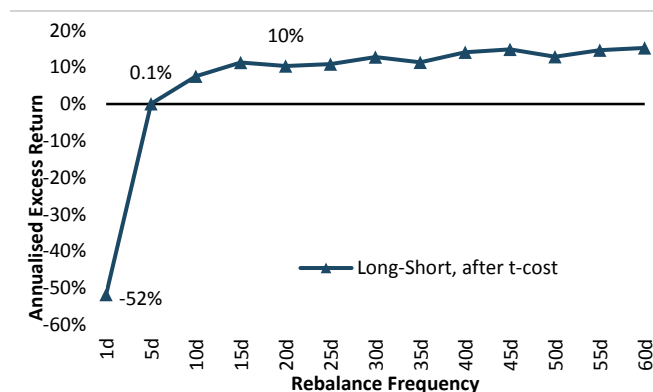
Source: DataYes, Wind, UBS Quant Research

Significant alpha at longer rebalancing horizons

In the section below, we report the strategy performance over the rebalancing horizon of one month.

In Figure 25, we see that the information coefficient of monthly news sentiment is, on average, 4.5%. It indicates that although news sentiment is a high-frequency signal, it can still well predict stocks' future returns over a longer horizon of one month.

Therefore, we long the top tercile of stocks with the highest News Sentiment Scores over the past one month, and we short the bottom tercile. The Long-Short strategy has generated an annualised return of 12.3% per annum since 2016, after t-costs, with a Sharpe ratio of 1.4 (Figure 26 and Figure 28).

Figure 25: Information coefficient (IC, average = 4.5%) of News Sentiment Score

Source: DataYes, Wind, UBS Quant Research

Figure 26: Long-short strategy performance, based on News Sentiment Score, after t-costs

Source: DataYes, Wind, UBS Quant Research

Short > long
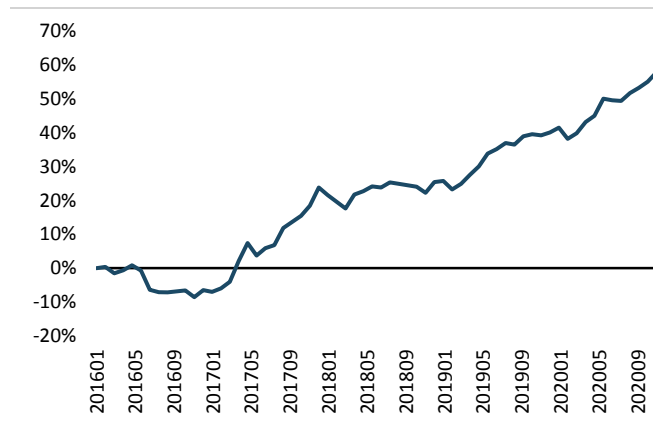
It is not surprising to see in Figure 27 and Figure 28 that news sentiment has generated more alpha on the short side rather than the long side, at -9.5% vs. 2.7%. It is consistent with behavioural bias that the market tends to react stronger towards negative news events than to positive ones. It is also the case that shorting is not widely available to retail investors, and that borrowing quantities are generally limited and shorting is costly.

Figure 27: Strategy performance of news sentiment
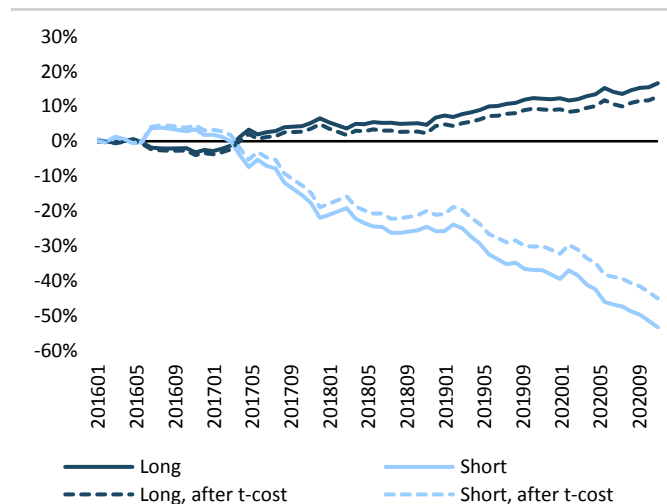
Source: DataYes, Wind, UBS Quant Research; strategy is monthly rebalanced, and back-test is within the universe of the CSI300 Index constituents; performance is above chart is the excess return of long/short baskets relative to the benchmark index performance.

Figure 28: Performance statistics

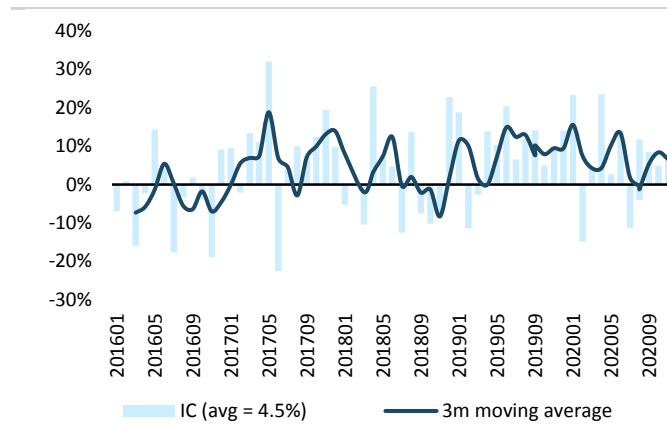|	Performance after t-cost		
	Long	Short	L-S
Annualised Excess Return	2.7%	-9.5%	12.3%
Annualised Volatility	3.1%	5.9%	8.6%
Risk-adjusted Excess Return	0.9	-1.6	1.4
Monthly One-side Turnover	17%	39%	57%
Maximum Drawdown	-4.3%	-5.1%	-9.4%
	Loading on generic factors		
	Long	Short	L-S
Market	0.1 (3.52)	-0.1 (-3.61)	0.1 (4.18)
Size (SMB)	-0.1 (-3.50)	0.3 (6.54)	-0.5 (-6.16)
Value (HML)	-0.0 (-0.41)	-0.1 (-2.77)	0.1 (1.67)
Momentum (HML)	0.0 (-0.56)	0.0 (0.68)	0.0 (-0.74)
Liquidity (HML)	0.1 (2.25)	-0.2 (-3.56)	0.3 (3.52)
Five-Factor Alpha	0.0% (0.61)	-0.3% (-3.14)	0.4% (2.43)

Source: DataYes, Wind, UBS Quant Research; in the lower panel of above table, we regress strategy performance on traditional risk premia factors including market, size, value, momentum, and liquidity, and we report the coefficients and alpha as above (t-values in brackets); numbers in bold are statistically significant at the 5% level.

After regressing against Market, Size, Value, Momentum and Liquidity, we show in Figure 28 that the performance of the news sentiment strategy is driven by Market, Size and Liquidity. This result is consistent with our previous finding that news sentiment has a tilt towards large-cap stocks. As expected, the beta against Value is not significant, but much to our surprise, Figure 28 also shows that the

signal is not significantly loading on Momentum. This could be due to the fact that monthly-rebalanced Momentum has not been a consistent pricing factor over the history of China's domestic equity markets.

More importantly, after regressing out the five factors, News Sentiment Score still generates significant alpha of -0.3% for the short side and 0.4% for the Long-Short strategy.

In Figure 29 and Figure 30, we show the top and bottom stocks ranked by News Sentiment Score.

Latest screens

Figure 29: Top 10 stocks based on news sentiment

Ticker	Company Name	Sector	Market Cap (Rmb bn)	Sentiment Score
600104	SAIC MOTOR	Cons Disc	298.5	56.19
000858	WULIANGYE	Cons Stpls	1203.3	46.25
300433	LENS	Tech	149.9	24.26
601012	LONGI	Tech	416.4	19.06
601211	GTJA	Financials	131.5	18.22
000002	VANKE-A	Real Estate	285.0	18.02
600309	WANHUA	Materials	155.2	17.40
600519	KWEICHOW MOUTAI	Cons Stpls	2625.5	17.00
002555	SANQI HUYU	Tech	50.1	16.70
002812	CHUANGXIN	Materials	81.5	14.33

Source: DataYes, Wind, UBS Quant Research

Figure 30: Bottom 10 stocks based on news sentiment

Ticker	Company Name	Sector	Market Cap (Rmb bn)	Sentiment Score
601658	PSBC	Financials	54.0	-9.59
000627	BIOCAUSE PHARMA	Financials	20.3	-4.30
300122	ZHIFEI-BIOL	Health Care	136.7	-3.32
601988	BANK OF CHINA	Financials	672.3	-2.74
601108	CAITONG SECURITIES	Financials	44.9	-2.40
002032	SUPOR	Cons Disc	50.6	-1.88
300498	WENS	Cons Stpls	92.5	-1.60
000768	AVIC XAC	Industrials	105.2	-0.94
601989	CSICL	Industrials	77.7	-0.90
000066	CGT GROUP	Tech	57.6	-0.86

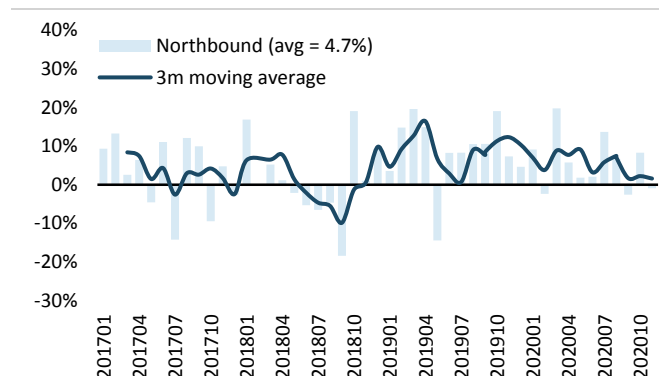Source: DataYes, Wind, UBS Quant Research

Retail vs. institutional investors

Smart money works…

In our previous research report, [Who is the smart money in China?](), we devised a stock selection model using the holding positions and fund flow of hedge funds that trade China A-shares via the Northbound Stock Connect Scheme. We preferred the stocks they overweighed and with net positive inflow.

Back tests show that the insights from Northbound smart money could have well predicted stock future returns. As shown in the figures below, the information coefficient (ie, the rank correlation between Northbound investor positions and stock returns in the subsequent month), was, on average, 4.7% over the back-test time period since 2017.

Figure 31: Information coefficient (IC, average = 4.7%) of Northbound investor positions

Source: DataYes, Wind, UBS Quant Research

Figure 32: Long-short strategy performance, based on Northbound, after t-costs
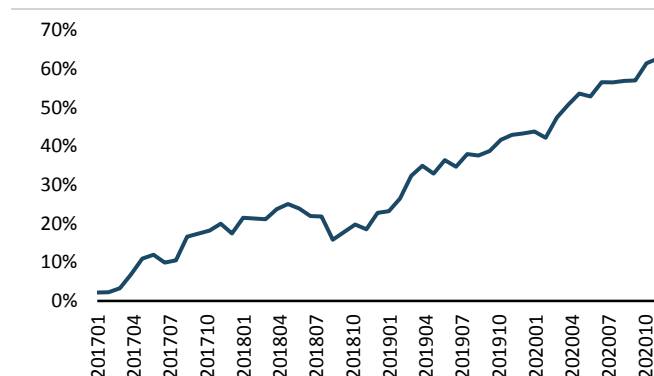
Source: DataYes, Wind, UBS Quant Research

In terms of strategy performance, after t-costs, a long basket of the top 1/3 high-holding stocks has generated an excess return of 12.5% pa since 2017, and the short side has underperformed the benchmark by 3.8% (Figure 33 and Figure 34).

Figure 33: Performance based on Northbound positions
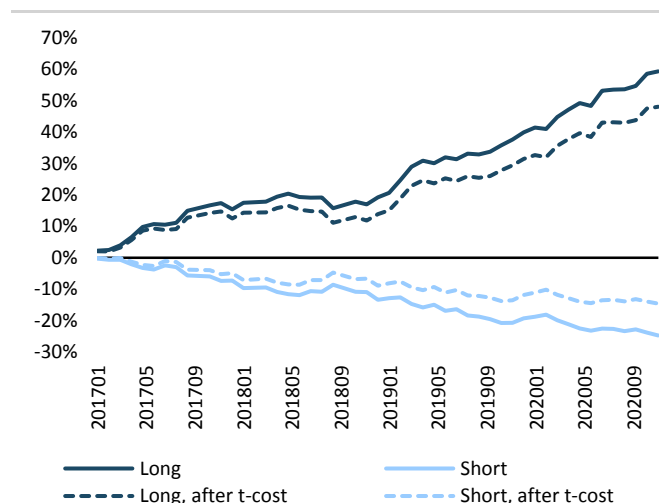
Source: DataYes, Wind, UBS Quant Research; strategy is monthly rebalanced, and back-test is within the universe of the CSI300 Index constituents; performance is above chart is the excess return of long/short baskets relative to the benchmark index performance.

Figure 34: Performance statistics

	Performance after t-cost		
	Long	Short	L-S
Annualised Excess Return	12.5%	-3.8%	16.3%
Annualised Volatility	6.0%	4.0%	8.7%
Risk-adjusted Excess Return	2.1	-1.0	1.9
Monthly One-side Turnover	61%	55%	116%
Maximum Drawdown	-5.5%	-3.9%	-9.2%
	Loading on generic factors		
	Long	Short	L-S
Market	0.1 (1.16)	-0.0 (-0.38)	0.1 (0.95)
Size (SMB)	0.1 (0.48)	0.1 (1.57)	-0.1 (-0.39)
Value (HML)	0.1 (1.51)	-0.1 (-1.49)	0.2 (1.68)
Momentum (HML)	0.0 (0.56)	0.1 (1.91)	0.0 (-0.49)
Liquidity (HML)	0.1 (0.83)	0.0 (-0.44)	0.2 (0.75)
Five-Factor Alpha	**0.8% (3.13)**	-0.2% (-0.99)	**0.9% (2.54)**

Source: DataYes, Wind, UBS Quant Research; in the lower panel of above table, we regress strategy performance on traditional risk premia factors including market, size, value, momentum, and liquidity, and we report the coefficients and alpha as above (t-values in brackets); numbers in bold are statistically significant at the 5% level.

The Long-Short strategy has generated an average annualised return of 16.3%, with a Sharpe ratio at 1.9 and significant alpha of 0.9%, after regressing out the five risk premia factors: Market, Size, Value, Momentum and Liquidity (Figure 32 and Figure 34). It should be noted that neither the long or short leg of the strategy nor the Long-Short have any significant beta against Market, Size, Value or Momentum.

…better where retail investors are active

In the section below, we refine the smart-money model above by identifying the interactions between institutional investors and individual investors, as proxied by the News Sentiment Score.

Higher sentiment, more alpha

We find evidence that among the sectors with a higher level of news attention and retail investor attention, such as Industrials, Consumer Discretionary and Information Technology, we can also observe a higher level of trading activities, presumably from retail investors who tend to be more active and more aggressive in their trading than institutional investors (Figure 35). Meanwhile, in Figure 36, we document a positive relationship between News Sentiment Score and the level of idiosyncratic risk (For the definition of idiosyncratic risk, see Figure 47 and Figure 48 in our previous report).

The charts below indicate an interesting finding that where there is a higher level of news sentiment, there is more active trading, and at the same time, there are more stock-level opportunities across these sectors. So the next question would be: can smart-money institutional investors harvest the alpha opportunities driven by news sentiment?

Figure 35: Higher sentiment, more active trading
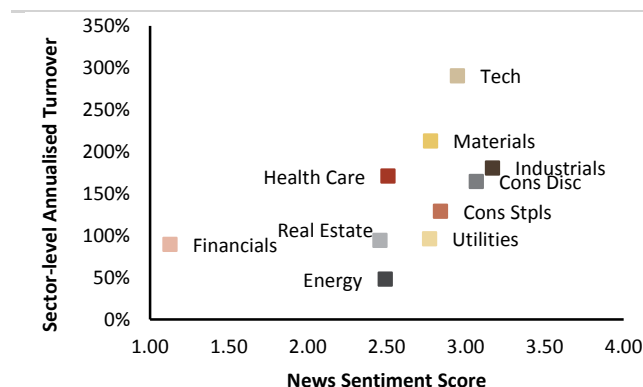
Source: DataYes, Wind, UBS Quant Research

Figure 36: Higher sentiment, more stock opportunities
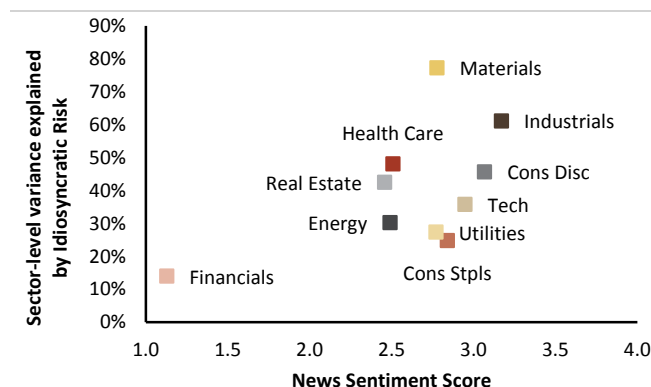
Source: DataYes, Wind, UBS Quant Research

We found evidence that smart-money positions have indeed generated higher information coefficients (in Figure 37) and higher excess returns within baskets where news sentiment conviction is strong, ie, HH-HL > LH-LL (in Figure 38 and Figure 39).

Figure 37: IC of Northbound positions in different baskets

		Northbound Positions		
		High	Mid	Low
	High	*7.4%*	3.5%	-1.8%
News Sentiment	Mid	*5.1%*	-3.4%	-3.5%
	Low	*-2.4%*	0.4%	-1.4%

Source: DataYes, Wind, UBS Quant Research

Figure 38: Annualised excess returns of double-sorting baskets (bf. costs)

		Northbound Positions			
		High	Mid	Low	H - L
	High	*26.2%*	3.7%	-5.3%	*31.4%*
News Sentiment	Mid	*9.0%*	-2.4%	-4.5%	*13.5%*
	Low	-7.6%	*-16.3%*	*-13.6%*	*6.0%*

Source: DataYes, Wind, UBS Quant Research

Figure 39: Risk-adjusted returns of double-sorting baskets (bf. costs)

		Northbound Positions			
		High	Mid	Low	H - L
	High	*3.02*	0.53	-0.95	*3.97*
News Sentiment	Mid	*1.30*	-0.37	-0.61	*1.91*
	Low	-0.93	*-2.25*	*-1.92*	*0.99*

Source: DataYes, Wind, UBS Quant Research

That adds to our previous finding that within sectors where there is a higher level of news sentiment and more active retail trading, institutional investors could have greater expertise and more information advantages to generate better alpha.

Therefore, in the following section, we further investigate the performance of Long-Short strategies that trade at the intersection of the Northbound signal and the News Sentiment Score.

Trading at the intersection of smart-money signal and news sentiment

Strategy 1: High-conviction signals only

In our first strategy we investigate the interaction effect of having both high (low) Northbound scores and high (low) sentiment scores. The strategy is rebalanced monthly, within the universe of the CSI300 Index constituents:

(1) Long: High-Northbound, High-Sentiment basket

(2) Short: Low-Northbound, Low-Sentiment basket

By incorporating News Sentiment Scores, we almost double the performance of the original smart-money model.

Compared with the 12.5% excess return of the original model (Figure 34), the long basket of the intersection has returned 23% per annum since 2017 (Figure 41), with a Sharpe ratio of 2.7 and a smaller maximum drawdown of 3.6% during 2018. Even after regressing out the five factors of Market, Size, Value, Momentum and Liquidity, we still have significant alpha of 1.3% with a t-value at 3.84. The short side underperformed the CSI300 Index by 10%, and the Long-Short return is up to 33% per annum, with a risk-adjusted return at 2.6.

We also highlight the fact that at the Long basket is neutral to Size, Value and Momentum, but has significant beta against Liquidity. The Short side has significant exposure to Market, Size and Value. The Long-Short signal only has significant beta against Market and Liquidity.

Figure 40: Strategy performance (version I)
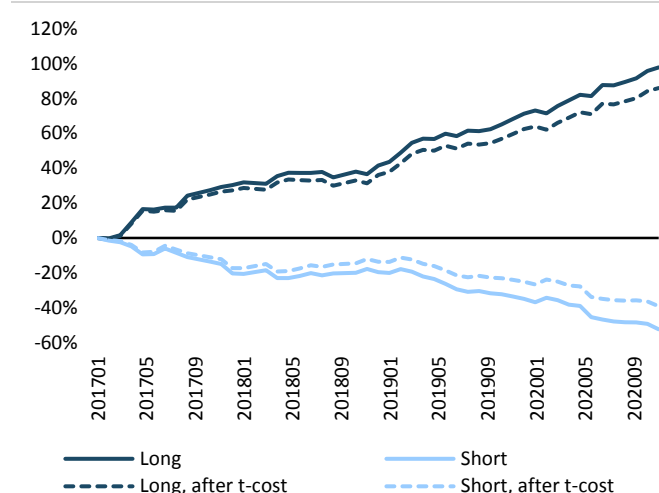
Source: DataYes, Wind, UBS Quant Research; strategy is monthly rebalanced, and back-test is within the universe of the CSI300 Index constituents; performance is above chart is the excess return of long/short baskets relative to the benchmark index performance.

Figure 41: Performance statistics

	Performance after t-cost		
	Long	Short	L-S
Annualised Excess Return	23.0%	-10.1%	33.3%
Annualised Volatility	8.7%	7.1%	13.0%
Risk-adjusted Excess Return	2.7	-1.4	2.6
Monthly One-side Turnover	65%	73%	138%
Maximum Drawdown	-3.6%	-8.0%	-9.2%
	Loading on generic factors		
	Long	Short	L-S
Market	0.1 (1.75)	-0.2 (-3.66)	0.3 (3.50)
Size (SMB)	0.1 (0.50)	0.3 (3.27)	-0.3 (-1.38)
Value (HML)	0.0 (0.15)	-0.1 (-2.31)	0.2 (1.40)
Momentum (HML)	0.1 (1.05)	0.0 (0.48)	0.1 (0.62)
Liquidity (HML)	0.4 (2.09)	-0.1 (-0.85)	0.5 (2.23)
Five-Factor Alpha	1.3% (3.84)	-0.3% (-1.13)	1.5% (3.87)

Source: DataYes, Wind, UBS Quant Research; in the lower panel of above table, we regress strategy performance on traditional risk premia factors including market, size, value, momentum, and liquidity, and we report the coefficients and alpha as above (t-values in brackets); numbers in bold are statistically significant at the 5% level.

Strategy 2: Exclude high-conviction contrarian signals

In our second strategy, we exclude the high conviction opposite signal. We devise a strategy that, on the long side, trades all high Northbound scores that do not fall in the low-sentiment basket. On the short side, we sell the stocks that are ranked low on sentiment signal and exclude the names that are subject to a high Northbound position (see the intersection baskets in Figure 38 and Figure 39).

Strategy, monthly rebalance:

   (1) Long: High Northbound, ex. Low News Sentiment

   (2) Short: Low News Sentiment, ex. High Northbound

In this strategy, we expand to a larger number of names in the top and bottom baskets. We end up with a small sacrifice in long side performance, down to 16.8% from 23% (Figure 41 and Figure 43) and we actually observe a better short basket, which underperformed by 13%, with significant alpha of 0.5% after regressing out the five risk premia. The Long-Short strategy has returned 30% pa, with a Sharpe ratio at 2.7 and significant five-factor alpha of 1.5% (t-value at 4.17). In terms of betas to Market, Size, Value, Momentum and Liquidity, the overall exposure is similar to that of the vanilla news sentiment factor.

Figure 42: Strategy performance (version II)
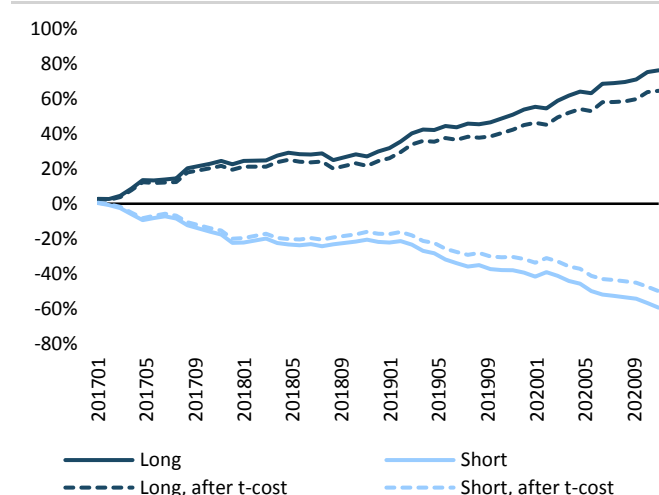
Source: DataYes, Wind, UBS Quant Research; strategy is monthly rebalanced, and back-test is within the universe of the CSI300 Index constituents; performance is above chart is the excess return of long/short baskets relative to the benchmark index performance.

Figure 43: Performance statistics

	Performance after t-cost		
	Long	Short	L-S
Annualised Excess Return	16.8%	-13.0%	29.9%
Annualised Volatility	7.1%	6.2%	11.0%
Risk-adjusted Excess Return	2.4	-2.1	2.7
Monthly One-side Turnover	63%	51%	115%
Maximum Drawdown	-5.0%	-4.5%	-7.5%
	Loading on generic factors		
	Long	Short	L-S
Market	0.1 (1.15)	-0.1 (-4.36)	0.2 (2.71)
Size (SMB)	0.0 (0.22)	0.4 (5.51)	-0.3 (-2.02)
Value (HML)	0.1 (1.22)	-0.2 (-3.86)	0.3 (2.57)
Momentum (HML)	0.0 (0.40)	0.0 (0.20)	0.0 (0.25)
Liquidity (HML)	0.2 (1.22)	-0.1 (-1.45)	0.3 (1.60)
Five-Factor Alpha	1.0% (3.40)	-0.5% (-3.30)	1.5% (4.17)

Source: DataYes, Wind, UBS Quant Research; in the lower panel of above table, we regress strategy performance on traditional risk premia factors including market, size, value, momentum, and liquidity, and we report the coefficients and alpha as above (t-values in brackets); numbers in bold are statistically significant at the 5% level.

Figure 44 and Figure 45 show the top and bottom names in our two strategies at the intersection of the Northbound score and the news sentiment factor.

Latest screens

Figure 44: Top 20 names based on our model

Ticker	Company Name	Sector	Market Cap (Rmb bn)	Northbound Score	Northbound Rank	Sentiment Score	Sentiment Basket
000725	BOE	Tech	215.6	1.94	1	11.05	high
002027	FOCUS MEDIA	Cons Disc	160.3	1.92	2	2.81	mid
000002	VANKE-A	Real Estate	285.0	1.90	3	18.02	high
000661	CCHN	Health Care	184.4	1.88	4	0.72	low
002271	ORIENTAL YUHONG	Materials	76.5	1.86	5	2.89	mid
300136	SUNWAY COMM	Tech	29.8	1.79	6	5.01	high
002475	LXJM	Tech	419.5	1.79	7	9.19	high
600019	BAOSTEEL	Materials	145.3	1.78	8	2.21	mid
603501	WILLSEMI	Tech	208.7	1.77	9	0.28	low
600009	SIA	Industrials	83.1	1.77	10	0.24	low
002236	DAHUA INC	Tech	44.1	1.75	11	4.71	high
601899	ZIJIN MINING	Materials	222.9	1.74	12	0.04	low
600004	GBIAC	Industrials	27.3	1.73	13	1.98	mid
601939	CCB	Financials	60.8	1.73	14	2.01	mid
002624	PWRD	Tech	54.5	1.71	15	1.24	mid
601225	SHCI	Energy	102.4	1.71	16	4.93	high
603160	GOODIX	Tech	70.2	1.71	17	3.04	mid
002410	GLODON	Tech	78.0	1.70	18	0.90	low
600522	ZTT	Tech	34.6	1.69	19	2.40	mid
600340	CFLD	Real Estate	47.3	1.65	20	0.34	low

Source: DataYes, Wind, UBS Quant Research; above screen is based on the holding positions and fund flow of Northbound hedge funds, as well as the News Sentiment Scores; portfolio is monthly rebalanced and data as of December 2020; screen is valid for January 2020.

Figure 45: Bottom 20 names based on our model

Ticker	Company Name	Sector	Market Cap (Rmb bn)	Northbound Score	Northbound Basket	Sentiment Score	Sentiment Rank
601658	PSBC	Financials	54.0	0.18	low	-9.59	1
000627	BIOCAUSE PHARMA	Financials	20.3	1.07	mid	-4.30	2
300122	ZHIFEI-BIOL	Health Care	136.7	0.30	low	-3.32	3
601988	BANK OF CHINA	Financials	672.3	0.84	low	-2.74	4
601108	CAITONG SECURITIES	Financials	44.9	1.13	mid	-2.40	5
002032	SUPOR	Cons Disc	50.6	0.49	low	-1.88	6
300498	WENS	Cons Stpls	92.5	0.37	low	-1.60	7
000768	AVIC XAC	Industrials	105.2	0.67	low	-0.94	8
000066	CGT GROUP	Tech	57.6	0.94	mid	-0.86	9
601838	BANK OF CHENGDU	Financials	17.8	1.26	high	-0.76	10
601808	COSL	Energy	43.6	1.27	high	-0.46	11
000708	CITIC STEEL	Materials	33.1	0.26	low	-0.44	12
600015	HUAXIA BANK	Financials	80.1	0.84	low	-0.16	13
002939	GREAT WALL SEC	Financials	21.4	1.09	mid	-0.12	14
002958	QRCB	Financials	13.0	1.05	mid	-0.11	15
600637	OPG	Cons Disc	31.1	1.15	high	-0.05	16
600760	AVIC SAC	Industrials	133.5	0.33	low	-0.04	17
002146	RISESUN	Real Estate	24.9	1.21	high	-0.02	18
000723	MEIJIN ENERGY	Energy	24.1	1.40	high	-0.01	19
002153	SHIJI INFORMATION	Tech	19.0	1.09	mid	0.00	20

Source: DataYes, Wind, UBS Quant Research; above screen is based on the holding positions and fund flow of Northbound hedge funds, as well as the News Sentiment Scores; portfolio is monthly rebalanced and data as of December 2020; screen is valid for January 2020.

References

Barber B M , Odean T. All That Glitters: The Effect of Attention and News on the Buying Behavior of Individual and Institutional Investors[J]. *Review of Financial Studies*, 2008(2):785-818.

Bollen J , Mao H , Zeng X J . Twitter Mood Predicts the Stock Market[J]. *Journal of Computational Science*, 2010, 2(1).

Gervais S , Kaniel R , Mingelgrin D H . The High Volume Return Premium[J]. *Journal of Finance*, 2001, 56(3):877-919.

Preis T , Moat H S , Stanley H E . Quantifying Trading Behavior in Financial Markets Using Google Trends[J]. *Scientific Reports*, 2013, 3(1684):1684.

Yuan Y . Market-wide attention, trading, and stock returns[J]. *Journal of Financial Economics*, 2015.

Zhi D A , Engelberg J , Gao P . In Search of Attention[J]. *Journal of Finance*, 2011, 66(5):1461-1499.

Valuation Method and Risk Statement

Our quantitative models rely on reported financial statement information, consensus earnings forecasts and stock prices. Errors in these numbers are sometimes impossible to prevent (as when an item is mis-stated by a company). Also, the models employ historical data to estimate the efficacy of stock selection strategies and the relationships among strategies, which may change in the future. Additionally, unusual company-specific events could overwhelm the systematic influence of the strategies used to rank and score stocks.

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Buy	FSR is > 6% above the MRA.	51%	31%
Neutral	FSR is between -6% and 6% of the MRA.	37%	29%
Sell	FSR is > 6% below the MRA.	12%	18%
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 2020.
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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