

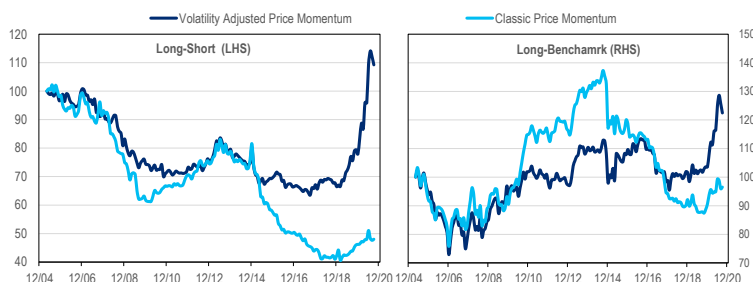
# Searching for Alpha

## China A Alpha – Smoothing Price Momentum



- **Price Momentum can work well in China** – Early research by both practitioners and academics has shown China A to be a contrarian market where reversal strategies worked well. Hence we believe a common misconception has prevailed that longer-term Price Momentum strategies based on continuation signals do not work well in China A. While we found that Price Momentum did suffer in early years before 2010, this trend has changed and more recently Price Momentum has strongly outperformed.
- **Volatility-Adjusted Price Momentum significantly improves performance** – Construction methodology matters, and for more than a decade Citi has been applying a smoothing function to Price Momentum as our standard approach. We apply Volatility-Adjusted Price Momentum (VPMOM) by ranking based on the regression slope and standard error (t-statistic) of logged stock prices, rather than the classic point-to-point construction which is more volatile. The performance has differed dramatically in recent years, particularly as overall markets themselves have been extremely volatile with frequent risk-on/risk-off rotations. On the other hand, VPMOM has been much more consistent, particularly in the last 2 years during which it posted over 60% L-S returns vs 15% returns of the classic approach (Figure 1).
- **Recent strong performance boosted by sectors** – Strong sector momentum helped VPMOM in the last couple of years, as VPMOM overweighted consistently outperforming sectors. Conversely, sector-neutral implementation underperformed by eliminating sector exposures and missing the strong gains from sector momentum. Strong institutional northbound flows have also helped performance.
- **A great complement to high-alpha Estimates Momentum** – [Estimates Momentum \(EMOM\) is a high-performing factor in China A](#). While EMOM presents better alpha on paper, combining VPMOM with EMOM still has a Sharpe above 1 (CSI 300), reducing the volatility, and lengthening the average holding period by 25%. This improves real world returns by reducing transaction costs and market impact. See our [Momentum Screen](#) for stocks that rank high on momentum factors.

Figure 1. Cumulative Performance of Price Momentum – CSI 300



Source: Citi Research, Wind, Datastream

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See Appendix A-1 for Analyst Certification, Important Disclosures and non-US research analyst disclosures.

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# Introduction

## Price Momentum as an Investment Style

Price Momentum has long been a popular investment style in global markets. It is documented by Jegadeesh and Titman (1993, 2001) and a number of subsequent authors. Jegadeesh and Titman found return continuation over intermediate horizons (3 to 12 months). They found that stocks which outperformed during the previous 6 months are likely to continue their outperformance over the next 6 months. Chan, Jegadeesh and Lakonishok (1996) extended the analysis to include both price momentum and earnings momentum effects. Although it was initially argued that price momentum may be driven by earnings momentum, they found that the two types of momentum effects are quite separate.

Research interest on efficacy of momentum strategies in China stock market has also been rising. Early research by Kang, Liu and Ni (2002) documented evidence of abnormal returns for short-term reversal and intermediate-term momentum strategies in China. They argued that investors' overreaction to firm-specific information is the main cause of abnormal return for short-term reversal but not intermediate-term momentum profits. Wang and Chin (2004) reported that momentum and reversal are driven by past trading volume over intermediate horizons in China stock market. They suggested that this phenomenon is related to market characteristics of the China market which prohibited short-selling and that the market is dominated by retail investors. Later work by Shumway and Wu (2006) suggested that disposition effect (investors tend to hold assets on which they have experienced paper losses, but sell assets on which they have experienced gains) may drive stock price momentum in China's market.

## Our Approach to Price Momentum

Volatility-Adjusted Price Momentum (which we also call Composite Price Momentum in this report) is one of the 7 composite style families that we regularly track and write about in publications such as:

- Monthly Quantitative Insights series ([Asia](#), [Global](#), and [US](#) editions)
- [Asia ex-Japan Factor Reference: Factor Performance by Countries, Sectors & Market Regimes](#)
- [Equity Risk Premia Investing: A New Methodology for Monitoring Style Performance](#)

In this report, we evaluate the performance of price momentum strategies in various cross-sections of the China A-shares market. We apply our standard Volatility-Adjusted Price Momentum (VPMOM) strategy and show that it outperforms signals based on a Classic Price Momentum construction using point-to-point stock returns.

In addition, we will also investigate the performance of sector-neutral price momentum strategies based on various classification standards. We will show that sector neutrality historically can achieve higher risk-adjusted returns, accomplishing this by generating both higher expected returns while still maintaining lower volatility. However this is not always consistent, and indeed in the recent couple of years, having a sector tilt actually helped price momentum perform much better.

## Previous Research on China A Alpha

This Price Momentum note is the third piece of our China A Alpha series research. Our previous research on Estimates Momentum and Value:

### Citi Composite Style Factors

Value

Growth

Quality

Low Risk

Size

Estimates Momentum

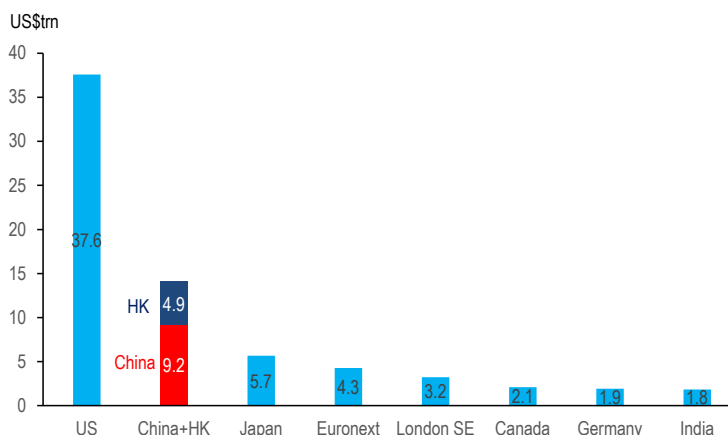
Price Momentum (Volatility-Adjusted)

- [Combining Consensus for A Better Earnings Revisions Strategy](#)
- [Sector-relative Value Is Powerful, Choose Sector Mappings Wisely](#)

## Rising Importance of China A-shares market

**The China A-share market is big and imminent.** It is increasingly important for global investors to have exposure to the China A-shares market. It is a broad market with over 4,000 stocks and over US\$9 trillion market capitalization. This is second only to the US, even when excluding Hong Kong and overseas listings. China A shares are also a deep market with ample liquidity: on average there was US\$50 million Average Daily Traded Value (ADTV) for MSCI China A Onshore constituents as of the end of 2019.

Figure 2. Domestic stock market capitalization as of June 2020

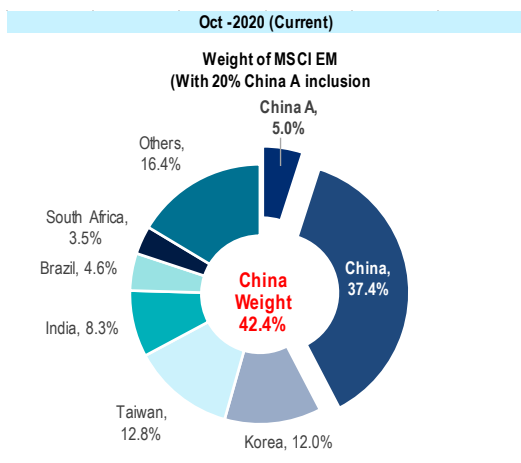


Source: WFE, Citi Research

**China market has become increasingly important to global institutional investors.** In 2019, China A shares accounted for 12.1% of MSCI China Index and 4.0% of MSCI EM Index. MSCI raised the A share inclusion factor from 5% to 20% and included mid-cap stocks with a 20% inclusion factor in 2019 (Figure 3). FTSE started to include A-shares in June 2019, with an inclusion factor of 5% in Jun 2019, rising to 15% in Sep 2019 and 25% in Mar 2020. More inclusion will likely happen ahead. Citi Research forecasts full inclusion by MSCI and FTSE by 2025. A shares would represent about 20.7% of MSCI EM Index and 22% of FTSE Emerging All Cap Index by then. Meanwhile, China would account for nearly 52% of MSCI EM Index by 2025E (Figure 4).

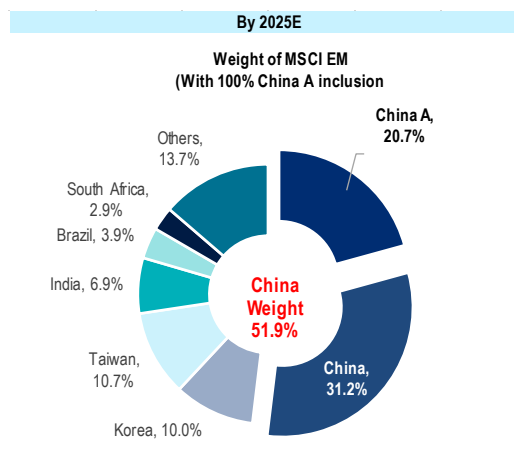
**Citi Global Equity Strategists recommend [overweighting China](#)** amid concerns around global economy negatively impacted by COVID-19 outbreak. China seems to have navigated the COVID-19 crisis better and recovered faster than most other countries. China GDP growth forecasts have stabilized even as lockdowns and associated downgrades are resuming elsewhere. China's economic outperformance is being reflected in a rising RMB. Citi economists expect the [RMB appreciation is here to stay in the remainder of the year](#). They believe that RMB would be pushed to a one-way appreciation path if persistent and large capital inflows continue. This would boost the returns on Chinese financial assets for global investors.

Figure 3. MSCI raised the large-cap A-share inclusion factor from 5% to 20% and included mid-cap A-shares with 20% inclusion factor



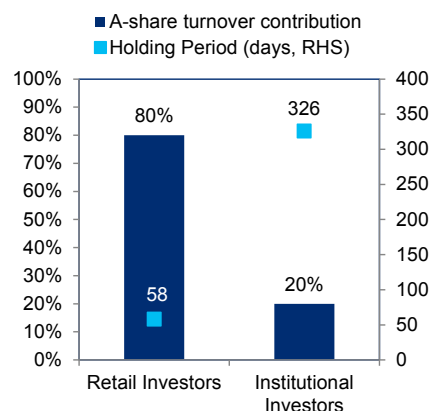
Source: Citi Research, Factset, MSCI

Figure 4. Citi Research forecasts full inclusion by MSCI. A-shares will represent ~20.7% of MSCI EM Index by 2025.



Source: Citi Research, Factset, MSCI

Figure 5. Retail Investors More Active



Source: Citi Research, CEIC, HkEx

**The structure of the China A-shares market continues to evolve**, presenting investors with a timely opportunity. The market has traditionally been driven by domestic retail investors, who contribute nearly 80% of the A share market turnover. Indeed, common perception by Western investors is that investing in China is speculative and resembles a “casino”, as mentioned by none other than Warren Buffett<sup>1</sup>. While we might not use the same terms to characterize the market, we do believe that the China A shares market is often more sentiment-driven than fundamentals-driven in the short-term. This leads to a less efficient market at pricing in new information, and one that currently presents systematic investors with opportunity to arbitrage these inefficiencies. Yet in the long-term, we do see that the market is rational and eventually fundamentals are priced in.

**Thanks to China’s ongoing efforts to open up the market** as well as inclusion in global indices such as MSCI and FTSE, the participation rate of foreign investors continues to rise dramatically. As the market structure evolves and becomes more efficient with an increasing proportion of institutional investment, we believe now is the best time for systematic strategies in China A while there is still ample alpha.

<sup>1</sup> <https://www.cnbc.com/2017/05/06/buffett-warns-china-that-markets-can-sometimes-become-a-casino.html>

## Methodology

Price Momentum can be measured in various ways. One classic measure of price momentum is to calculate point-to-point stock returns over a particular period. While this method is widely used by both academia and practitioners, our research shows that Citi's Volatility-Adjusted Price Momentum (t-statistic of the trend line slope fitted to logged daily stock prices) is able to deliver better performance (please refer to Momentum Matters, 3 December 2001 for details). Our recent research has further confirmed that our [Volatility-Adjusted approach outperforms the overlapping momentum strategies](#) from both absolute return and risk-adjusted perspectives and suffers from smaller drawdowns.

Our Price Momentum style family consists of three individual factors, as detailed in Figure 6. Instead of using raw factor values, we adopt a cross-sectional approach to each single factor and calculate normalized factor scores. We then equally weight the three normalized factor scores to form our Composite Price Momentum factor (in this report, when we mention the performance of "Price Momentum" it generally refers to Composite Price Momentum). This is consistent with our regional and global definition which allows for convenient comparison with stocks outside of China.

Figure 6. Citi's Volatility-Adjusted Price Momentum Factors

Price Momentum Composite	Simple average of the normalized scores of Price Momentum factors mentioned below. Normalization is specific to the region.
3 months	T-Stat of slope by regressing natural logarithm of closing stock prices over previous 90 week days against an arithmetic progression where the first term is 1 with common difference of 1 between the terms.
12 months	T-Stat of slope by regressing natural logarithm of closing stock prices over previous 360 week days against an arithmetic progression where the first term is 1 with common difference of 1 between the terms.
First 11 months	T-Stat of slope by regressing natural logarithm of closing stock prices over previous first 330 of the 360 week days against an arithmetic progression where the first term is 1 with common difference of 1 between the terms.

Source: Citi Research

Every month-end, we compute the factor scores and group stocks (for every universe) into quintile portfolios based on the Composite Price Momentum factor, with Q1 being the worst quintile (i.e. Short Basket) and Q5 being the best quintile (i.e. the Long Basket). We then calculate the equal-weighted total returns for the respective quintile portfolios with a monthly rebalance frequency to evaluate their performance.

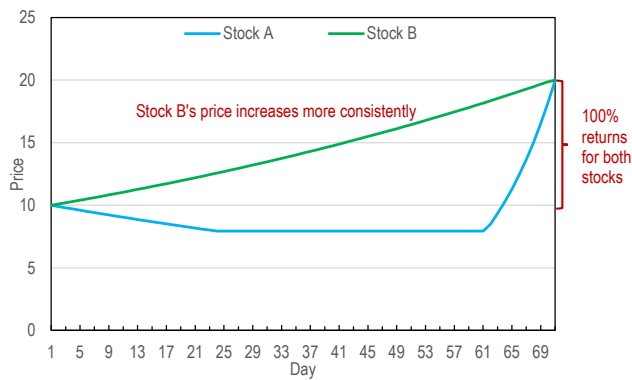
In this report, we evaluate Price Momentum factor performance as implemented by Long-only, Long-Benchmark, and Long-Short strategies.

- **Long-only:** long all stocks in the top quintile (Q5), equal-weighted
- **Long-Benchmark:** same as Long-only but as excess returns relative to benchmark
- **Long-Short:** long the top quintile (Q5) and simultaneously short the bottom quintile (Q1) on an equal-weighted basis

To illustrate the difference between our Volatility-Adjusted Price Momentum (Figure 6) against the classic approach, we show an example of two conceptual stocks in Figure 7 and Figure 8.

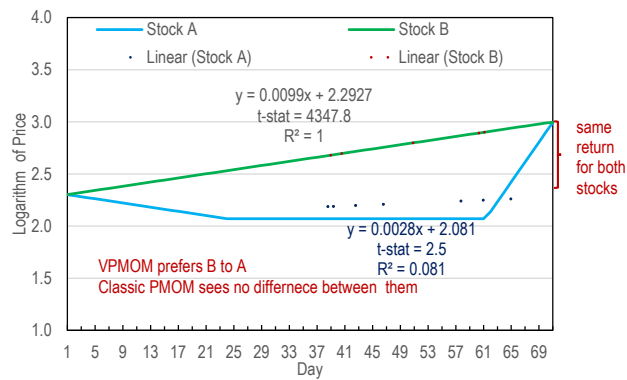
In this case, both stock A and B posted the same return (up +100%) over the same period, while Stock B's return is clearly more consistent. If adopting the classic point-to-point price momentum approach, we will get the same momentum scores for both stocks, despite their price trajectories differing significantly. On the other hand, our Volatility-Adjusted Price Momentum method will be able to distinguish the two stocks and give us significantly different momentum scores (with stock B having a much higher t-statistic value than that of stock A). Essentially, the VPMOM is path-dependent and prefers stocks that have a much smoother return profile.

Figure 7. Price Trajectories of Two Conceptual Stocks



Source: Citi Research

Figure 8. Volatility-Adjusted PMOM vs Classic PMOM



Source: Citi Research

## Backtesting Universe

For the purpose of evaluating our Price Momentum strategies, we list below several widely benchmarked indices/universe.

**MSCI China A Onshore Index:** the MSCI China A Onshore Index is USD denominated which captures large and mid-cap stocks across China securities listed on the Shanghai and Shenzhen exchanges.

**CSI 300 Index:** launched in Apr 2005, CSI 300 index consists of the 300 largest and most liquid A-share stocks. The index aims to reflect the overall performance of the China A-shares market.

**CSI 500 Index:** launched in Jan 2007, CSI 500 index consists of the next largest 500 A Share stocks after excluding the largest 300 stocks in the CSI 300 index. The Index reflects the overall performance of mid-cap A-shares.

**CSI 800 Index:** launched in Jan 2007, CSI 800 index consists of the combined constituents of the CSI 300 and CSI 500 indices. It is designed to reflect the overall performance of the large and mid-cap A-shares.

**CSI 1000 Index:** launched in Oct 2014, CSI 1000 index consists of 1,000 small and liquid A Share stocks after excluding the constituents of the CSI 800 index. The index aims to reflect the overall performance of small-cap A-shares.

**Stock Connect:** a cross-border investment channel that connects the China A-shares stock exchanges (Shanghai/Shenzhen Stock Exchanges) and the Hong Kong Stock Exchange. Under the program, investors in each market are able to trade shares on the other market using their local brokers and clearing houses. This provides a channel for foreign investors without QFII or RQFII quota to invest in the China A-shares market.

Basic statistics of the above indices/universe are summarized in Figure 9.

Figure 9. Statics of China A Share Universes

	MSCI China A	CSI 300	CSI 500	CSI 800	CSI 1000	Stock Connect
# of Stocks	716	300	500	800	1000	2234
Total Market Cap (US\$ bn)	7,132	5,583	1,508	7,091	1,436	9,089
Avg. Market Cap (US\$ bn)	9.96	18.61	3.02	8.86	1.44	4.07
Avg. Liquidity (US\$ mn)	73.91	102.27	36.34	61.06	24.45	36.22
Percentage of SOE	37.3%	30.0%	29.0%	29.4%	30.1%	29.5%

Source: Citi Research, FactSet, MSCI, Wind. Statistics as of Sep 15, 2020.

In this report, we adopt local currency returns (RMB returns) to evaluate factor performance when the universe is one of the above CSI indices (as the CSI indices are mostly benchmarked by China's domestic investors). For the MSCI China A Onshore index (which is USD denominated), we use USD returns.

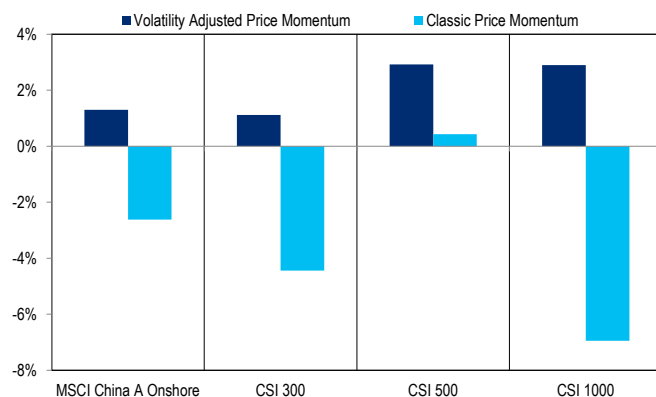


## Performance of Price Momentum

Figure 10 and Figure 11 compare the annualized return and information ratio of Composite Price Momentum (the equal-weighted average of the three individual factors) for the Long-Short quintile portfolios. As a comparison, both results for our Volatility-Adjusted Price Momentum as well as the Classic Price Momentum are shown to illustrate their differences. To be clear, unless otherwise specified, when discussing the performance of Classic Price Momentum it generally refers to Composite Classic Price Momentum which is an equal-weighted blend of the three individual price momentum factors of the same duration as those in Figure 6, with the only difference being that the Classic Price Momentum factors are constructed based on the point-to-point stock returns over the specified duration (as compared with the t-statistic approach of our Volatility-Adjusted Price Momentum).

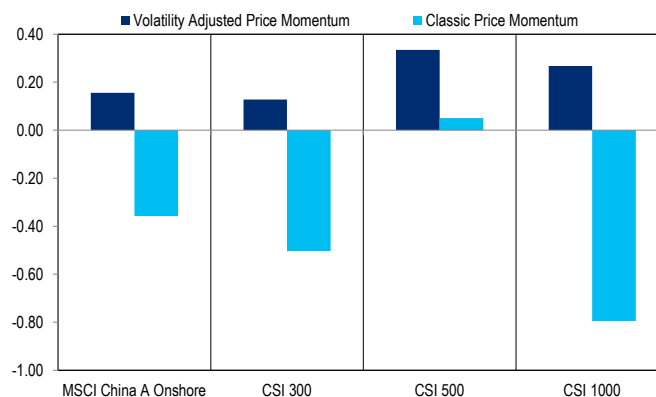
We can see that at the composite level, our Volatility-Adjusted Price Momentum substantially outperformed the classic approach for all of the four universes spanning across all market cap ranges. In particular, the Volatility-Adjusted Price Momentum posted positive returns/information ratios while the classic approach clocked in negative returns/information ratios for most of the universes while the latter was only slightly up for mid-cap CSI 500 universe.

**Figure 10. Annualized Return of Price Momentum Composite (Long-Short)**



Source: Citi Research, MSCI, Wind, Datastream

**Figure 11. Information Ratio of Price Momentum Composite (Long-Short)**



Source: Citi Research, MSCI, Wind, Datastream

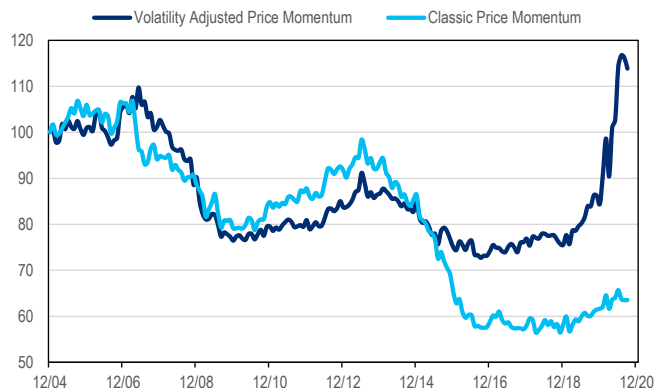
### Cumulative Returns of Price Momentum Composite (Long-Short)

Figure 12 - Figure 15 show the cumulative performance of Price Momentum composite for the four universes. As expected, performance discrepancies between the two approaches were quite prominent, especially in the past two years, despite both underperforming before 2010. This may explain widely-held beliefs that China A is more of a contrarian market where longer-term price momentum does not work. While we acknowledge this is true in earlier years, we find this situation has changed as we see price momentum working quite well recently. Importantly, the way of constructing price momentum does make a big difference.

Cumulative returns and performance summaries for each of the individual factors can be found in Figure 59, Figure 70 and Figure 71-Figure 74 of Appendix 1, respectively. For reference purposes, the results for a short-term (1-month) price reversal strategy is also included (see Figure 75 - Figure 78). Empirically, the short-term reversal strategy has had episodes of strong performance though it has not always been consistent except for the strong long-term performance in the small-cap CSI 1000 universe. It is also worth noting that the Classic construction based on point-to-point periodic stocks returns outperformed the t-statistic based

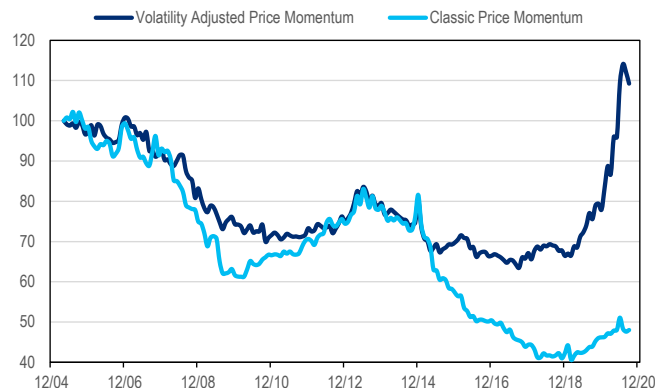
approach. This may be because for a reversion signal, you may actually want to have higher volatility for the reversion to take place.

Figure 12. MSCI China A Onshore



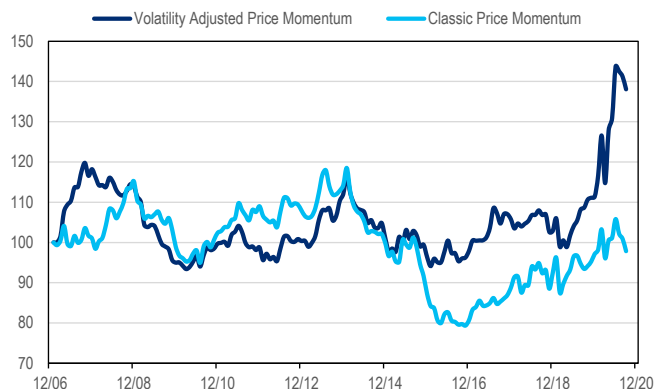
Source: Citi Research, MSCI, Wind, Datastream

Figure 13. CSI 300



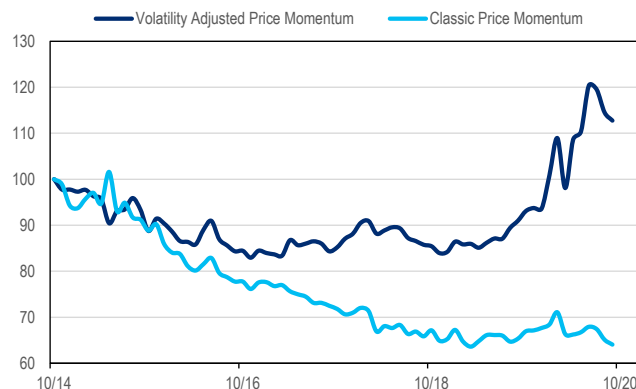
Source: Citi Research, MSCI, Wind, Datastream

Figure 14. CSI 500



Source: Source: Citi Research, MSCI, Wind, Datastream

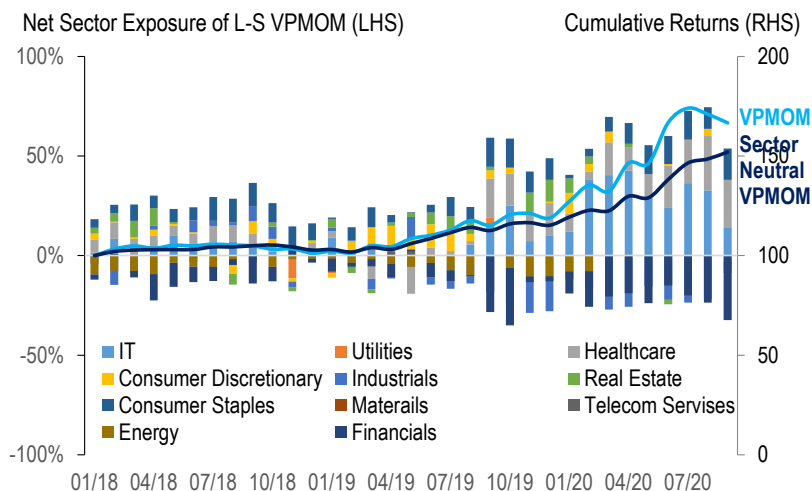
Figure 15. CSI 1000



Source: Source: Citi Research, MSCI, Wind, Datastream

The powerful performance of Volatility-Adjusted Price Momentum factor in the past two years is likely related to the strong sector momentum effect during that time. This is illustrated in Figure 16 which shows net sector exposures of Long-Short Volatility-Adjusted Price Momentum factor overlaid with its performance, with and without sector neutrality. As we can see, our Volatility-Adjusted Price Momentum strategy in the past two years has been overweighting Tech, Healthcare and Consumer sectors which have consistently outperformed during this same period. On the other hand, the sector-neutral version underperformed by eliminating these sector exposures and thereby missing the strong gains from Tech, Healthcare, and Consumer sectors.

Figure 16. Net Sector Exposure of VPMOM and Cumulative Returns – CSI 300



Source: Citi Research, Wind, Datastream. Note: WIND-1 sector classification is adopted, see Figure 54 and Figure 56 for more details.

### Performance Summary by Year (Long-Short)

Figure 17 - Figure 20 summarize the performance statistics for our Volatility-Adjusted Price Momentum on a Long-Short basis. Performance summaries for Long-only and Long-Benchmark strategies can be found in Appendix 2. Unsurprisingly, the worst year for VPMOM was in 2009 during the GFC recovery.

Figure 17. MSCI China A Onshore

Year	Ann Ret	Ann Std	Hit Rate	T-Stat	IR (L-S)	Turnover
2005	0.9%	6.4%	50.0%	0.17	0.14	28.0%
2006	4.5%	8.4%	58.3%	0.57	0.54	28.6%
2007	-2.7%	9.0%	58.3%	-0.26	-0.29	28.7%
2008	-12.2%	6.8%	25.0%	-1.87	-1.79	27.0%
2009	-15.2%	7.1%	25.0%	-2.27	-2.14	36.7%
2010	4.1%	4.5%	66.7%	0.90	0.89	27.2%
2011	1.7%	3.5%	58.3%	0.51	0.49	28.8%
2012	3.4%	5.2%	66.7%	0.67	0.66	29.2%
2013	3.6%	6.9%	75.0%	0.54	0.52	26.9%
2014	-1.9%	4.2%	33.3%	-0.44	-0.46	29.1%
2015	-11.8%	7.5%	33.3%	-1.63	-1.57	34.2%
2016	-1.1%	6.1%	41.7%	-0.16	-0.19	29.6%
2017	3.6%	4.5%	50.0%	0.82	0.81	26.5%
2018	-1.8%	4.2%	33.3%	-0.41	-0.42	25.6%
2019	11.8%	7.0%	58.3%	1.63	1.69	27.8%
2020 (YTD)	48.8%	23.2%	66.7%	1.60	2.10	27.5%

Figure 18. CSI 300

Year	Ann Ret	Ann Std	Hit Rate	T-Stat	IR (L-S)	Turnover
2005	-4.0%	4.2%	37.5%	-0.78	-0.96	29.4%
2006	3.6%	6.8%	50.0%	0.55	0.53	28.8%
2007	-7.8%	6.5%	41.7%	-1.20	-1.19	28.4%
2008	-10.5%	8.3%	33.3%	-1.29	-1.27	27.4%
2009	-10.7%	6.9%	33.3%	-1.59	-1.54	35.7%
2010	-3.6%	7.7%	50.0%	-0.44	-0.47	27.1%
2011	2.4%	3.5%	58.3%	0.68	0.67	29.8%
2012	2.2%	5.4%	58.3%	0.43	0.41	29.2%
2013	6.2%	8.0%	58.3%	0.78	0.77	26.2%
2014	0.8%	9.0%	41.7%	0.13	0.09	28.9%
2015	-13.0%	10.3%	50.0%	-1.30	-1.27	32.8%
2016	-4.7%	5.7%	50.0%	-0.82	-0.82	31.1%
2017	1.0%	5.6%	33.3%	0.20	0.18	27.1%
2018	-1.1%	5.7%	41.7%	-0.16	-0.19	27.0%
2019	17.3%	8.1%	66.7%	2.03	2.15	29.0%
2020 (YTD)	56.8%	21.0%	55.6%	1.97	2.70	28.5%

Figure 19. CSI 500

Year	Ann Ret	Ann Std	Hit Rate	T-Stat	IR (L-S)	Turnover
2007	20.0%	7.5%	90.9%	2.36	2.65	28.5%
2008	-3.6%	4.3%	33.3%	-0.82	-0.83	30.8%
2009	-16.7%	5.3%	8.3%	-3.41	-3.17	37.0%
2010	5.0%	5.4%	66.7%	0.92	0.91	27.3%
2011	-0.9%	5.0%	58.3%	-0.16	-0.19	28.3%
2012	1.6%	6.5%	50.0%	0.28	0.25	29.1%
2013	11.7%	6.6%	75.0%	1.71	1.77	29.1%
2014	-9.7%	7.7%	25.0%	-1.29	-1.27	29.1%
2015	-4.7%	8.6%	41.7%	-0.53	-0.55	33.7%
2016	1.6%	6.9%	58.3%	0.26	0.23	30.5%
2017	8.0%	6.8%	58.3%	1.17	1.18	27.6%
2018	-2.7%	5.5%	66.7%	-0.48	-0.50	26.8%
2019	8.2%	9.2%	83.3%	0.90	0.89	27.6%
2020 (YTD)	33.2%	23.2%	55.6%	1.17	1.43	30.9%

Figure 20. CSI 1000

Year	Ann Ret	Ann Std	Hit Rate	T-Stat	IR (L-S)	Turnover
2015	-7.6%	9.7%	41.7%	-0.77	-0.78	32.6%
2016	-6.5%	7.7%	33.3%	-0.83	-0.84	31.5%
2017	4.4%	5.6%	50.0%	0.79	0.78	28.0%
2018	-4.5%	5.3%	41.7%	-0.83	-0.84	27.1%
2019	11.2%	4.4%	66.7%	2.43	2.53	28.1%
2020 (YTD)	28.2%	24.4%	55.6%	0.98	1.16	30.5%

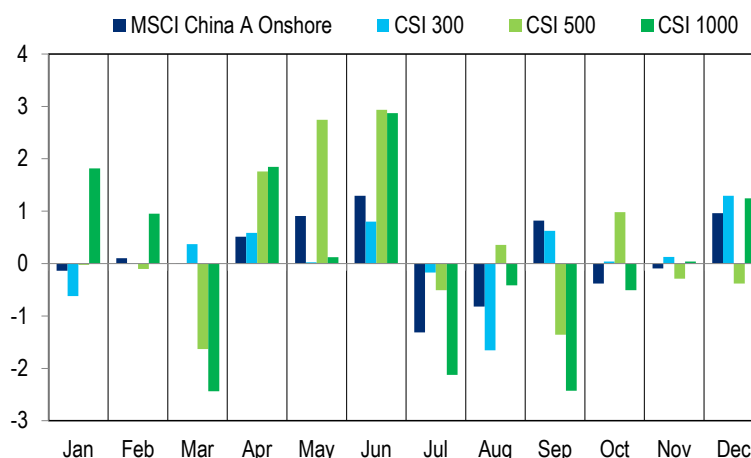
Source: Citi Research, MSCI, Wind, Datastream

Source: Citi Research, MSCI, Wind, Datastream

## Seasonality

The risk-adjusted returns (Information Ratios, aka Sharpe Ratios) by calendar month are shown in Figure 21. Because the CSI 1000 index was launched in late 2014, there are only a handful of observations for it and hence may be less significant. On a risk-adjusted basis, Price momentum outperformed in Apr-Jun, while underperformed afterwards in Jul-Aug. For other months, the results are quite mixed amongst the four universes.

Figure 21. Composite Price Momentum: Annualized IR by Month



Source: Citi Research, MSCI, Wind, Datastream

Figure 22. Return and Hitrate – MSCI China A Onshore

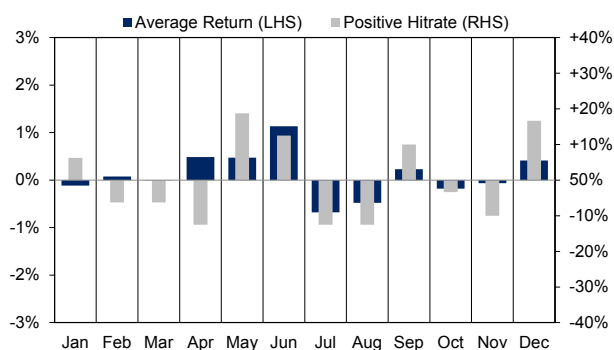


Figure 23. Return and Hitrate – CSI 300

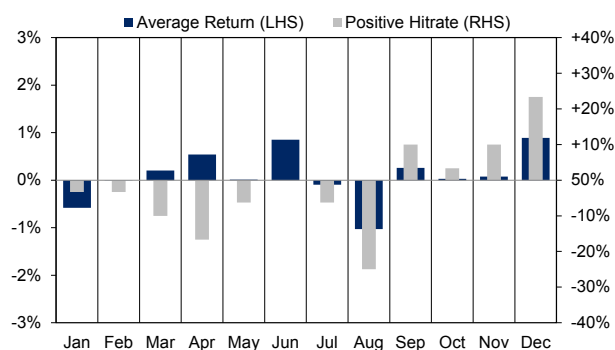


Figure 24. Return and Hitrate – CSI 500

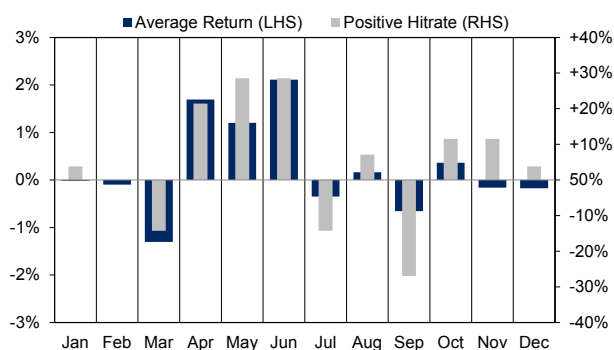
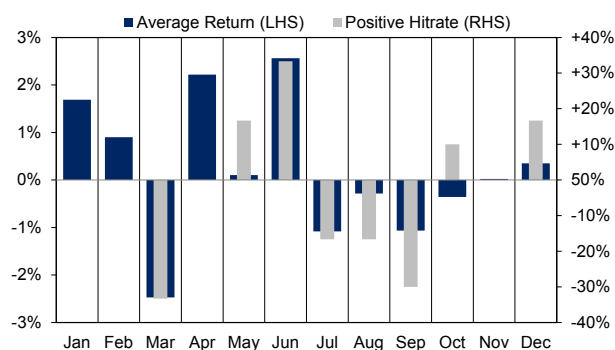


Figure 25. Return and Hitrate – CSI 1000



Source: Citi Research, MSCI, Wind, Datastream

Source: Citi Research, MSCI, Wind, Datastream

Figure 22 - Figure 25 show the seasonal performance of Price Momentum by calendar month. Here, we look at positive hit-rates to see how persistent a seasonal effect is, as a 50% hit-rate means an equal chance of positive/negative returns. Note that the statistics for each universe are based on historical performance since the launch of each index.

As we can see, Apr-Jun are typical strong months for price momentum, while no clear seasonal pattern can be observed in other months as we see quite divergent numbers between average returns and positive hit-rates. For example, some months have high average returns but poor hitrate at the same time (i.e., less than 50% hit-rate), suggesting high volatilities of returns in those calendar months.

### Seasonality during Chinese New Year Season

Chinese New Year (CNY), also known as Spring Festival or Lunar New Year, is the most important festival in China with a 7-day long holiday. Unlike the calendar year New Year observed on January 1st, Chinese New Year does not fall on a fixed date, but generally occurs in January or February – see Figure 26 for more details.

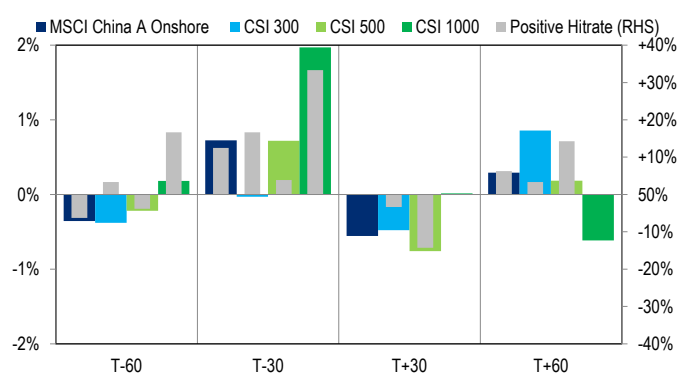
Figure 26. CNY Months Since 2005

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
CNY Month	Feb	Jan	Feb	Feb	Jan	Feb	Feb	Jan	Feb	Jan	Feb	Feb	Jan	Feb	Feb	Jan	Feb

Source: Citi Research

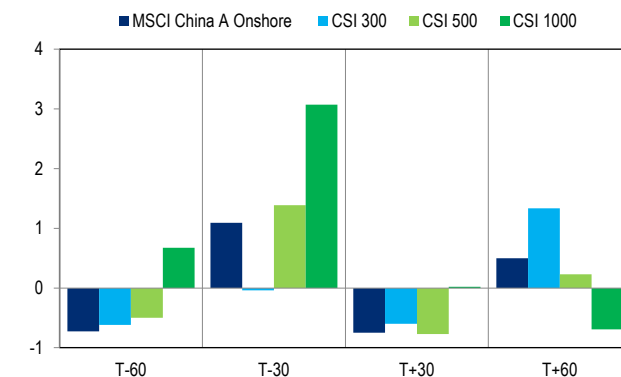
Investors tend to behave differently during the CNY season. To illustrate this 'Chinese New Year effect', we show the performance of Price Momentum before and after CNY in Figure 27 and Figure 28. Empirically, Price Momentum performed well during the 30 days before CNY but suffered within 30 days after CNY. The pattern of this CNY effect is more consistent (in terms of consistency of signs of average return and positive hitrate) than the January effect. Notably, this effect is much more pronounced in the smaller cap universes, while it's insignificant in the larger cap CSI 300.

Figure 27. Average Return and Hit-rate during CNY Season



Source: Citi Research, MSCI, Wind, Datastream

Figure 28. Annualized Information Ratio during CNY Season



Source: Citi Research, MSCI, Wind, Datastream

## Correlation with Stock Connect Flows

With more long-term investors in the market, this could be another reason why long-term momentum strategies based on continuation signals have been more effective in recent years.

Figure 29 to Figure 32 show the correlation of price momentum factor against the Northbound flows via Stock Connect since mid-2016. On average, correlation before mid-2019 has been less significant at ~2% level, however, it rose sharply in Jun-2019 and more recently to the highest level we have ever seen, suggesting a structural change of market participants in China A-shares market.

This can also be observed from Figure 33 where we see northbound turnover as % of total A-share turnover has been consistently rising. Given more of the northbound money are institutional by nature, this would have diluted the retail participation in China A market which has long been retail-driven. We believe investor trading via northbound will continue to play an important role in China A-shares market.

Figure 29. 1M Price Momentum

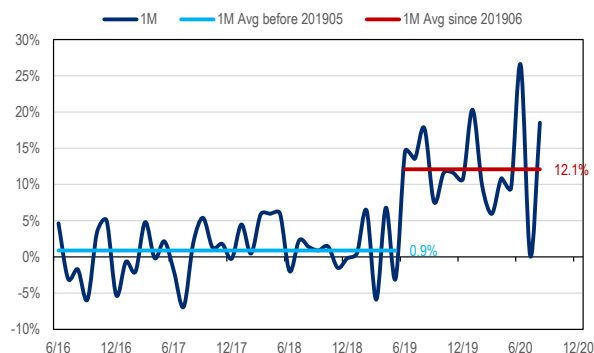


Figure 30. 3M Price Momentum

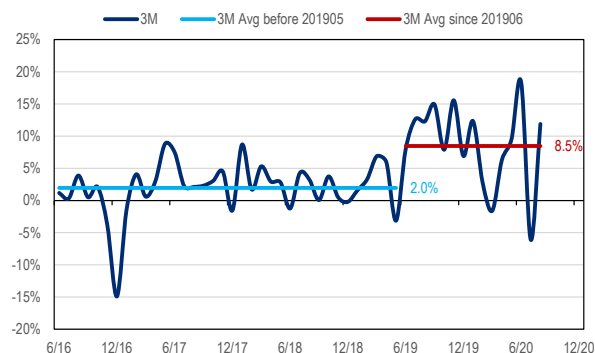


Figure 31. 12M Price Momentum

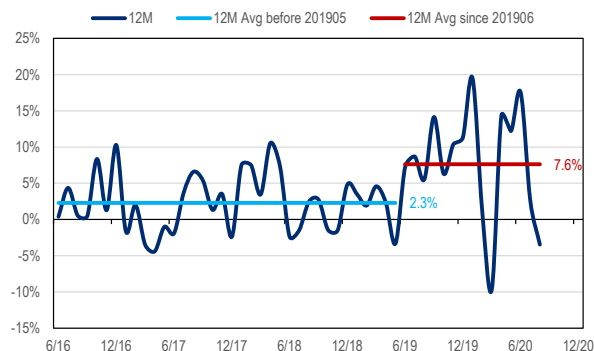
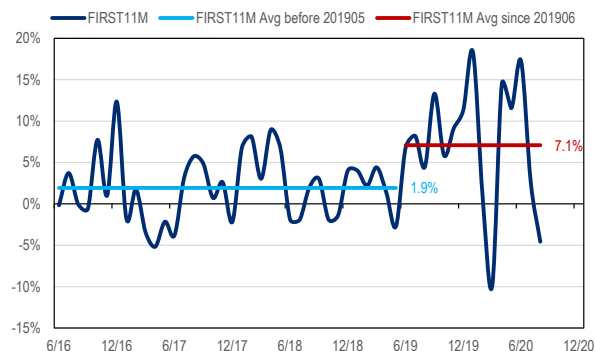


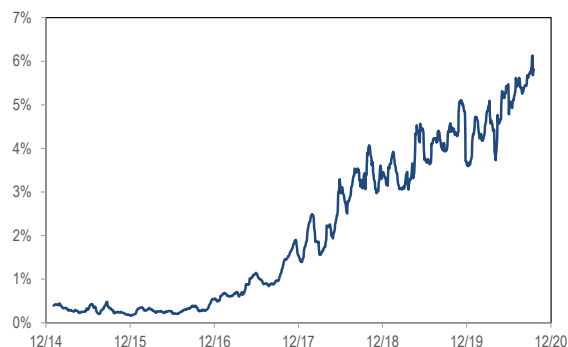
Figure 32. First 11M Price Momentum



Source: Citi Research, MSCI, Wind, Datastream

Source: Citi Research, MSCI, Wind, Datastream

Figure 33. Northbound Turnover As % of Total Turnover (rolling 20 days)



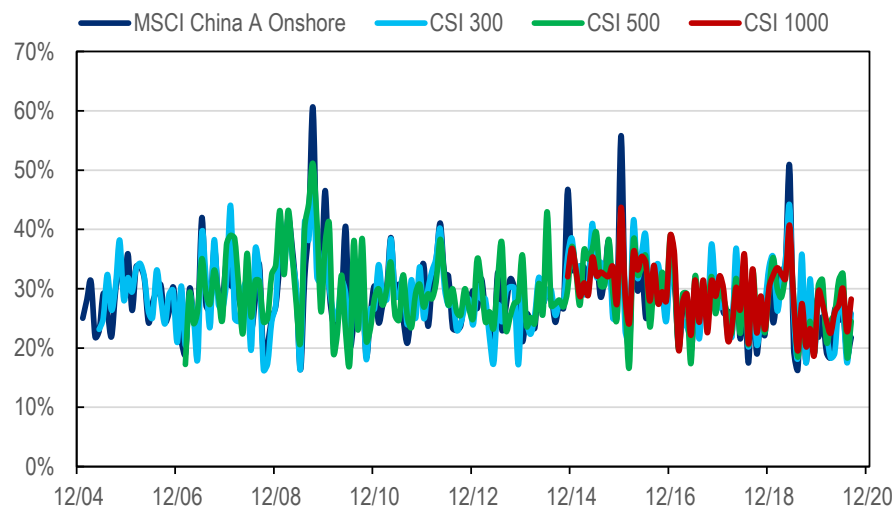
Source: Citi Research, Wind

While Price Momentum has relatively high turnover at ~28% on average per month, it is still much less than its cousin Estimates Momentum which is ~50% per month on average.

## Turnover of Price Momentum Composite

Momentum strategies are typically accompanied by high turnover. We find this to be the case for Price Momentum as we observe in Figure 34 where the monthly turnovers for the long-short portfolio are plotted.

Figure 34. Composite Price Momentum: Monthly Turnover



Source: Citi Research, MSCI, Wind, Datastream

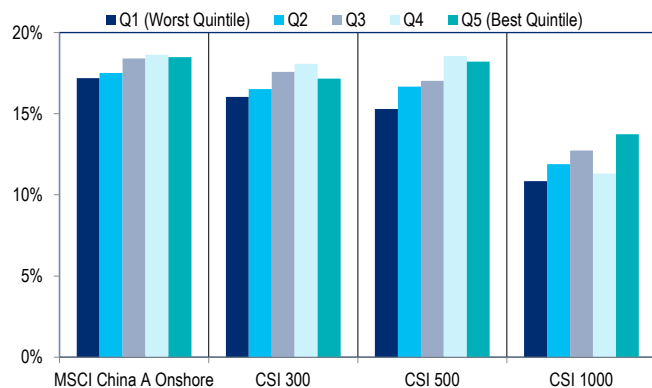
- On average, turnover was quite similar for stocks in different market cap ranges, at ~28% levels per month.
- Unsurprisingly, turnover of price momentum was relatively higher during the financial crisis from 2007-2009 (~31% on average), as well as during the China A market turbulence in late 2014-2015 (~34% on average).

We acknowledge that the actual performance of price momentum strategies will be impacted due to transaction costs and market impacts caused by high turnover of portfolios.

## Monotonicity of Quintile Returns

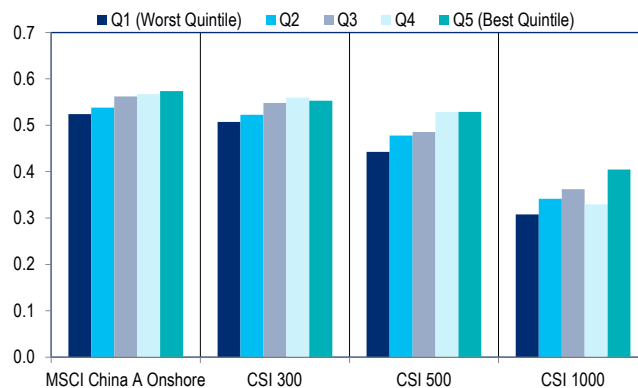
Annualized returns and risk-adjusted returns of each quintile portfolio for the Price Momentum Composite are shown in Figure 35 and Figure 36. We see that the quintile returns are modestly monotonic for all universes, further evidence that the factor is significant. This gives us confidence that previous winning stocks are more likely to outperform on average.

Figure 35. Annualized Returns by Quintile



Source: Citi Research, MSCI, Wind, Datastream

Figure 36. Risk-Adjusted Returns (IR) by Quintile



Source: Citi Research, MSCI, Wind, Datastream

## Performance versus Other Regions

To illustrate the effectiveness of Price Momentum strategies in China A shares market, we adopt the same model to other regions and compare the performance over different horizons in Figure 37-Figure 39.

We see that over a longer-term time horizon, Price Momentum in China A is not as effective as in most other global markets. This can also be observed in Figure 12 - Figure 15 where we can see Price Momentum significantly underperformed in earlier years, e.g. before 2010.

However, over more medium and shorter term horizons, performance of Price Momentum has improved significantly in China A-shares market. This improvement is more prominent in recent years, with IR of CSI 300 approaching 1.0 on a long-short basis, more than doubled most of other global markets during the same period of time.

Given its ample alpha, we believe now is the best time for systematic investments in China A shares market.



Figure 37. Long-term: Price Momentum in China vs. Other Regions Since 2005/Index Launch Date

Region	MSCI China A Onshore	CSI 300	CSI 500	CSI 1000	AC Asia x Japan	Japan	Australia	USA	Europe	AC World	World	EM
Long-Short												
Ann. Ret	1.3%	1.1%	2.9%	2.9%	7.3%	-1.7%	0.4%	0.7%	6.9%	5.8%	5.5%	5.9%
Std. Dev	8.3%	8.7%	8.7%	10.8%	14.4%	14.4%	17.7%	17.5%	16.2%	13.1%	14.0%	14.3%
IR	0.16	0.13	0.34	0.27	0.51	-0.12	0.02	0.04	0.43	0.45	0.39	0.41
Long-only												
Ann. Ret	18.5%	17.2%	2.9%	13.7%	15.6%	5.6%	10.1%	10.0%	9.4%	11.9%	10.4%	13.9%
Std. Dev	32.1%	30.9%	8.7%	33.7%	21.0%	14.5%	23.2%	14.7%	17.3%	16.1%	14.7%	21.1%
IR	0.57	0.55	0.34	0.41	0.74	0.38	0.44	0.68	0.54	0.74	0.71	0.66
Long-Benchmark												
Ann. Ret	1.6%	2.0%	-13.3%	-20.2%	4.9%	0.5%	0.8%	-0.2%	3.2%	3.5%	1.9%	4.2%
Std. Dev	9.8%	9.6%	32.5%	47.6%	7.0%	8.2%	8.4%	7.1%	6.6%	6.2%	5.8%	6.3%
IR	0.17	0.20	-0.41	-0.42	0.70	0.06	0.10	-0.02	0.48	0.56	0.33	0.66

Note: Backtests from Jan 2005 (MSCI China A Onshore, AC Asia x Japan, Japan, Australia, USA, Europe, AC World, World, EM), from Apr 2005 (CSI 300), from Jan 2007 (CSI 500), from Oct 2014 (CSI 1000).

Figure 38. Medium-term: Price Momentum in China vs. Other Regions in past 10 years

Region	MSCI China A Onshore	CSI 300	CSI 500	CSI 1000	AC Asia x Japan	Japan	Australia	USA	Europe	AC World	World	EM
Long-Short												
Ann. Ret	4.4%	4.8%	4.2%	2.9%	6.5%	1.1%	8.1%	2.3%	10.1%	7.1%	7.3%	8.0%
Std. Dev	8.7%	9.5%	9.2%	10.8%	13.7%	13.9%	14.7%	15.3%	14.7%	12.2%	12.5%	12.9%
IR	0.50	0.50	0.45	0.27	0.47	0.08	0.55	0.15	0.69	0.59	0.58	0.62
Long-only												
Ann. Ret	10.2%	10.5%	4.2%	13.7%	11.0%	9.2%	11.4%	15.0%	11.1%	11.6%	12.9%	9.5%
Std. Dev	26.6%	24.0%	9.2%	33.7%	16.3%	13.2%	20.7%	12.8%	15.1%	13.0%	12.5%	17.0%
IR	0.38	0.44	0.45	0.41	0.68	0.69	0.55	1.17	0.73	0.89	1.03	0.56
Long-Benchmark												
Ann. Ret	1.9%	2.7%	-2.4%	-20.2%	2.8%	1.6%	3.9%	-0.3%	3.6%	0.6%	1.1%	3.8%
Std. Dev	8.6%	8.1%	29.8%	47.6%	6.8%	8.0%	7.6%	5.9%	6.3%	5.4%	5.2%	6.2%
IR	0.22	0.34	-0.08	-0.42	0.41	0.20	0.51	-0.05	0.57	0.11	0.22	0.62

Note: Backtests from Sep 2010 (CSI 300, MSCI China A Onshore, AC Asia x Japan, Japan, Australia, USA, Europe, AC World, World, EM), from Jan 2007 (CSI 500), from Oct 2014 (CSI 1000).

Figure 39. Short-term: Price Momentum in China vs. Other Regions in past 5 years

Region	MSCI China A Onshore	CSI 300	CSI 500	CSI 1000	AC Asia x Japan	Japan	Australia	USA	Europe	AC World	World	EM
Long-Short												
Ann. Ret	8.4%	10.5%	7.0%	4.2%	5.3%	1.4%	2.1%	2.7%	8.4%	2.9%	4.7%	3.8%
Std. Dev	10.8%	10.6%	11.1%	11.1%	12.3%	14.5%	13.7%	17.2%	14.2%	10.9%	12.9%	11.6%
IR	0.78	1.00	0.63	0.37	0.43	0.09	0.15	0.16	0.59	0.27	0.36	0.33
Long-only												
Ann. Ret	9.6%	12.9%	7.0%	8.4%	13.6%	8.6%	12.3%	13.1%	9.3%	11.3%	11.5%	11.5%
Std. Dev	26.5%	22.3%	11.1%	29.0%	15.9%	12.9%	21.7%	14.4%	13.8%	13.7%	13.3%	17.0%
IR	0.36	0.58	0.63	0.29	0.86	0.66	0.57	0.91	0.68	0.83	0.86	0.68
Long-Benchmark												
Ann. Ret	2.6%	3.8%	-2.1%	-32.8%	1.9%	1.6%	2.8%	-1.8%	3.3%	0.0%	0.0%	1.3%
Std. Dev	8.4%	7.6%	27.2%	44.1%	6.9%	8.1%	8.8%	6.4%	6.3%	5.7%	5.4%	6.2%
IR	0.32	0.50	-0.08	-0.74	0.27	0.20	0.31	-0.28	0.51	-0.01	0.00	0.22

Note: Backtests from Sep 2015 for all universes.

Source: Citi Research, MSCI, Wind, Datastream

## Sector Exposure of Price Momentum

Some sectors like Financials tend to be larger cap hence higher representation in CSI 300 vs. small cap CSI 1000.

Figure 40-Figure 43 show the net and excess sector exposures of the long quintile of Composite Price Momentum. Here we used Wind-1 sector classification for illustration purposes, as there are too many sectors in CITICS-1 and SWS-1.

Figure 40. MSCI China A Onshore – Composite Price Momentum Sector Exposure (Wind-1)

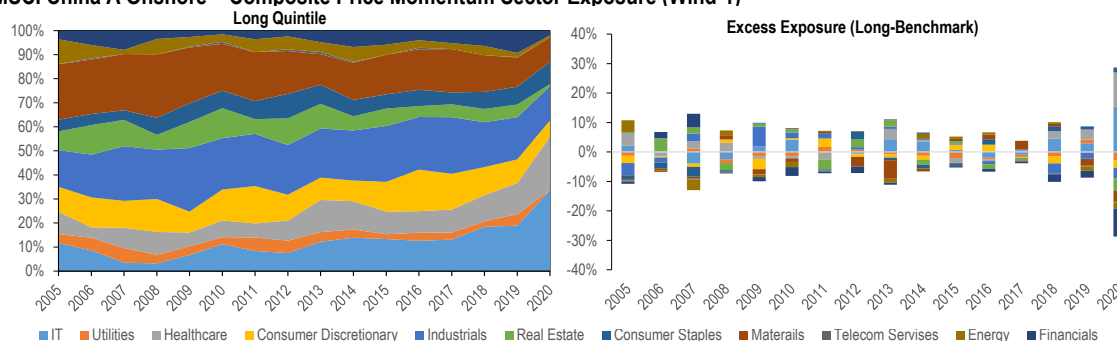


Figure 41. CSI 300 – Composite Price Momentum Sector Exposure (Wind-1)

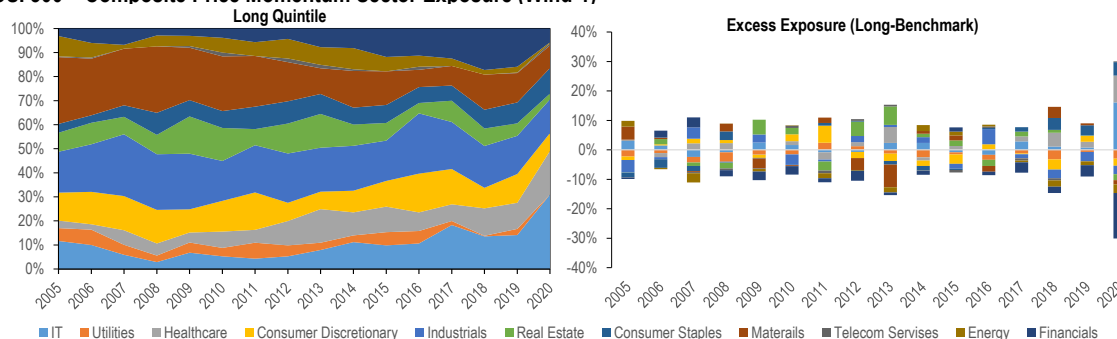


Figure 42. CSI 500 – Composite Price Momentum Sector Exposure (Wind-1)

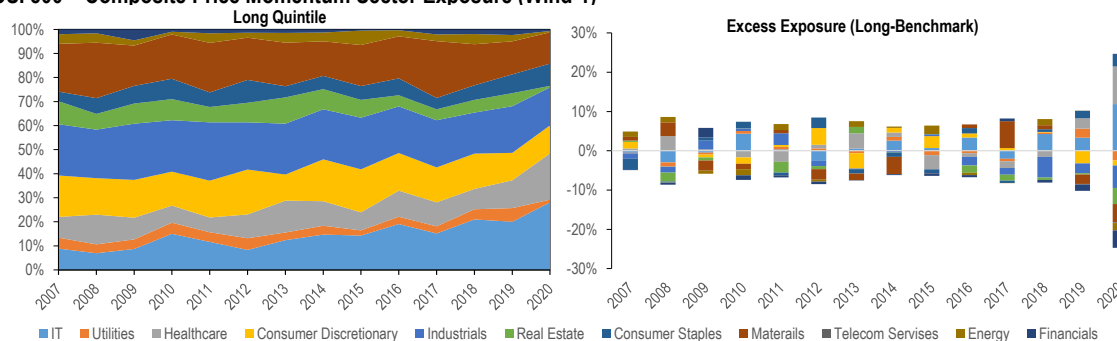
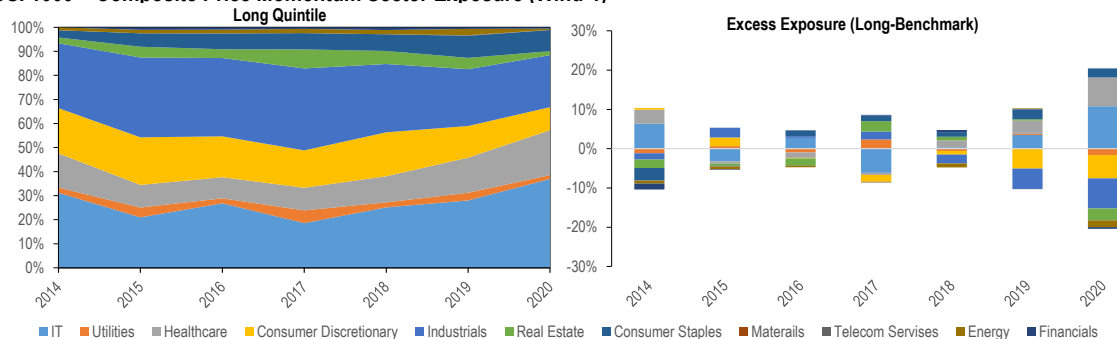


Figure 43. CSI 1000 – Composite Price Momentum Sector Exposure (Wind-1)



Source: Citi Research, MSCI, Wind, Datastream

## Correlation with other Quant Styles

Figure 44 summarizes the average correlation of Volatility-Adjusted Price Momentum against other quant styles. As we can see, Price Momentum is negatively correlated with Value while highly correlated with Estimates Momentum (which makes sense given they both are momentum strategies by nature).

**Figure 44. Average Correlation (Rank IC) of Price Momentum with other Styles**

	Value	Growth	Quality	Low Risk	Large Size	Estimates Momentum
MSCI China A Onshore	-6.7%	2.7%	-0.1%	2.8%	4.6%	5.9%
CSI 300	-6.5%	4.6%	-1.4%	0.8%	5.2%	5.9%
CSI 500	-6.0%	5.8%	2.6%	3.9%	3.7%	7.0%

Source: Citi Research, MSCI, Wind, IBES, Worldscope, Datastream. Note: Backtest period: Jan 2005 – Sep 2020 (MSCI China A Onshore), Apr 2005 – Sep 2020 (CSI 300), from Jan 2007 – Sep 2020 (CSI 500).

Our previous research has shown that [Estimates Momentum works strongly in China A](#). It would be interesting to see how it works if we combine both Price and Estimates Momentum factors together. To illustrate this, we show the backtest results of Composite Momentum (referred to as EMOM+VPMOM which is the equally-weighted average of EMOM and VPMOM, both at the composite level) as compared with EMOM and VPMOM in Figure 45-Figure 48.

We can see that EMOM+VPMOM empirically outperforms VPMOM despite their high correlations. While it is relatively easy to build a PMOM exposure in portfolios by simply holding on to your winners, we can have a more robust portfolio and mitigate some Price Momentum exposures by combining it with Estimates Momentum. For instance, if you have a portfolio of "winners", then you really need to pay attention to downward earnings revisions.

On the other hand, we do see that EMOM still presents better alpha (long-term Sharpe Ratio of 1.4 in CSI 300). However, this does not mean we would abandon Price Momentum because investing in EMOM alone can be risky while adding Price Momentum could help reduce the volatility and empirically avoid large drawdowns during the time from late 2018 to early 2019 (Figure 45-Figure 46). Combining VPMOM with EMOM still has a Sharpe above 1 for CSI 300.

High turnover could be another concern with high-alpha EMOM strategies, as shown in Figure 49-Figure 52, monthly turnover of EMOM can be as high as over 70% (~50% on average) while that of VPMOM is much lower at ~28%. Empirically, VPMOM+EMOM has a turnover of ~40% on average, this lengthens the average holding period by 25% which would effectively improve real world returns after transaction costs and market impacts.

Figure 45. Cumulative Returns (L-S) – MSCI China A Onshore

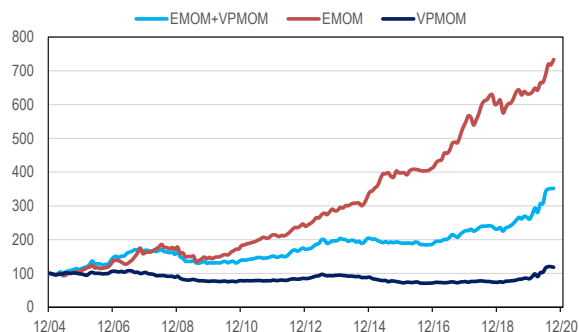


Figure 46. Cumulative Returns (L-S) – CSI 300

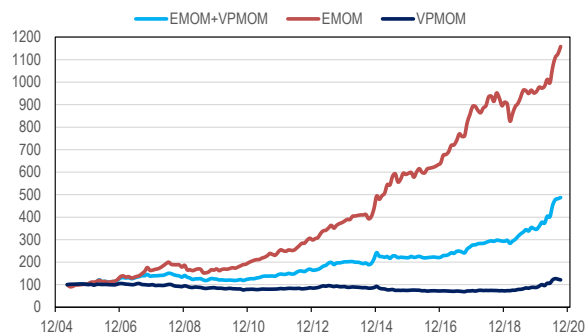


Figure 47. Cumulative Returns (L-S) – CSI 500

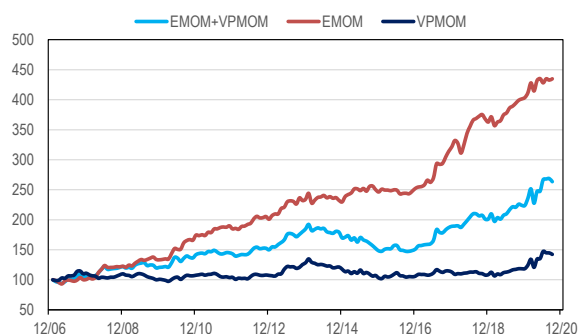
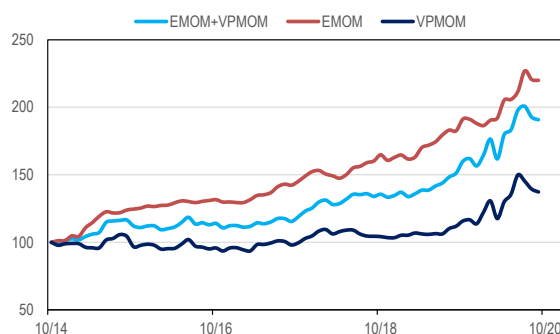


Figure 48. Cumulative Returns (L-S) – CSI 1000



Source: Citi Research, MSCI, Wind, Datastream

Source: Citi Research, MSCI, Wind, Datastream

### Turnover of Momentum Strategies

Figure 49. Turnover (L-S) – MSCI China A Onshore

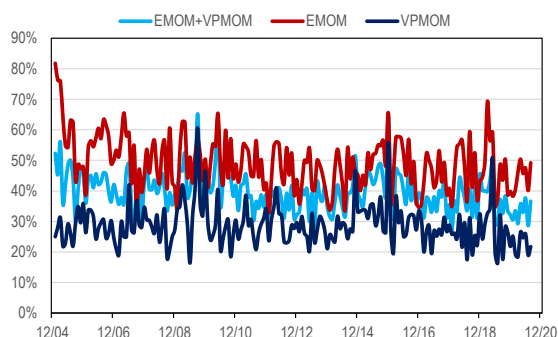


Figure 50. Turnover (L-S) – CSI 300

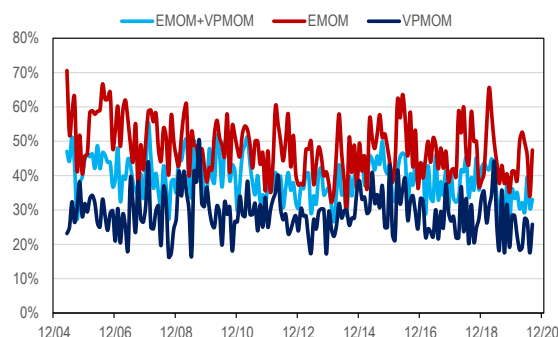


Figure 51. Turnover (L-S) – CSI 500

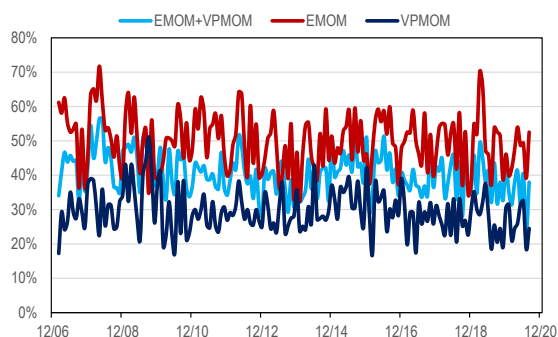
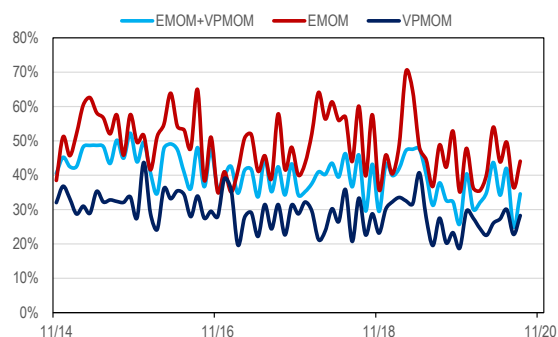


Figure 52. Turnover (L-S) – CSI 1000



Source: Citi Research, MSCI, Wind, Datastream

Source: Citi Research, MSCI, Wind, Datastream

## Sector-relative Momentum

Previous discussions focused on stock-level momentum, while ignoring sector exposures. Hence, such strategy may lead to a concentrated portfolio with biased exposure towards some particular sectors, which is more prone to idiosyncratic risks. Sector neutrality offers a good way to avoid the problem of having too biased exposures and create a more balanced portfolio across different industries/sectors.

### Sector Classification Standards for China A Shares

There are several classification standards that are widely adopted by global investors, such as GICS (Global Industry Classification Standard), BICS (Bloomberg Industrial Classification System), RBICS (FactSet Revere Business Industry Classification System), etc. One advantage of these global schemes is the consistency across different countries. This makes it easier for investors to compare companies with similar products or business models across the globe. On the other hand, the drawback is that they may not be catered for each region's particular company demographics needs in order to maintain this consistency.

The China A share market is not only broad, but also very unique. There are multiple industry classification standards that are widely used and published by domestic institutions, including CITIC Securities Industry Classification System (CITICS), Shenyin Wanguo Industry Classification System ("Shen Wan" / SWS) and Wind Industry Classification. Compared with the global standards, they are more localized for the China A share market. Figure 53 shows the basic information of different classification standards, see Appendix 3 for more details on the tree hierarchy.

Figure 53. Sector Classification Standards

Name	Full name	Provider	No. of Levels	No. of Sectors			
				Level 1	Level 2	Level 3	Level 4
Global Classificaions							
BICS	Bloomberg Industrial Classification System	Bloomberg	7	10	48	192	777
GICS	Global Industry Classification Standard	S&P, MSCI	4	11	24	69	158
ICB	Industry Classification Benchmark	FTSE	4	11	20	45	173
RBICS	FactSet Revere Business Industry Classification System	FactSet	6	14	36	105	316
China Local Classificaions							
CITICS	CITIC Securities Industry Classification System	CITIC Securities	3	30	109	285	-
SWS	Shenyin Wanguo Industry Classification System	Shenyin Wanguo Securities	3	28	104	227	-
WIND	Wind Industry Classification System	Wind Financial	4	11	24	69	161

Source: Citi Research, Bloomberg, FactSet, FTSE, MSCI, Wind. Data as of Sep 30, 2020.

Note: Only data for the top 4 levels is shown in the table.

In this section, we investigate the performance of Composite Price Momentum with Sector Neutrality applied. Several sector classifications will be investigated, including CITICS, SWS, Wind and GICS classifications. It is worth noting that sector classifications can change over time, so in our backtests, we use historical point-in-time classifications for each standard.

## Performance of Sector-Neutral Price Momentum

Recall from Figure 53 that in the Level 2 classifications of CITICS and SWS, there are respectively 109 and 104 categories. These are too many for generating insightful results for the four universes, each with 300-1000 stocks. Hence, we will only consider Level 1 classifications of CITICS and SWS, referred to as CITICS-1 and SWS-1, respectively. Given there are fewer levels in Level 2 for Wind and GICS classifications, we consider both Level 1 and Level 2 classifications.

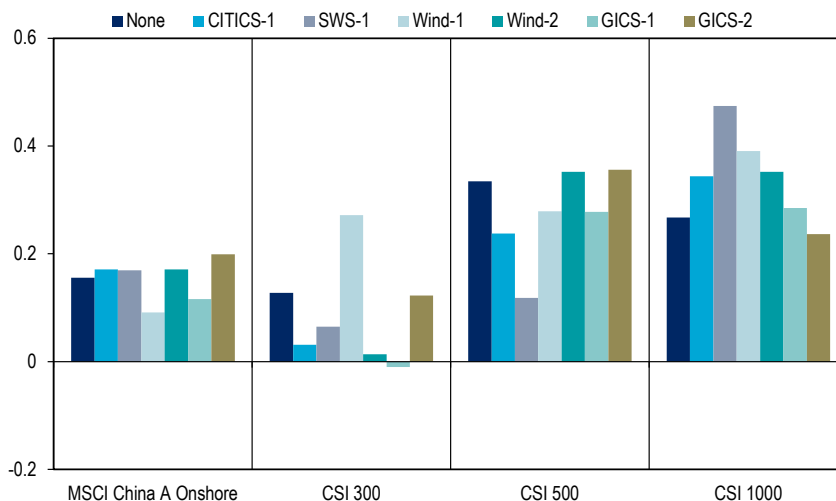
Figure 54 compares the IRs of sector-neutral Composite Price Momentum based on various sector classifications as discussed above. For comparison, the results without sector neutrality is also included (labelled as 'None'). We find that:

- **Performance of Price Momentum differ significantly and can be improved/worsened with sector neutrality**, depending on the underlying sector classification methods.
- **More alpha can be generated in small caps using sector neutrality.** However, again it depends on which sector classification standard is adopted, with SWS-1 delivering the best performance empirically. For large cap CSI 300, only Wind-1 classification helped enhance performance in the long term.

Figure 55-Figure 58 show cumulative returns of the Composite Price Momentum with/without sector neutrality:

- The performance of Price Momentum (both with and without sector neutrality) has been consistently strong across all market cap ranges since mid-2015. In the recent couple years, we do see that sector-neutrality did detract from returns (see Figure 16) as strong sector momentum helped VPMOM position into Tech, Healthcare, and Consumer sectors.
- The volatility of Price Momentum returns is lower with sector neutrality – this is reasonable as sector exposure of sector-neutral signal is more balanced than that of the un-neutral one.
- Higher cumulative returns can also be achieved by selecting sector classification properly – this is interesting as typically the tradeoff in lower volatility is lower returns, yet the cumulative returns of sector-neutral momentum signals are generally higher than un-neutral momentum.

Figure 54. IR of Price Momentum Composite with/without Sector Neutrality (Long-Short)



Source: Citi Research, MSCI, Wind, Datastream

Note: Backtest period Jan 2005 – Sep 2020 (MSCI China A Onshore), Apr 2005 – Sep 2020 (CSI 300), from Jan 2007 – Sep 2020 (CSI 500), Oct 2014 – Sep 2020 (CSI 1000).

### Cumulative Returns of Price Momentum Composite (Long-Short)

Figure 55. Cumulative Returns (L-S) – MSCI China A Onshore

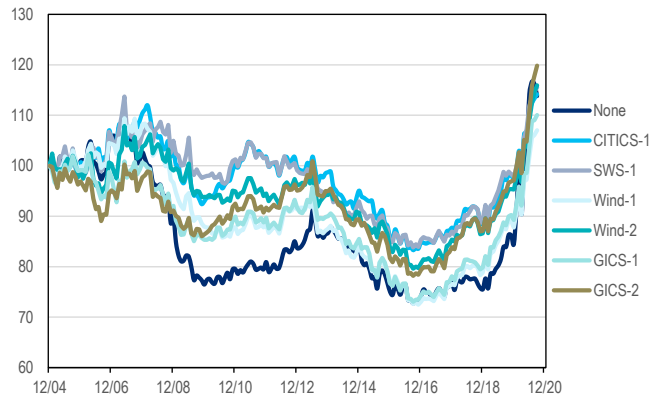


Figure 56. Cumulative Returns (L-S) – CSI 300

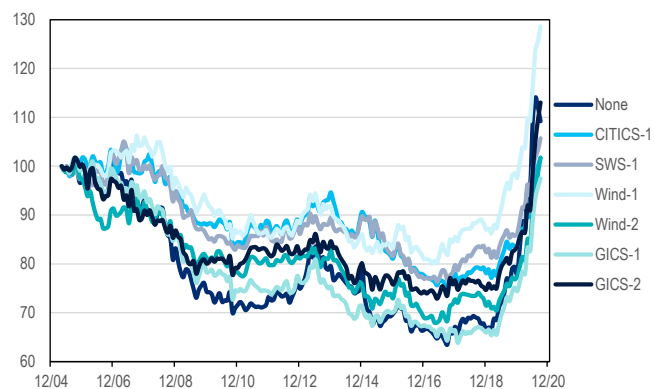


Figure 57. Cumulative Returns (L-S) – CSI 500

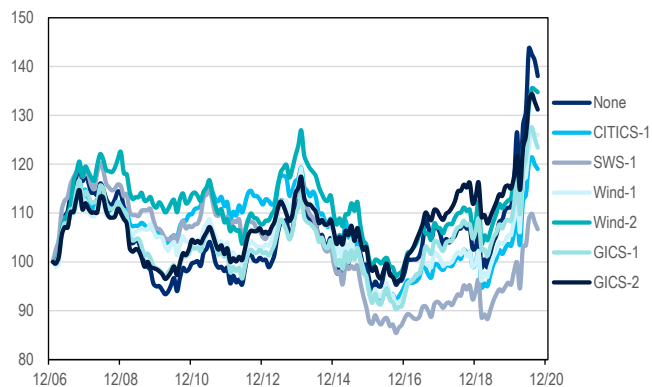
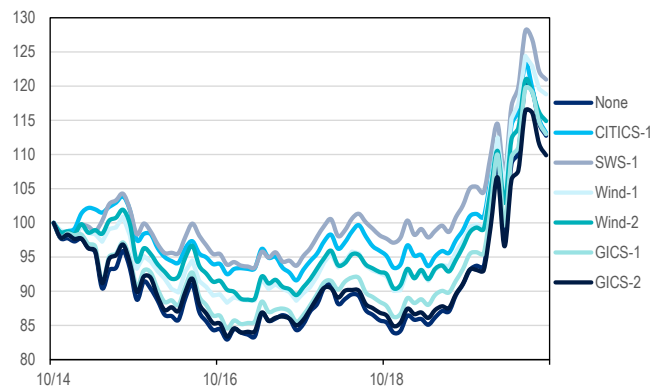


Figure 58. Cumulative Returns (L-S) – CSI 1000



Source: Citi Research, MSCI, Wind, Datastream

Source: Citi Research, MSCI, Wind, Datastream

## Conclusion

Early research by both practitioners and academics have shown that China A was a contrarian market where reversal strategies worked well. Hence a common misconception prevailed that Price momentum strategies didn't work in China A. While we found it was true that Price Momentum suffered in early years before 2010, this trend has changed and we have been seeing Price Momentum outperforming strongly in recent years. One reason may be an increasing level of institutional participation in the markets, as evidenced with the growing importance of northbound flows through the stock connect.

Not all definitions of momentum are the same, and while momentum can be implemented in various ways, their performance can differ significantly. Our empirical backtests show that Volatility-Adjusted Price Momentum is able to provide much better results than the classic approach which focuses on periodic point-to-point return over a particular time horizon.

Sector neutrality can enhance risk-adjusted performance of price momentum strategies by reducing volatility from creating more balanced portfolios without sector exposures. We show that performance of price momentum factors differ significantly depending on the underlying sector classification methods. However, sector neutrality can at times detract from returns as well during periods of strong sector momentum, such as the recent couple of years.

We also find strong seasonality effects in Price Momentum, which is something to consider when managing portfolio exposures during certain times of the year. While we do see seasonal effects in some calendar months, a Chinese New Year effect is even more pronounced.

Turnover is a consideration in any momentum strategy, as it can quickly eat away much of the alpha from the signal. This is especially true for Estimates Momentum, which is a high-performing factor in China A (long-term Sharpe Ratio of 1.4 in CSI 300, but with a turnover of ~50%. While Estimates Momentum and Price Momentum are relatively highly correlated, by blending them together we achieve a lower turnover signal with less volatile returns, achieving a Sharpe above 1 in CSI 300. The combination of VPMOM + EMOM lengthens the average holding period by 25% to further improve real world returns after transaction costs and market impact.

Price momentum strategies have shown strong empirical results in China A in recent years, with higher returns and Sharpe ratios than many other regions around the globe. We believe now is the best time for systematic strategies in China A-shares market due to the relatively low penetration active institutional investors and its ample empirical alpha.



## Further Research

In this publication, we study the performance of Price Momentum strategies in China A-shares market. We list below several research directions that may further improve performance of Price Momentum strategies.

Efficacy of other Price Momentum factors in China A-shares market: This research introduced the consistent framework to rank global stocks through the combination of three Price Momentum factors. This framework has been applied for more than a decade. We acknowledge that there are other Price Momentum factors studied by both academics and practitioners in the past decade. It would be interesting to study the efficacy of these factors in the China A-shares market as well.

Timing Price Momentum: Investing in Price Momentum as a style historically shows strong returns in certain time periods but large drawdowns detract from its overall efficacy. An ability to time exposure to Price Momentum may enhance its overall performance dramatically.

Combining Price Momentum with other momentum factors: We have shown in our first China A Alpha report that [Estimates Momentum is highly effective in China A shares market](#). On the other hand, our [APAC Radar model](#) which includes volume momentum (abnormal trading volume) has been performing strongly in Asia. One area of research is to see if the performance can be further improved by creating a composite momentum factor which combines these different types of momentum factors.

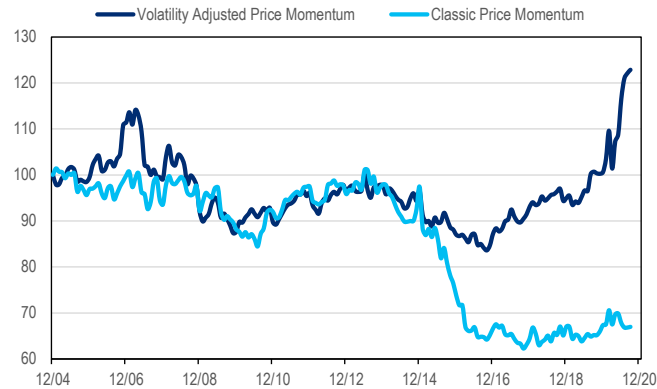
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8. Wang, C., and S. Chin, 2004. "Profitability of return and volume-based investment strategies in China's stock market", *Pacific-Basin Finance Journal* 12, pp.541-564.
9. Shumway, Tyler & Wu, Guojun, 2006. Does Disposition Drive Momentum?. *SSRN Electronic Journal*. 10.2139/ssrn.686901.

# Appendix 1

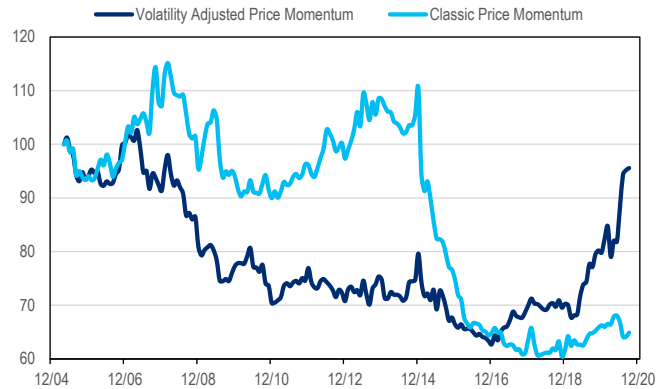
## Cumulative Returns of 3M Price Momentum (Long-Short)

Figure 59. MSCI China A Onshore



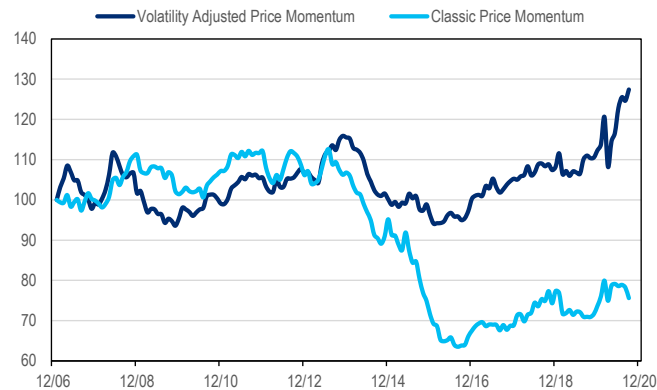
Source: Citi Research, MSCI, Wind, Datastream

Figure 60. CSI 300



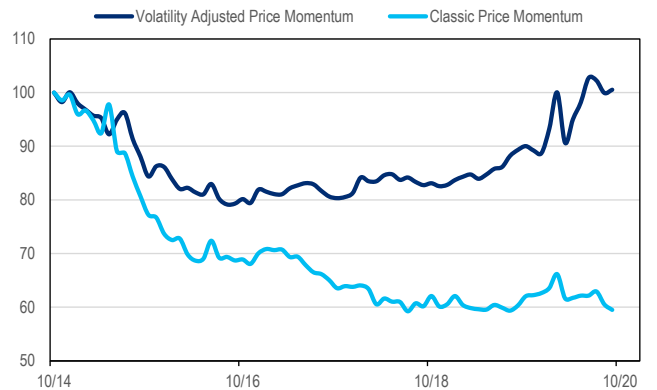
Source: Citi Research, MSCI, Wind, Datastream

Figure 61. CSI 500



Source: Citi Research, MSCI, Wind, Datastream

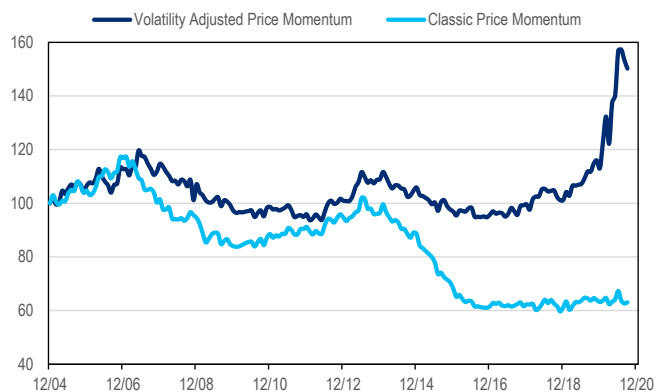
Figure 62. CSI 1000



Source: Citi Research, MSCI, Wind, Datastream

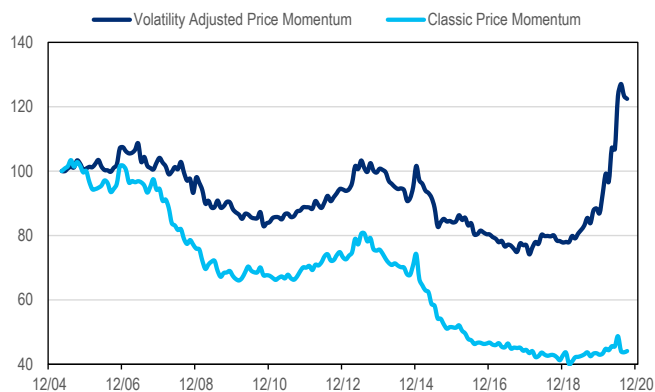
## Cumulative Returns of 12M Price Momentum (Long-Short)

Figure 63. MSCI China A Onshore



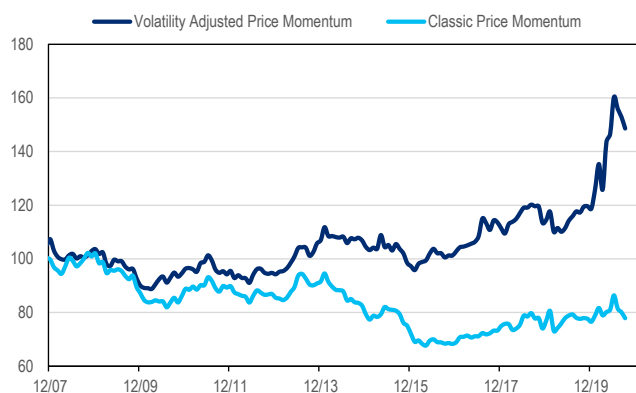
Source: Citi Research, MSCI, Wind, Datastream

Figure 64. CSI 300



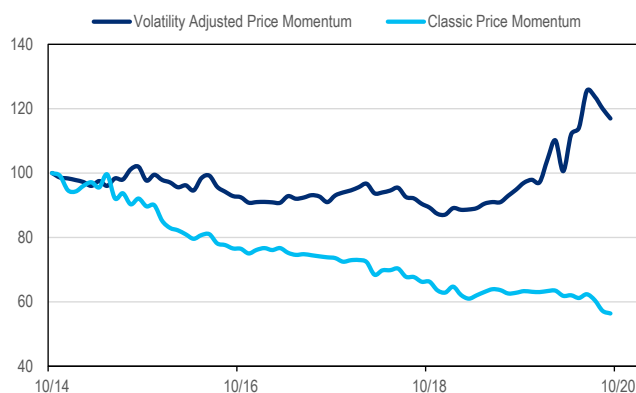
Source: Citi Research, MSCI, Wind, Datastream

Figure 65. CSI 500



Source: Citi Research, MSCI, Wind, Datastream

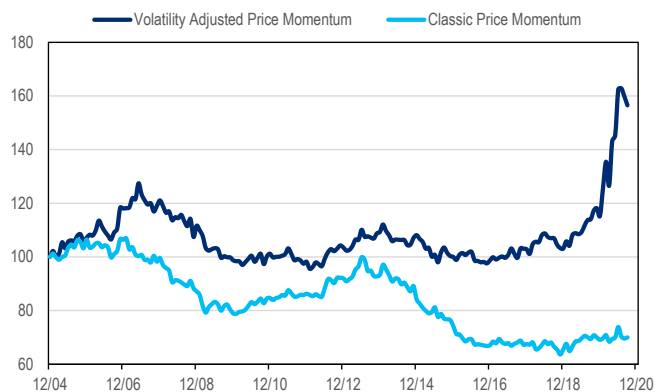
Figure 66. CSI 1000



Source: Citi Research, MSCI, Wind, Datastream

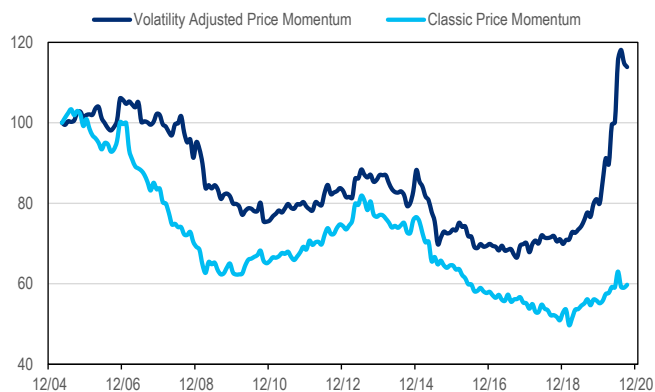
## Cumulative Returns of First 11 Month Price Momentum (Long-Short)

Figure 67. MSCI China A Onshore



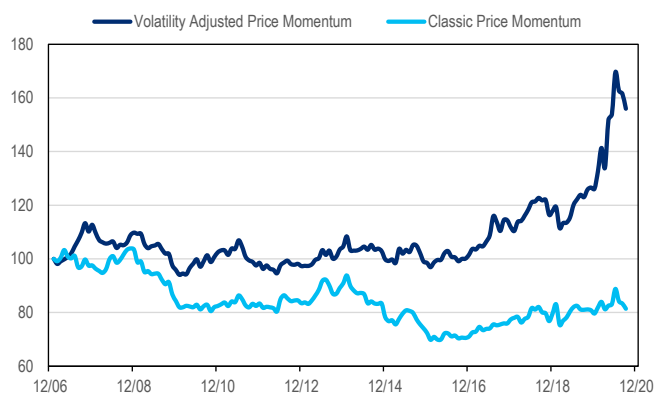
Source: Citi Research, MSCI, Wind, Datastream

Figure 68. CSI 300



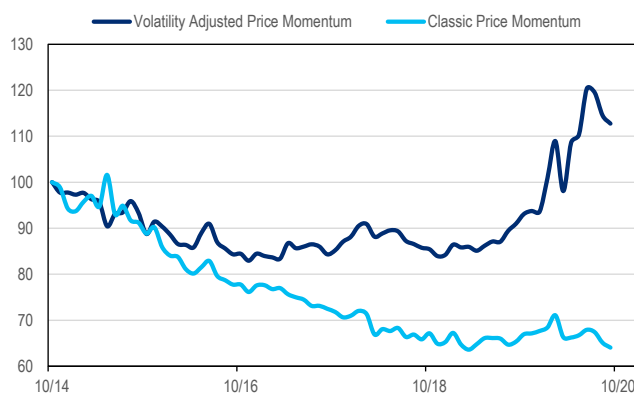
Source: Citi Research, MSCI, Wind, Datastream

Figure 69. CSI 500



Source: Citi Research, MSCI, Wind, Datastream

Figure 70. CSI 1000



Source: Citi Research, MSCI, Wind, Datastream

## Performance Summary of Price Momentum Factors

Figure 71. MSCI China A Onshore

Factor	Ann Ret	Ann Std	Hit Rate	T-Stat	IR	Turnover
Long-Short						
3 Months	1.5%	7.0%	55.9%	0.86	0.22	57.4%
12 Months	3.1%	8.6%	52.1%	1.43	0.36	17.9%
First 11 Months	3.3%	8.5%	51.6%	1.56	0.39	19.4%
Composite	1.3%	8.3%	50.0%	0.62	0.16	28.6%
Long-only						
3 Months	18.8%	32.2%	58.0%	2.31	0.58	56.2%
12 Months	19.3%	32.2%	60.1%	2.36	0.60	17.3%
First 11 Months	19.5%	32.2%	59.0%	2.40	0.61	18.9%
Composite	18.5%	32.2%	59.0%	2.27	0.57	28.0%
Long-Benchmark						
3 Months	1.9%	10.0%	50.5%	0.76	0.19	56.2%
12 Months	2.4%	9.9%	51.1%	0.96	0.24	17.3%
First 11 Months	2.7%	10.0%	48.9%	1.07	0.27	18.9%
Composite	1.6%	9.8%	47.3%	0.66	0.17	28.0%

Source: Citi Research, MSCI, Wind, Datastream

Figure 72. CSI 300

Factor	Ann Ret	Ann Std	Hit Rate	T-Stat	IR	Turnover
Long-Short						
3 Months	0.0%	8.3%	48.9%	0.01	0.00	57.3%
12 Months	1.7%	8.8%	47.8%	0.78	0.20	18.1%
First 11 Months	1.3%	8.9%	49.5%	0.57	0.14	19.7%
Composite	1.1%	8.8%	47.8%	0.50	0.13	28.9%
Long-only						
3 Months	17.5%	31.4%	57.6%	2.18	0.56	56.0%
12 Months	17.6%	31.2%	58.2%	2.22	0.57	17.4%
First 11 Months	17.4%	30.9%	57.6%	2.21	0.56	19.2%
Composite	17.2%	31.0%	57.6%	2.16	0.55	28.8%
Long-Benchmark						
3 Months	2.3%	10.1%	52.2%	0.88	0.23	56.0%
12 Months	2.4%	9.5%	53.3%	1.01	0.26	17.4%
First 11 Months	2.2%	9.5%	53.8%	0.92	0.24	19.2%
Composite	2.0%	9.7%	54.3%	0.79	0.20	28.8%

Source: Citi Research, MSCI, Wind, Datastream

Figure 73. CSI 500

Factor	Ann Ret	Ann Std	Hit Rate	T-Stat	IR	Turnover
Long-Short						
3 Months	1.9%	6.8%	52.8%	1.00	0.27	57.3%
12 Months	3.5%	8.8%	56.4%	1.48	0.40	18.6%
First 11 Months	3.9%	8.6%	57.1%	1.67	0.45	20.2%
Composite	2.9%	8.7%	55.2%	1.23	0.33	29.5%
Long-only						
3 Months	16.8%	35.0%	58.3%	1.77	0.48	56.0%
12 Months	19.0%	34.3%	57.7%	2.05	0.56	18.0%
First 11 Months	19.2%	34.4%	58.3%	2.06	0.56	19.6%
Composite	18.2%	34.4%	57.7%	1.95	0.53	28.8%
Long-Benchmark						
3 Months	2.8%	4.9%	55.8%	2.08	0.56	56.0%
12 Months	5.0%	4.8%	61.3%	3.83	1.04	18.0%
First 11 Months	5.2%	4.7%	62.0%	4.00	1.09	19.6%
Composite	4.2%	4.8%	57.1%	3.21	0.87	28.8%

Source: Citi Research, MSCI, Wind, Datastream

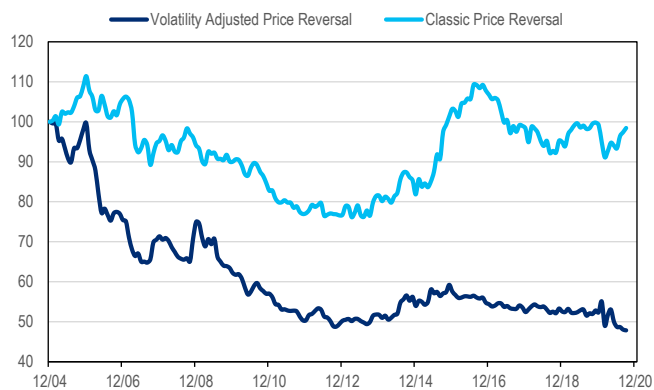
Figure 74. CSI 1000

Factor	Ann Ret	Ann Std	Hit Rate	T-Stat	IR	Turnover
Long-Short						
3 Months	0.3%	8.4%	48.6%	0.10	0.04	56.8%
12 Months	3.6%	9.9%	50.0%	0.88	0.36	19.2%
First 11 Months	4.0%	9.7%	48.6%	1.01	0.42	20.7%
Composite	2.9%	10.9%	48.6%	0.65	0.27	29.2%
Long-only						
3 Months	11.7%	34.6%	47.1%	0.82	0.34	55.3%
12 Months	13.8%	34.1%	48.6%	0.97	0.40	18.5%
First 11 Months	13.3%	34.2%	47.1%	0.94	0.39	19.8%
Composite	13.7%	34.0%	50.0%	0.98	0.40	28.8%
Long-Benchmark						
3 Months	3.9%	4.9%	62.9%	1.95	0.81	55.3%
12 Months	5.9%	4.6%	64.3%	3.09	1.28	18.5%
First 11 Months	5.5%	4.7%	58.6%	2.81	1.16	19.8%
Composite	5.9%	5.2%	60.0%	2.77	1.15	28.8%

Source: Citi Research, MSCI, Wind, Datastream

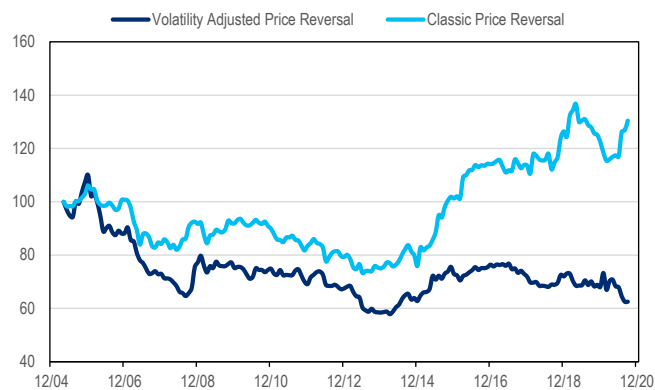
## Cumulative Returns of 1M Price Reversal (Long-Short)

Figure 75. MSCI China A Onshore



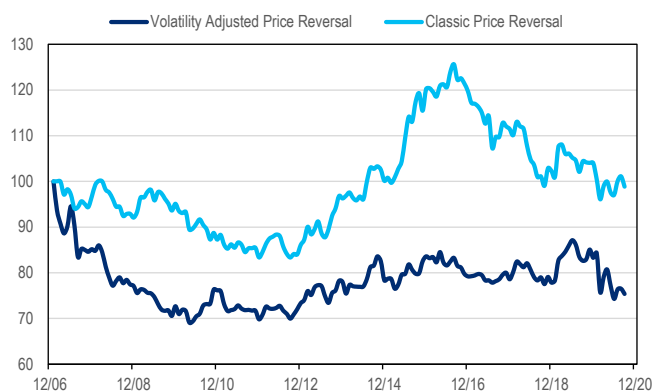
Source: Citi Research, MSCI, Wind, Datastream

Figure 76. CSI 300



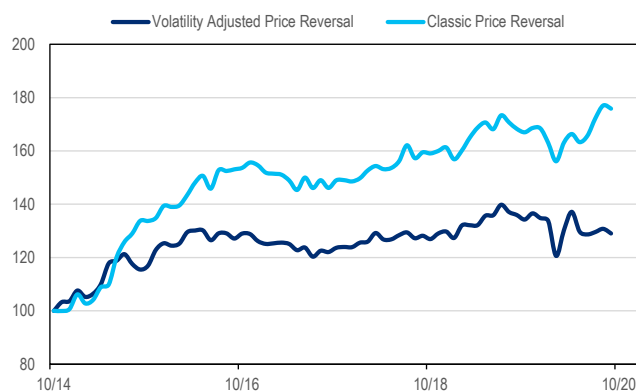
Source: Citi Research, MSCI, Wind, Datastream

Figure 77. CSI 500



Source: Citi Research, MSCI, Wind, Datastream

Figure 78. CSI 1000



Source: Citi Research, MSCI, Wind, Datastream

## Appendix 2

### Performance Summary by Year (Long-only)

Figure 79. MSCI China A Onshore

Year	Ann Ret	Ann Std	Hit Rate	T-Stat	IR (L)	Turnover
2005	-14.1%	20.8%	41.7%	-0.63	-0.68	21.4%
2006	92.6%	23.9%	91.7%	2.93	3.88	28.3%
2007	224.5%	48.5%	75.0%	2.76	4.63	27.1%
2008	-60.4%	43.8%	33.3%	-1.82	-1.38	25.4%
2009	105.1%	35.2%	83.3%	2.27	2.98	33.4%
2010	10.6%	27.2%	58.3%	0.49	0.39	25.8%
2011	-29.0%	22.4%	33.3%	-1.40	-1.29	29.7%
2012	7.6%	27.4%	50.0%	0.39	0.28	28.8%
2013	9.3%	23.0%	58.3%	0.50	0.40	26.7%
2014	34.2%	16.0%	66.7%	1.93	2.14	29.8%
2015	26.5%	42.9%	66.7%	0.75	0.62	36.2%
2016	-21.9%	35.4%	50.0%	-0.51	-0.62	28.4%
2017	6.4%	12.4%	66.7%	0.56	0.51	26.8%
2018	-32.9%	16.7%	33.3%	-2.26	-1.97	24.0%
2019	36.3%	23.8%	58.3%	1.42	1.52	32.1%
2020 (YTD)	60.7%	33.3%	77.8%	1.38	1.82	27.9%

Source: Citi Research, MSCI, Wind, Datastream

Figure 80. CSI 300

Year	Ann Ret	Ann Std	Hit Rate	T-Stat	IR (L)	Turnover
2005	-10.3%	17.9%	50.0%	-0.43	-0.57	22.3%
2006	76.3%	24.6%	83.3%	2.46	3.10	31.3%
2007	190.8%	44.9%	75.0%	2.68	4.25	27.3%
2008	-65.2%	45.4%	33.3%	-2.00	-1.44	26.4%
2009	116.2%	38.2%	83.3%	2.27	3.04	31.5%
2010	-4.5%	29.1%	50.0%	-0.03	-0.15	26.2%
2011	-28.1%	18.0%	25.0%	-1.73	-1.56	32.6%
2012	6.4%	27.6%	50.0%	0.35	0.23	27.2%
2013	5.4%	21.4%	58.3%	0.35	0.25	25.5%
2014	38.1%	20.9%	66.7%	1.66	1.83	29.8%
2015	17.5%	37.1%	58.3%	0.61	0.47	34.4%
2016	-11.4%	30.3%	50.0%	-0.25	-0.38	31.2%
2017	9.2%	10.6%	66.7%	0.88	0.87	27.8%
2018	-22.9%	14.2%	41.7%	-1.74	-1.61	25.2%
2019	38.6%	20.8%	58.3%	1.68	1.86	33.2%
2020 (YTD)	43.4%	29.9%	66.7%	1.17	1.45	30.0%

Source: Citi Research, MSCI, Wind, Datastream

Figure 81. CSI 500

Year	Ann Ret	Ann Std	Hit Rate	T-Stat	IR (L)	Turnover
2007	170.9%	56.6%	72.7%	1.99	3.02	27.3%
2008	-58.0%	52.4%	33.3%	-1.34	-1.11	28.5%
2009	124.9%	32.4%	91.7%	2.74	3.86	34.9%
2010	20.8%	26.1%	58.3%	0.85	0.80	26.3%
2011	-33.0%	24.8%	33.3%	-1.47	-1.33	28.5%
2012	0.7%	29.2%	41.7%	0.15	0.02	29.7%
2013	22.8%	26.9%	58.3%	0.90	0.85	28.3%
2014	31.4%	14.3%	83.3%	2.00	2.20	27.9%
2015	56.8%	46.3%	66.7%	1.20	1.23	34.5%
2016	-13.7%	35.4%	50.0%	-0.23	-0.39	28.2%
2017	2.1%	13.4%	50.0%	0.21	0.15	27.3%
2018	-32.8%	13.5%	25.0%	-2.82	-2.42	26.0%
2019	30.8%	23.5%	66.7%	1.26	1.31	29.9%
2020 (YTD)	41.1%	28.9%	77.8%	1.16	1.42	29.1%

Source: Citi Research, MSCI, Wind, Datastream

Figure 82. CSI 1000

Year	Ann Ret	Ann Std	Hit Rate	T-Stat	IR (L)	Turnover
2015	100.0%	52.9%	66.7%	1.59	1.89	31.6%
2016	-19.5%	39.2%	50.0%	-0.34	-0.50	31.0%
2017	-16.1%	13.8%	33.3%	-1.20	-1.16	29.3%
2018	-34.2%	18.0%	16.7%	-2.19	-1.90	25.3%
2019	32.7%	27.8%	66.7%	1.15	1.18	28.8%
2020 (YTD)	44.4%	29.9%	66.7%	1.20	1.48	30.0%

Source: Citi Research, MSCI, Wind, Datastream



## Performance Summary by Year (Long-Benchmark)

Figure 83. MSCI China A Onshore

Year	Ann Ret	Ann Std	Hit Rate	T-Stat	IR (L-B)	Turnover
2005	-10.2%	7.0%	25.0%	-1.50	-1.46	21.4%
2006	-20.2%	8.8%	16.7%	-2.50	-2.29	28.3%
2007	21.2%	17.3%	66.7%	1.20	1.23	27.1%
2008	4.6%	12.0%	58.3%	0.43	0.38	25.4%
2009	3.3%	10.3%	58.3%	0.37	0.33	33.4%
2010	15.1%	7.9%	58.3%	1.83	1.91	25.8%
2011	-7.2%	7.0%	41.7%	-1.04	-1.03	29.7%
2012	-1.7%	5.9%	33.3%	-0.26	-0.29	28.8%
2013	8.3%	5.1%	66.7%	1.60	1.63	26.7%
2014	-10.8%	12.2%	41.7%	-0.87	-0.89	29.8%
2015	20.0%	11.1%	58.3%	1.71	1.81	36.2%
2016	-2.1%	6.8%	50.0%	-0.28	-0.31	28.4%
2017	-11.7%	5.6%	33.3%	-2.19	-2.09	26.8%
2018	-0.5%	6.7%	41.7%	-0.04	-0.07	24.0%
2019	-1.1%	6.8%	41.7%	-0.13	-0.16	32.1%
2020 (YTD)	29.1%	12.8%	66.7%	1.80	2.28	27.9%

Source: Citi Research, MSCI, Wind, Datastream

Figure 84. CSI 300

Year	Ann Ret	Ann Std	Hit Rate	T-Stat	IR (L-B)	Turnover
2005	-9.1%	9.9%	37.5%	-0.75	-0.92	22.3%
2006	-22.3%	11.0%	25.0%	-2.21	-2.02	31.3%
2007	12.5%	15.0%	66.7%	0.86	0.83	27.3%
2008	3.9%	13.6%	66.7%	0.34	0.28	26.4%
2009	9.8%	10.5%	66.7%	0.94	0.93	31.5%
2010	8.9%	7.8%	75.0%	1.14	1.15	26.2%
2011	-3.8%	5.4%	41.7%	-0.70	-0.71	32.6%
2012	-0.8%	5.1%	58.3%	-0.13	-0.16	27.2%
2013	13.6%	5.9%	75.0%	2.22	2.32	25.5%
2014	-11.1%	10.7%	50.0%	-1.04	-1.04	29.8%
2015	11.8%	11.9%	41.7%	0.99	0.99	34.4%
2016	0.5%	6.1%	50.0%	0.11	0.08	31.2%
2017	-10.3%	6.8%	33.3%	-1.57	-1.53	27.8%
2018	2.8%	6.5%	50.0%	0.46	0.43	25.2%
2019	1.9%	6.8%	58.3%	0.31	0.29	33.2%
2020 (YTD)	25.0%	11.8%	66.7%	1.70	2.13	30.0%

Source: Citi Research, MSCI, Wind, Datastream

Figure 85. CSI 500

Year	Ann Ret	Ann Std	Hit Rate	T-Stat	IR (L-B)	Turnover
2007	10.7%	5.0%	72.7%	1.97	2.13	27.3%
2008	6.8%	5.8%	66.7%	1.16	1.17	28.5%
2009	-3.1%	3.0%	33.3%	-1.03	-1.03	34.9%
2010	9.7%	2.7%	75.0%	3.46	3.60	26.3%
2011	1.2%	2.2%	50.0%	0.56	0.55	28.5%
2012	0.2%	4.0%	50.0%	0.06	0.05	29.7%
2013	4.9%	4.4%	66.7%	1.11	1.11	28.3%
2014	-5.6%	3.8%	25.0%	-1.49	-1.47	27.9%
2015	10.5%	7.3%	66.7%	1.40	1.43	34.5%
2016	5.3%	3.9%	75.0%	1.34	1.35	28.2%
2017	2.4%	3.3%	41.7%	0.73	0.72	27.3%
2018	0.6%	3.1%	50.0%	0.22	0.20	26.0%
2019	3.1%	4.1%	58.3%	0.76	0.75	29.9%
2020 (YTD)	15.2%	9.7%	66.7%	1.31	1.57	29.1%

Source: Citi Research, MSCI, Wind, Datastream

Figure 86. CSI 1000

Year	Ann Ret	Ann Std	Hit Rate	T-Stat	IR (L-B)	Turnover
2015	14.4%	6.3%	83.3%	2.19	2.30	31.6%
2016	0.9%	3.5%	41.7%	0.28	0.27	31.0%
2017	1.5%	2.8%	50.0%	0.53	0.52	29.3%
2018	4.1%	1.9%	66.7%	2.12	2.15	25.3%
2019	5.6%	2.8%	66.7%	1.96	2.00	28.8%
2020 (YTD)	16.2%	9.9%	66.7%	1.36	1.64	30.0%

Source: Citi Research, MSCI, Wind, Datastream

## Appendix 3

### Level 1 & 2 Hierarchy of Various Sector Classification Methods

Figure 87. CITICS-1 – Level 1 Hierarchy of CITIC Securities Industry Classification System

Sector Name in Chinese	Sector Name in English	No. of stocks			
		MSCI China A Onshore	CSI 300	CSI 500	CSI 1000
农林牧渔	Agriculture	15	5	11	19
汽车	Automotive	19	10	19	32
银行	Bank	30	27	7	1
建材	Building Materials	14	4	8	20
基础化工	Chemicals	31	6	31	70
煤炭	Coal	10	5	7	13
通信	Communication	19	9	12	43
计算机	Computer and Software	48	13	25	92
建筑	Construction	16	9	13	39
消费者服务	Consumer Services	6	4	4	6
国防军工	Defense and Military	21	9	14	31
电子	Electronic Components	55	20	28	75
食品饮料	Food and Beverage	30	12	15	27
医药	Health Care	80	25	53	91
机械	Heavy Industry Manufacturing	25	5	19	67
家电	Home Appliances	10	6	7	14
轻工制造	Light Industry Manufacturing	10	2	9	37
传媒	Media	28	9	28	46
综合	Multi-industry	6	1	5	11
综合金融	New Finance	2	0	4	7
非银行金融	Non-Bank Finance	51	36	17	7
有色金属	Non-Ferrous Metals	27	13	18	31
石油石化	Petrochemical	12	8	8	8
电力设备及新能源	Power Equipment and New Energy	28	12	28	63
房地产	Real Estate	34	14	27	37
商贸零售	Retail	14	4	17	21
钢铁	Steel	18	5	20	8
纺织服装	Textile and Apparel	4	2	3	13
交通运输	Transportation	28	17	21	26
电力及公用事业	Utilities	25	8	22	45
	<b>Total no. of stocks</b>	<b>716</b>	<b>300</b>	<b>500</b>	<b>1000</b>

Source: Citi Research, MSCI, Wind. Data as of Oct 30, 2020

Figure 88. SWS-1 – Level 1 Hierarchy of Shenyin Wanguo Industry Classification System (Shen Wan)

Sector Name in Chinese	Sector Name in English	No. of stocks			
		MSCI China A Onshore	CSI 300	CSI 500	CSI 1000
农林牧渔	Agriculture	18	5	11	20
汽车	Automotive	20	10	22	36
银行	Bank	30	27	7	1
化工	Chemical	39	10	41	74
商业贸易	Commercials	11	4	18	18
通信	Communication	17	6	13	37
计算机	Computer and Software	44	12	24	92
建筑材料	Construction Materials	14	4	9	17
建筑装饰	Constructions	15	9	10	39
国防军工	Defense and Military	22	10	12	29
电气设备	Electrical Equipment	23	10	20	47
电子	Electronic Components	59	24	31	80
食品饮料	Food and Beverage	28	12	14	26
医药生物	Healthcare	85	25	55	91
家用电器	Home Appliance	10	6	6	14
休闲服务	Leisure Services	4	2	3	4
轻工制造	Light Industry Manufacturing	10	2	10	41
机械设备	Mechanical Equipment	23	5	20	68
传媒	Media	32	10	28	52
采掘	Mining	15	10	10	21
综合	Multi-industry	4	0	4	5
非银金融	Non-Bank Finance	52	37	19	13
有色金属	Non-Ferrous Metals	30	14	20	40
房地产	Real Estate	35	15	27	35
钢铁	Steel	16	4	17	6
纺织服装	Textile and Apparel	4	1	3	15
交通运输	Transportation	29	17	23	26
公用事业	Utilities	27	9	23	53
	<b>Total no. of stocks</b>	<b>716</b>	<b>300</b>	<b>500</b>	<b>1000</b>

Source: Citi Research, Wind. Data as of Oct 30, 2020

Figure 89. Wind-1 and Wind-2 – Level 1 & 2 Hierarchy of Wind Industry Classification System

Wind-1						Wind-2					
		No. of stocks						No. of stocks			
Sector Name in Chinese	Sector Name in English	MSCI China A Onshore	CSI 300	CSI 500	CSI 1000	Sector Name in Chinese	Sector Name in English	MSCI China A Onshore	CSI 300	CSI 500	CSI 1000
可选消费	Consumer Discretionary	68	28	66	126	汽车与汽车零部件	Automobiles & Components	18	8	19	39
						耐用消费品与服装	Consumer Durables & Apparel	18	9	14	40
						消费者服务 II	Consumer Services II	6	4	4	6
						媒体 II	Media II	18	5	17	31
日常消费	Consumer Staples	55	19	34	51	零售业	Retailing	8	2	12	10
						能源 II	Energy II	17	10	10	19
						食品与主要用品零售 II	Food & Staples Retailing II	8	2	7	7
						食品、饮料与烟草	Food, Beverage & Tobacco	44	17	23	43
能源	Energy	17	10	10	19	家庭与个人用品	Household & Personal Products	3	0	4	1
金融	Financials	84	65	27	12	银行	Banks	30	27	7	1
						多元金融	Diversified Financials	48	32	19	11
						保险 II	Insurance II	6	6	1	0
医疗保健	Health Care	79	25	53	94	医疗保健设备与服务	Health Care Equipment & Services	17	5	12	15
						制药、生物技术与生命科学	Pharmaceuticals, Biotechnology & Life Sciences	62	20	41	79
工业	Industrials	121	48	103	248	资本货物	Capital Goods	84	30	76	184
						商业和专业服务	Commercial & Professional Services	11	1	8	37
						运输	Transportation	26	17	19	27
信息技术	Information Technology	138	48	75	238	半导体与半导体生产设备	Semiconductors & Semiconductor Equipment II	24	8	8	28
						软件与服务	Software & Services	47	10	30	93
						技术硬件与设备	Technology Hardware & Equipment	67	30	37	117
材料	Materials	99	32	89	145	材料 II	Materials II	99	32	89	145
房地产	Real Estate	33	14	25	38	房地产 II	Real Estate II	33	14	25	38
电信服务	Telecommunication Services	1	2	1	1	电信服务 II	Telecommunication Services II	1	2	1	1
公用事业	Utilities	21	9	17	28	公用事业 II	Utilities II	21	9	17	28
Total no. of stocks		716	300	500	1000	Total no. of stocks		716	300	500	1000

Source: Citi Research, Wind. Data as of Oct 30, 2020

Figure 90. GICS-1 and GICS-2 – Level 1 & 2 Hierarchy of Global Industry Classification Standard

GICS-1						GICS-2					
		No. of stocks						No. of stocks			
Sector Name in Chinese	Sector Name in English	MSCI China A Onshore	CSI 300	CSI 500	CSI 1000	Sector Name in Chinese	Sector Name in English	MSCI China A Onshore	CSI 300	CSI 500	CSI 1000
通讯服务	Communication Services	28	11	23	40	媒体及娱乐	Media & Entertainment	27	10	22	38
						电信服务	Telecommunication Services	1	1	1	2
可选消费	Consumer Discretionary	55	23	56	98	汽车与汽车零部件	Automobiles & Components	18	8	18	37
						耐用消费品与服装	Consumer Durables & Apparel	18	7	15	48
						消费者服务	Consumer Services	5	3	5	3
						零售业	Retailing	14	5	18	10
日常消费	Consumer Staples	53	19	34	52	食品与主要用品零售	Food & Staples Retailing	6	1	6	7
						食品、饮料与烟草	Food, Beverage & Tobacco	43	18	22	43
						家庭与个人用品	Household & Personal Products	4	0	6	2
能源	Energy	20	10	14	17	能源	Energy	20	10	14	17
金融	Financials	82	65	23	8	银行	Banks	30	27	7	1
						多元金融	Diversified Financials	46	32	15	7
						保险	Insurance	6	6	1	0
医疗保健	Health Care	80	25	52	93	医疗保健设备与服务	Health Care Equipment & Serv	22	7	13	18
						制药、生物技术与生命科学	Pharmaceuticals, Biotechnology	58	18	39	75
工业	Industrials	120	53	95	252	资本货物	Capital Goods	90	35	70	193
						商业和专业服务	Commercial & Professional Serv	8	1	8	31
						运输	Transportation	22	17	17	28
信息技术	Information Technology	123	40	69	218	半导体与半导体生产设备	Semiconductors & Semiconductor	24	7	13	30
						软件与服务	Software & Services	32	7	20	71
						技术硬件与设备	Technology Hardware & Equipmen	67	26	36	117
材料	Materials	100	30	92	150	材料	Materials	100	30	92	150
房地产	Real Estate	34	15	27	42	房地产	Real Estate	34	15	27	42
公用事业	Utilities	21	9	15	30	公用事业	Utilities	21	9	15	30
Total no. of stocks		716	300	500	1000	Total no. of stocks		716	300	500	1000

Source: Citi Research, Bloomberg, MSCI. Data as of Oct 30, 2020

## Previously Published Research

Figure 91. Research Reports (since 2009)

Report	Date Published
Under the Microscope: Overlapping Momentum	16-Oct-2020
Equity Markets Positioning Model – Introducing the EMP	14-Sep-2020
Searching for Alpha: Combining ESG and Risk Premia – A Double Screen Approach	11-Sep-2020
Searching for Alpha: Factoring Short Interest – Measuring and Profiting from Information in Shorts	8-Sep-2020
Searching for Alpha: Machine Learning – Attributing Higher-Order Interactions: SHAP Value as Factor Selection Criterion	28-May-2020
Searching for Alpha: Machine Learning – Leveraging Return Forecasts	28-Feb-2020
Searching for Alpha: China A Alpha - Sector-relative Value Is Powerful, Choose Sector Mappings Wisely	21-Feb-2020
Searching for Alpha: Machine Learning – Beyond Random Forests for Stock Selection	03-Oct-2019
Searching for Alpha: Earnings Surprise: Managing Expectations	23-Sep-2019
What Works in Equity Markets: Free Cashflow Yield – Quality in Disguise	27-Aug-2019
Searching for Alpha: Machine Learning – Interpreting Machine Learning Predictions	5-Mar-2019
What Works in Equity Markets: China A Alpha – Combining Consensus for A Better Earnings Revisions Strategy	20-Feb-2019
Searching for Alpha: GAAP vs. Non-GAAP - Which Earnings does the Market Price?	7-Feb-2019
Searching for Alpha: Style Crowding in Asia - Getting Ahead of the Crowd	21-Nov-2018
Searching for Alpha: Earnings Surprise – Using Machine Learning to Forecast Earnings Surprises & Returns	17-Sep-2018
Searching for Alpha: The ESG Edge – A Step Forward	13-Sep-2018
Searching for Alpha: Machine Learning – Interacting Machine Learning and Factors	3-Sep-2018
Measuring the Crowded Trade: Introduction to our Crowding Composite for Individual Stocks	3-May-2018
Searching for Alpha: Profiting from Capex – Look to Capex Announcements	14-Mar-2018
Searching for Alpha: Tactical Style Rotation – Using Risk and Return to Manage Style Exposure	7-Sep-2017
Searching for Alpha: Big Data – Navigating New Alternative Datasets	10-Mar-2017
Searching for Alpha: Betting Against Accurate Beta	13-Feb-2017
Searching for Alpha: Competitive Advantage – Survival of the Fittest	19-Sep-2016
Searching for Alpha: Financial Strength Redux	9-Sep-2016
Searching for Alpha: Dynamic Style Weighting – Risk-Based Equity Style Allocation	14-Apr-2016
No Shorts Please: Long-Only Pure Style Portfolios	4-Mar-2016
Industry Alpha insights: Banks – One Size Does Not Fit All	18-Feb-2016
Under the Microscope: Stock Momentum Conflation	21-Sep-2015
Searching for Alpha: Macro Moves Markets	15-Sep-2015
Searching for Alpha: Style Performance, Trading Volumes and Investor Agreement	23-Mar-2015
World Radar Screen: Refining Our Global Search for Alpha	13-Mar-2015
Searching for Alpha: Networking with Analysts: Modelling Analyst Forecast Dependence	18-Feb-2015
The Rise of Low Risk Investing: Is it Getting Crowded Out There	01-Oct-2014
Under the Microscope: Five Innovations in Momentum Investing	27-Mar-2014
Searching for Alpha: Timing Price Momentum	07-Mar-2014
Equity Risk Premia Investing: A New Methodology For Monitoring Style Performance	27-Nov-2013
Stock Market Country Selection: Changes to a Well Established Model	23-Jul-2013
Searching for Alpha: Digging for Dividends – QUARI Quality with A Reliable Income	02-Jul-2013
Global Theme Machine: An Objective Way of Identifying Attractive Investment Themes	24-Jun-2013
Searching for Alpha: Purifying Analyst Recommendations – Removing Beta to get to the Alpha	25-Mar-2013
Searching for Alpha: Tangible Benefits of Intangibles – Brand, Respect & Intellectual Capital	06-Nov-2012
Low-Risk Portfolio Strategies: Sharpe Ratio Maximisation and Multi-Asset Applications	09-Mar-2012
Macro Risk and Style Rotation: A Guide Rather than a Prescription	28-Feb-2012
Searching for Alpha: Accruals Volatility – A New Approach to Quality Investing	14-Sep-2011
Industry Alpha Insights: Four Approaches to Tactical Industry Selection	24-Aug-2011
Industry Alpha Insights: Quantifying Industry Specific Fundamentals	17-Mar-2011
Low-Risk Equity Portfolios: More than just Minimum Variance	18-Nov-2010
Under the Microscope: Measuring Systemic Risk – The Absorption Ratio	15-Nov-2010
Under the Microscope: Optionality in Valuation	14-Jun-2010
Searching for Alpha: Earnings Surprise – Still Profiting from Surprises	31-Mar-2010
Searching for Alpha: Optimising Style Rotation Strategies	15-Oct-2009

Source: Citi Research

## Citi Quant Research Team

Figure 92. Citi Quantitative Research Teams

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# Appendix A-1

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	12 Month Rating			Catalyst Watch		
	Buy	Hold	Sell	Buy	Hold	Sell
<b>Data current as of 30 Sep 2020</b>						
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% of companies in each rating category that are investment banking clients	65%	62%	59%	68%	62%	68%
Citi Research Quantitative World Radar Screen Model Coverage	30%	40%	30%			
% of companies in each rating category that are investment banking clients	38%	36%	37%			
Citi Research Quantitative Latam Radar Screen Model Coverage	20%	59%	21%			
% of companies in each rating category that are investment banking clients	66%	66%	73%			
Citi Research Quantitative Asia Radar Screen Model Coverage	20%	60%	20%			
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