

Quantitative Portfolio Strategy

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Asia Equity Style Investing with Citi QuantIFI

Quant 

QuantIFI: Quantitative Investable Factor Indices

- **New Research Tool for Pan Asia Style Analysis** — In this report we introduce a new research tool for equity style analysis across Asia Pacific Ex Japan markets that clients can use for daily monitoring (via Bloomberg) of payoffs to six equity investment styles: Size, Value, Growth, Risk, Momentum and Quality.
- **Key Differentiating Characteristics** — In addition to explicit liquidity constraints, each style index has a unit beta to itself and a zero beta to the other styles, so each index represents a pure factor payoff, free of biases to the other five factors.
- **Superior Backtesting Approach** — We also illustrate why this factor orthogonalization results in more robust style factor backtest results and key takeaways from an analysis of equity style investing in Asia over the past 15 years.
- **Value, undoubtedly** — Value has trounced other equity styles in Asia since 1995. While this is not news anymore, the Asia QuantIFI indices help us determine the pure payoff to Value net of country, sector and style effects at 9% per annum on a 5% annualized volatility, i.e. a passive Value strategy, risk-adjusted for other common market effects has been an impressive 1.8 Sharpe Ratio trade in Asia
- **Growth disappoints** — Asia may be a growth region, but returns to growth have been poor. Moreover even when growth was rewarded, it has not been at the expense of Value
- **Size matters, beware Risk, befriend the Trend and buy Quality** — To sum up our other key takeaways; Large Caps do well; Momentum works (much of the time) and while quality hasn't been a stand-out attribute, it too helps. Detailed performance figures inside
- **Citi QuantIFI indices on Bloomberg** — Daily index updates are available on the Bloomberg <ALLX CITQ> page on a T+1 basis

Figure 1. Summary Risk & Return¹ Characteristics of Citi QuantIFI Asia Indices

Return/Risk (% Ann.)	Size	Value	Growth	Risk	Momentum	Quality
Return (% Ann.)	3.6	8.8	-0.9	2.5	3.6	1.8
Volatility (% Ann.)	4.6	5.0	4.0	9.1	4.6	4.1
Information Ratio	0.8	1.8	-0.2	0.3	0.8	0.4

Source: Citi Investment Research and Analysis

¹ Past performance is not indicative of expected future performance. Historical index performance data does not constitute a recommendation from the Authors to invest in any index

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

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Executive Summary

We extend our proprietary pure factor returns construction methodology, developed earlier this year for the Australia² market, to equity markets across the region and launched the Citi Quantitative Investable Factor Indices (QuantIFI) for Asia. Clients can view daily performance of the QuantIFI indices directly on the Bloomberg <ALLX CITQ> page.

The returns to each QuantIFI index represents the “pure” payoff to a given equity style, orthogonalized for the effects of other styles as well as sector and country effects. As the indices are liquidity weighted and well diversified they serve as good proxies for returns actually achievable from investing in the particular style. This also gives them widespread applications within the overall investment process in areas such as Portfolio Construction, Risk Management & Asset Allocation as discussed within the report.

Underlying rationale of pure factor indices

Factor indices are a multi-factor extension of the market beta, where the beta itself is expressed as a combination of “factor betas” to several individual and independent factors. In a nutshell, working with factor indices helps us to accomplish the following:

- attribute equity market returns between systematic market wide factors and an unsystematic, stock specific component
- create orthogonal factor (or style) indices as benchmarks of linearly independent payoffs to each systematic factor
- apply tilts to (or hedge) the individual factor exposures as a way of effectively managing the portfolio's systematic risk exposures

Accessing updates to the QuantIFI Indices

Daily returns, on a T+1 basis, are available to clients at the <ALLX CITQ> page.

Figure 2. Bloomberg Codes for QuantIFI Indices

Citi QuantIFI Index	Bloomberg Ticker
Asia Pacific Ex Japan	
Size	CITQASSZ
Value	CITQASVA
Growth	CITQASGR
Risk	CITQASRI
Momentum	CITQASMO
Quality	CITQASQU
Australia	
Size	CITQAUSZ
Value	CITQAUVA
Growth	CITQAUGR
Risk	CITQAURI
Momentum	CITQAUMO
Quality	CITQAUQU

Source: Citi Investment Research and Analysis

Figure 3. Citi QuantIFI Indices on Bloomberg



Source: Citi Investment Research and Analysis

² Introducing Citi QuantIFI Indices for Australian Equities, Tanuj Dutt and Josh Cherian, Citi Investment Research & Analysis, 8 January 2010

Index Construction Methodology

The first step in the QuantIFI index construction process involves the identification of the most important systematic drivers of risk and return within the Asia equity markets over the long term. Using results from the extensive style performance research published by the Citi Global Quantitative Research team^{3,4} together with client feedback and stylized facts documented within the Academic literature we arrive at the following styles: Size, Value, Growth, Risk, Momentum and Quality.

For each style factor, we then select a list of descriptors that best represent that specific attribute. For instance we use the total market capitalization and last reported total assets to represent a company's Size attribute. These descriptors are then winsorized, normalized and weighted to arrive at a style factor loading or style factor beta for each stock in the S&P Pan Asia Ex Japan Primary Market universe to each style. We also center the market cap weighted mean loading of the estimation universe around zero for each style factor. To capture the commonality of returns within a country and sector, each stock has a unit loading to the country and sector it belongs to.

We next employ weighted regression techniques to compute a set of orthogonal style factor portfolios using the monthly total excess returns of all stocks in the estimation universe and their *a priori* style factor loadings constructed as described above. Please see Appendix A for further details.

Figure 4 below shows the Citi QuantIFI Asia style indices together with the descriptors used in the construction of each index.

Figure 4. Citi QuantIFI Asia – Style Factors & Descriptors

Style Index	Descriptors	Description
Size	Market Capitalization	Natural log of Market Capitalization
	Balance Sheet Size	Last Reported Total Assets
Value	12 Month Forward Earnings Yield	Forecast IBES Consensus 12 Month Forward Earnings Yield
	Trailing Valuation Measures	Combination of Trailing Yields (Earnings, Book, Operating Cash Flow, Dividends and Sales per Share)
Growth	Trend Growth in Earnings	Trend in Historical (3 Years) + Forecast (2 Years) Earnings per Share
	Balance Sheet Growth	5 Year Trailing Growth measures (Sales, Total Assets)
	Growth Sustainability	Forecast ROE x (1 - Forecast DPS/EPS)
Risk	Beta	Historical Beta (1 Year) to the S&P Pan Asia Ex Japan Primary Market Index
	Volatility	Share Price Volatility (6 Months)
Momentum	Price Momentum - Long Term	One year volatility adjusted price trend
	Price Momentum - Short Term	60 days volatility adjusted price trend
	Earnings Momentum	Earnings Revision Ratio (IBES Consensus - 1 Months)
Quality	Profitability	IBES Consensus FY1 Return on Equity
	Earnings Certainty	Standard Deviation of IBES 12 Month Forward EPS/Absolute Value of the 12 Month Forward EPS
	Leverage	Debt/Assets Ratio
	Operational Efficiency	Asset Turnover Ratio
	Accruals	Cash Flow/Earnings

Source: Citi Investment Research and Analysis

³ Australia In-Style, 7 October 2009, Tanuj Dutt and Nick Morton, Citi Investment Research and Analysis

⁴ Asian Factor Investing: A Comprehensive Look at What Works Where in Asia, 19 January 2010, Paul Chanin, Josh Cherian and team, Citi Investment Research and Analysis

Index characteristics

In this section we review a few key characteristics of the style factor portfolios such as their betas to the styles and to the market, and their historical return and risk characteristics.

Index Factor & Market Betas

By construction each style index has a unit beta to itself and a beta of zero to all other styles at the time of the monthly rebalance. While no specific constraint is applied on the market beta of each index, this too is close to zero given the dollar neutral weights of each index.

The style and market betas of each QuantIFI style index as of April 2010 are shown in Figure 5 below. We also show the betas of the S&P Pan Asia Ex Japan index benchmark and its corresponding Growth and Value sub-components for comparison.

Citi QuantIFI indices have a non-zero Style beta to only one Style; a characteristic not shared by most other commonly used Style benchmarks

Figure 5. Style Factor Betas of QuantIFI Indices, April 2010

	Size	Value	Growth	Risk	Momentum	Quality	Market Loading
QuantIFI Style Indices							
Size	1.0	0.0	0.0	0.0	0.0	0.0	0.1
Value	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Growth	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Risk	0.0	0.0	0.0	1.0	0.0	0.0	0.3
Momentum	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Quality	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Common Index Benchmarks							
S&P Pan Asia Ex Japan	-0.2	0.1	-0.1	0.2	0.2	0.0	1.0
S&P Pan Asia Ex Japan BMI	-0.2	-0.1	0.1	0.3	0.3	0.2	1.0
Growth Index							
S&P Pan Asia Ex Japan BMI	-0.2	0.4	-0.3	0.2	0.2	-0.2	1.0
Value Index							

Source: Citi Investment Research and Analysis

Performance Summary

Figure 6 overleaf shows summary risk and return characteristics since 1995 for each style index. These returns are “pure” returns to a specific style i.e. the returns to Value are the actual payoff to Value characteristics in Asia ex after neutralizing for beta and other systematic effects represented by the other style indices & country and sector effects. This indicates an annualized return of 8.8%, ex cost, on an Information Ratio of 1.8 for Value.

It is interesting to note that there has been a positive payoff to both Value and Momentum even though these are negatively correlated, as we discuss later in this report. We also see evidence of a Large Cap premium as the positive Size returns represent returns to large caps vs. small caps. Likewise there is also evidence of an aggregate Risk premium.

Figure 6. Risk & Return⁵ Characteristics of Citi QuantIFI Asia Indices

Return (% Ann.)	Size	Value	Growth	Risk	Momentum	Quality
1995	3.6	9.2	0.7	0.7	2.0	0.8
1996	0.1	4.8	-1.5	9.6	5.7	0.9
1997	4.3	9.0	-5.6	-8.6	9.6	4.6
1998	4.7	18.1	-2.4	13.6	-4.7	8.0
1999	11.2	8.2	3.6	7.0	11.5	-5.4
2000	15.8	20.5	0.6	-14.0	-5.8	1.9
2001	1.6	13.3	1.0	6.7	3.6	9.2
2002	7.2	16.6	-3.9	1.7	16.9	3.6
2003	5.8	18.0	0.5	6.3	8.0	-3.1
2004	2.7	7.9	-1.9	-0.3	6.3	-2.4
2005	3.2	0.8	2.3	3.5	6.9	5.1
2006	2.1	1.4	3.5	5.4	3.8	2.9
2007	-0.7	4.5	1.0	5.2	9.6	-0.3
2008	4.2	-0.4	-9.9	-7.6	-5.0	5.3
2009	-7.0	7.0	-0.9	14.7	-7.5	-1.3
2010 YTD	-0.5	1.7	-0.2	0.2	-1.1	-1.2
1995 - 2010 YTD						
Return (% Ann.)	3.6	8.8	-0.9	2.5	3.6	1.8
Volatility (% Ann.)	4.6	5.0	4.0	9.1	4.6	4.1
Information Ratio	0.8	1.8	-0.2	0.3	0.8	0.4

Source: Citi Investment Research and Analysis

Macro characteristics of the Style Indices

We next analyze the characteristics of each index through the lens of the Citigroup Asia Pacific Risk Attribute Model (RAM). RAM is a macroeconomic time series based model that can be used to predict portfolio volatility and to run volatility decompositions and scenario analyses.

Figure 7 shows the ex ante volatility predicted by RAM for the March 2010 style factor portfolios as well as a breakdown of the portfolio variance into total systematic variance and residual variance.

Figure 7. Volatility Decomposition of Citi QuantIFI Asia Indices using RAM

	Size	Value	Growth	Risk	Momentum	Quality
Predicted (ex ante) Volatility	7.3%	5.2%	6.5%	14.5%	5.5%	5.3%
Variance Decomposition						
% Systematic Contribution	73%	23.73%	36%	91%	48%	25%
% Residual Contribution	27%	76.27%	64%	9%	52%	75%

Source: Citi Investment Research and Analysis

For well diversified portfolios, which by construction do not incorporate large stock bets, a low % systematic contribution to total variance likely signifies that there is a factor risk or systematic risk not captured by the factors in the risk model. The high % systematic variance in the case of the Size index is because the Small cap effect is explicitly modeled within RAM while the lower systematic contributions for other indices reflects the fact that these indices represent factor risks not modeled within the macroeconomic RAM model.

⁵ Past performance is not indicative of expected future performance. Historical index performance data does not constitute a recommendation from the Authors to invest in any index

Systematic contribution refers to the percentage of predicted volatility likely to come from the portfolio's exposures to the systematic factors modeled with RAM

The RAM analysis indicates a 10% outperformance of Small Caps over Large Caps is likely to result in a negative 5% return to the Citi QuantIFI Size index

Figure 8 shows a macro sensitivity analysis for each style index. Each row shows the likely return to the index for a one standard deviation move in the respective RAM factor, assuming also that other RAM factors too move by an amount equal to their correlation with that RAM factor. We highlight the factors that are the largest drivers of portfolio systematic variance in each case, i.e. the Small cap effect is the biggest systematic driver of the Size portfolio.

Figure 8. Macro Risk Profiles of Citi QuantIFI Asia Indices, March 2009

	Factor Standard Deviation (%)	Size	Value	Growth	Risk	Momentum	Quality
Macro Factors in RAM							
Asian Interest Rates	18.0	1.7	0.0	-0.7	1.4	1.3	0.0
US\$ to market cap weighted Asian FX basket	8.6	1.1	0.7	1.5	11.3	-1.7	0.0
US\$ to Yen	11.6	1.2	0.7	0.7	5.3	-0.7	-0.3
US Credit Spreads	25.7	-0.4	-0.8	-0.5	-5.6	-0.6	0.1
Emerging Market Bond Index	18.5	-0.9	-1.6	-0.5	-9.5	0.6	0.3
Oil	43.2	1.9	0.7	0.2	6.9	0.0	0.7
Commodity Prices (GSCI)	21.6	1.7	0.3	1.2	7.9	-0.4	0.9
Asian Market Effect (Residual)	13.3	0.9	-0.4	-0.3	6.5	-0.9	0.3
Asia Small Caps vs. Large Caps (S&P Size Indices)	10.2	-5.0	-0.6	2.7	0.6	-1.8	-0.9
Asia Growth vs. Value (S&P Style Indices)	6.4	2.2	-0.9	1.3	1.1	-1.2	1.8
Sector factors in RAM (Residual of Macro Factors)							
Energy	11.4	0.2	0.3	-0.1	0.4	0.2	0.0
Materials	9.6	0.8	0.2	-0.4	0.5	0.4	0.0
Industrials	8.0	0.4	0.0	-0.4	1.3	0.1	0.1
Consumer Discretionary	8.8	0.5	0.7	-0.4	0.6	0.8	0.3
Consumer Staples	8.9	0.2	0.0	0.3	-0.2	0.1	-0.1
Health Care	17.5	0.1	0.0	0.1	0.0	0.0	0.0
Financials	5.9	0.1	-0.2	0.0	0.9	-0.3	0.1
Information Technology	14.3	0.4	-0.1	0.0	0.1	-0.2	-0.1
Telecommunication Services	12.5	0.9	0.4	-0.2	-0.2	-0.5	-0.4
Utilities	9.8	0.0	0.0	0.0	-0.1	0.1	-0.1
Country Factors in RAM (Residual of Macro Factors)							
Australia	10.2	-0.2	-0.2	-0.5	0.6	0.2	0.0
China	15.3	-0.2	0.2	0.0	0.3	-0.2	-0.1
Hong Kong	12.3	0.2	-0.6	-0.8	0.7	0.4	0.4
Indonesia	20.6	0.1	0.1	-0.1	0.3	-0.1	0.1
India	23.6	0.2	0.1	0.6	0.4	-0.6	-0.6
Korea	15.6	0.1	0.3	0.1	0.3	-0.1	0.1
Malaysia	11.3	0.1	-0.1	0.2	0.1	0.0	-0.1
New Zealand	15.1	0.0	0.0	0.0	0.0	0.0	0.0
Philippines	38.2	0.1	-0.1	-0.1	0.0	-0.1	0.1
Singapore	13.2	0.1	0.1	-0.3	0.5	0.2	0.3
Thailand	20.9	0.1	0.0	0.1	0.1	-0.1	0.0
Taiwan	15.8	-0.4	-0.5	-0.1	0.9	-0.1	0.2

Source: Citi Investment Research and Analysis

Robust Style Backtesting using QuantIFI

Backtesting returns to systematic factors such as Value, Growth and Momentum forms the backbone of most quantitative investment processes. Quantitatively inclined strategists and fundamental investors too employ some measure of factor backtesting to better understand the systematic effects that have been driving the market and in making their investment decisions.

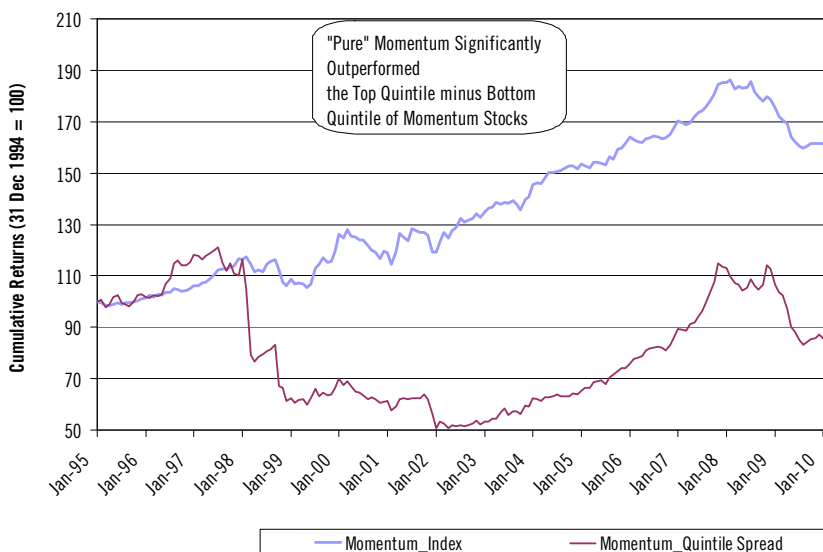
The most commonly used backtesting methodology employed by both quants and non-quants alike is a quantile-based approach that involves ranking the universe of stocks based on a particular factor and then comparing the performance of the group of stocks that rank highest to the factor versus the group of stocks that rank the lowest, for example, using the return difference between the top and bottom quintile of stocks to a price momentum factor as a proxy for systematic returns to price momentum.

It is also quite commonly accepted that this approach has two main limitations:

1. Information in the middle quantiles or the center of the distribution is completely ignored
2. Information embedded within the relative ranking of stocks in the top and bottom quantiles is ignored in the averaging process

In spite of these obvious limitations there is still a widespread usage of the quantile backtesting approach (including, historically, by us at Citi!) as the magnitude of the errors propagated by these approximations is often not fully appreciated. We compare below the performance to pure Momentum returns across the entire universe as proxied by the QuantIFI Momentum index versus returns to a Q1-Q5 backtest on the same Momentum factor: the latter underperformed by over 4.3% p.a. since 1995! Even more pertinent than the magnitude of the underperformance itself is the fact that a factor selection process based on a quantile backtest would have rejected this factor even though there has been a positive payoff to Momentum investing in Asia.

Figure 9. Long Q1/Short Q5 Momentum Portfolio & the Citi QuantIFI Asia Momentum Index



Source: Citi Investment Research and Analysis

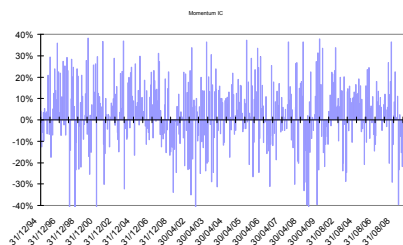
Of course, three reasons underlying the performance difference. The QuantIFI pure factor returns approach improves on the naive quantile backtests by:

1. Incorporating the information within the middle quantiles
2. Capturing the relative ranking of stocks within the top and bottom quantiles, and
3. Neutralizing the payoff to Momentum for other common Style effects such as Value, Risk etc.

Two other commonly used enhancements to the quantile backtesting approach are the Factor Information Coefficient and Regression Analysis. In the first the correlation between the ranks of stocks to a factor and their ranks on the returns in the subsequent period (as shown in Figure 10) is used as a measure of factor effectiveness. In the second, the beta from a linear regression of stock returns on their factor values is used as a measure of the factor payoff.

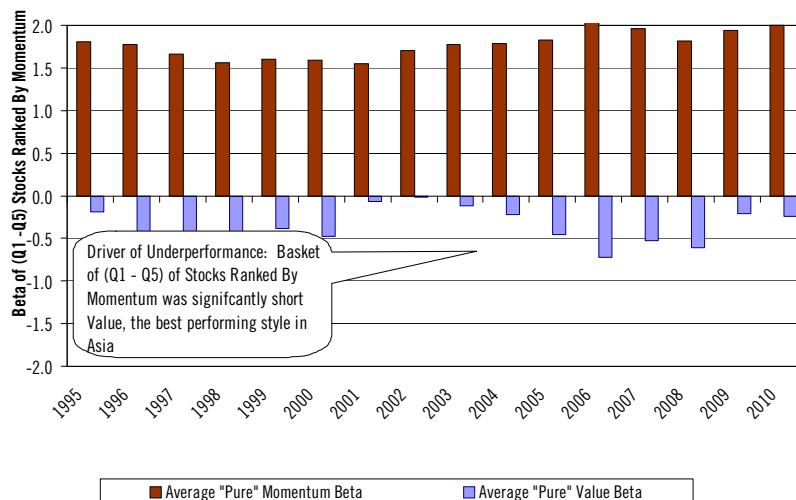
While both of these approaches can address the first two of the above three limitations, neither addresses the third limitation: embedded factor bets to other systematic risk effects. We show in the figure below the exposures of the Q1-Q5 Momentum portfolio to Value: clearly this portfolio was short Value for most of the last 15 years when Value was shooting the lights out in Asia. Negative correlation between factors is not always a good thing!

Figure 10. Momentum Factor IC



Source: Citi Investment Research and Analysis

Figure 11. Pure Style Exposures of a Long Q1/Short Q5 Portfolio of Stocks Ranked By Momentum



Source: Citi Investment Research and Analysis

For further details on the same topic, we would also refer Clients back to our analysis on the effect of Short Risk tilts embedded in Australia Growth portfolios in 2009 discussed in one of our previous reports⁶.

⁶ Introducing Citi QuantIFI Indices for Australian Equities, Tanuj Dutt and Josh Cherian, Citi Investment Research & Analysis, 8 January 2010

Style Investing in Asia: What Really Works?

In this chapter we include a brief discussion of equity style investing in Asia using the QuantIFI indices, our preferred methodology for interpreting systematic style effects in Asia for all the reasons discussed in the previous chapter.

In addition, there are two other key reasons why we believe the QuantIFI indices help provide a clearer picture (than most other previously published style factor research) on what works and what doesn't as far as style investing across Asia is concerned: in the QuantIFI approach we also neutralize for both the cross-country and cross-sector effects in determining Style payoffs. As we have discussed in previous research⁷, cross-market effects are very important across the region. Hence regional style backtests that are not country and sector neutral can often be quite misleading as the returns can be driven more by the macro country selection strategy than the payoff to the equity style itself.

The figure below shows performance of the Asia Pacific ex Japan equity market since 1995. The bold line (Left Hand Scale) shows returns on a logged scale to the S&P Pan Asia Ex Japan index in local currency, inclusive of dividends.

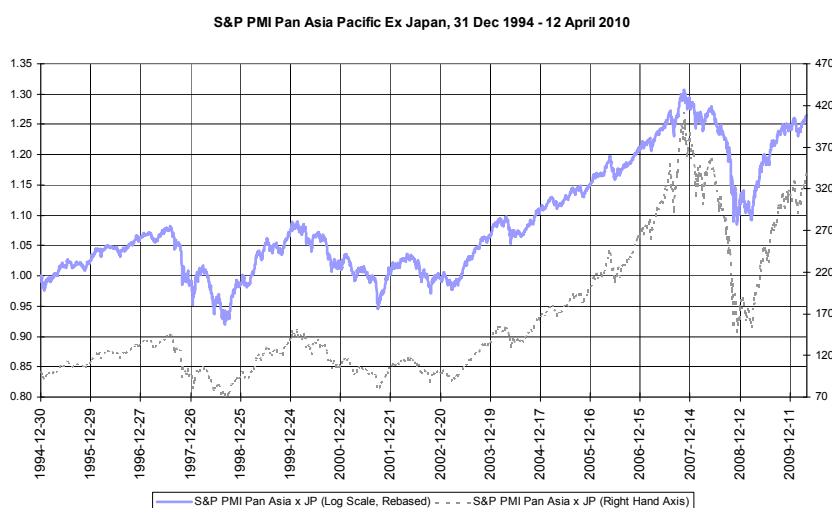
The logged scale helps us compare the relative drawdowns in each of the market crashes over the period including the Asian Crises, the dot-com boom and burst, the SARS related losses and the most recent Global Financial Crisis. For instance the Asian crisis event of 1997 was almost similar in magnitude to the disruption of the recent Global Financial Crisis.

Another undeniable feature of the Asian equity market over this period has been that while the returns have been strongly positive, the ride itself has been volatile, characterized by both large run-ups and equally large declines....

Asian markets have historically been volatile, characterized by large run-ups and equally large declines....

The Asian crisis even of 1997 was similar in magnitude to the disruption of the recent Global Financial Crisis

Figure 12. Asia Pacific ex Japan market performance, 1995 – 2010 To Date



Source: Citi Investment Research and Analysis

⁷ Asia: Country, Sector and Factor Effects, 18 September 2009, Paul Chanin and team, Citi Investment Research and Analysis

In Figures 13-18 we show the daily returns to each QuantIFI style index between 2nd Jan 1995 to 09 Apr 2010 and, as we do believe that a picture is worth a thousand words, relegate our own commentary to the side comments.

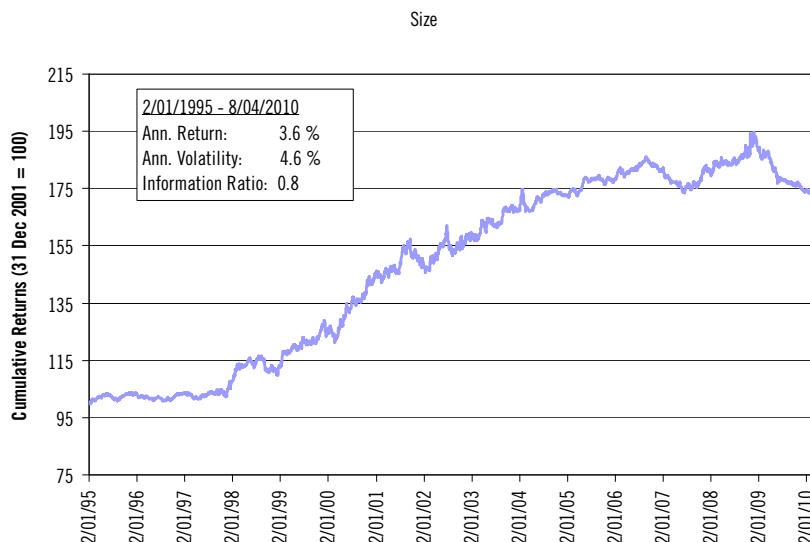
Asian large-caps tended to do well: although when capital exits the region large-caps have also tended to get hit hardest.

Many justifications for this size effect can be posited: but it is likely that it is a combination of a liquidity premium and the lack of level playing fields.

Historically dominant Asian players have benefited from better access to both financial and human capital – and have also sometimes benefited from a helpful regulatory environment.

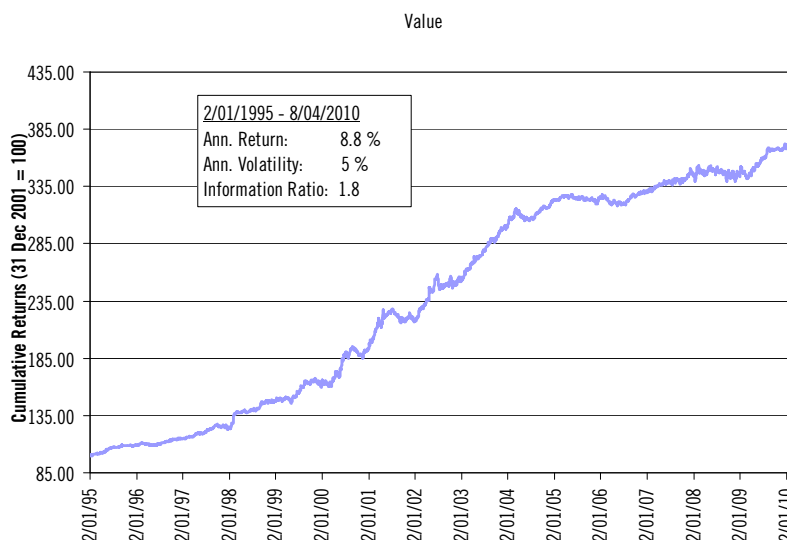
The surprise in 2009/2010 is that, so far, the regionally rally has occurred without the normal positive size effect.

Figure 13. Citi QuantIFI Asia Size Index



Source: Citi Investment Research and Analysis

Figure 14. Citi QuantIFI Asia Value Index



Source: Citi Investment Research and Analysis

The payoff to value has been both very substantial and remarkably consistent.

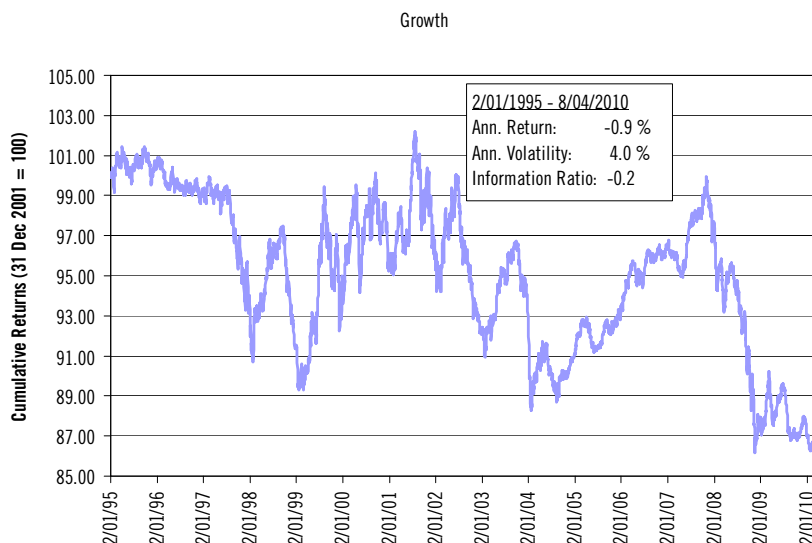
Draw-downs have been negligible: value strategies may not always work, but they almost never "don't work"!

Figure 15. Citi QuantIFI Asia Growth Index

... this is a marked contrast to the performance of Growth strategies in Asia.

Although many investors are lured to Asia looking for growth, over time the payoff has been poor.

What is also interesting to note is that even when Growth has done well, Value has also tended to do well



Source: Citi Investment Research and Analysis

Figure 16. Citi QuantIFI Asia Risk Index

The pay-off to Risk in Asia has been modest, and un-surprisingly volatility and draw-downs have been high: every time we see a "crisis" event risk tolerance changes rapidly and risk hurts performance

Generally it is only in the immediate post-crisis periods (as risk-appetite returns) that the period pay-off to risk has been high.

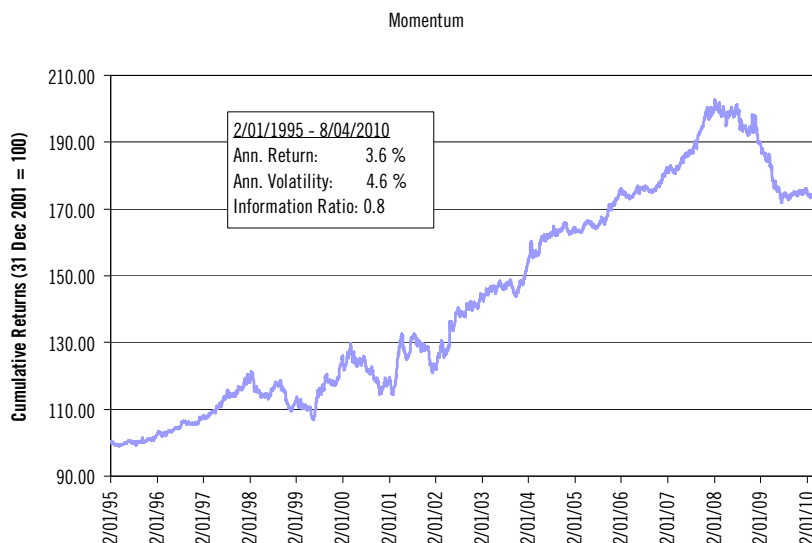


Source: Citi Investment Research and Analysis

Figure 17. Citi QuantIFI Asia Momentum Index

Value and momentum are the two style-tilts we actively seek to be exposed to in Asia: and while momentum has not been as-strong nor as consistent a performer as value, it has delivered solid returns over time— especially before the recent crisis.

In percentage terms prior drawdowns to momentum were similar to the recent "GFC drawdown. So while the current hiatus in efficacy has been a little longer than previous ones, we believe one needs to recognise the global nature of this event and we feel it is premature to declare that momentum in Asia will not be rewarded in the future.

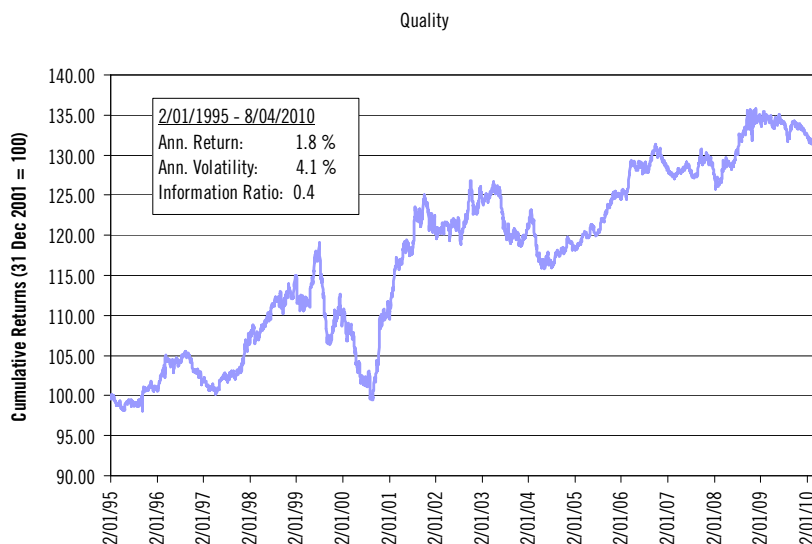


Source: Citi Investment Research and Analysis

Figure 18. Citi QuantIFI Asia Quality Index

As a univariate investment style, the case for quality in Asia is weak. There has been a modest payoff over time, but it has not been consistent.

Surprisingly there has been no recent payoff to quality, although quality was modestly rewarded into the sell-off in 2008.



Source: Citi Investment Research and Analysis

Performance Attribution using QuantIFI

We round up our introductory report on the Asia QuantIFI indices with a discussion on another interesting and useful application of the indices: Performance Attribution.

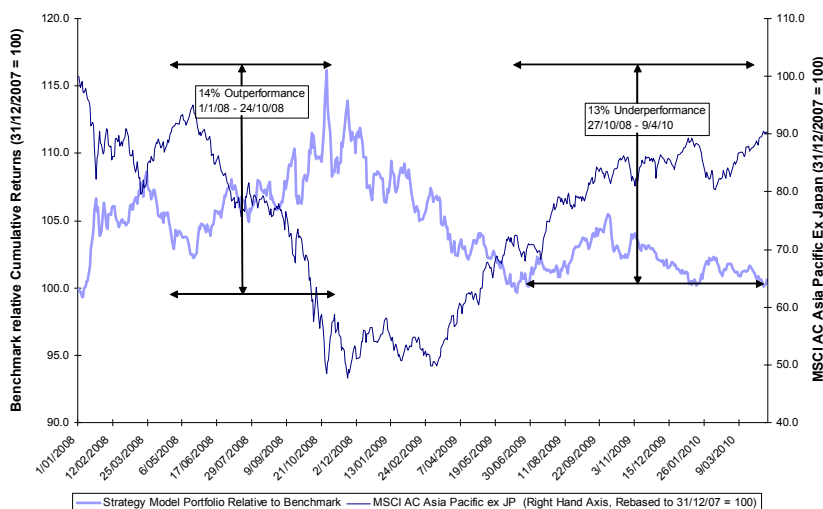
Performance attribution is a key element of the portfolio construction process of most investors today, regardless of their investment style or philosophy. An ex post analysis of the drivers of portfolio performance can be helpful in identifying where the portfolio might be carrying excessive factor exposures even if the ex ante risk decomposition fails to flag it as an area of concern.

We illustrate below the use of style indices in running a factor based attribution of portfolio performance. Factor based performance attribution enables a Manager to drill down into the primary drivers of portfolio performance. In addition to a split between “Alpha” and “Beta” P&L, it can also be used to understand other systematic drivers of portfolio P&L, such as any embedded Small cap bets or Sector tilts.

Figure 19 shows indicative historical performance, pre-cost and relative to the MSCI AC Asia Pacific Ex Japan benchmark to the model strategy portfolios, published by Citi’s Pan Asia Equity strategists, Markus Rosgen and Elaine Chu, over the past couple of years.

We chose this period not only because it encompasses perhaps the most interesting period of market action in the last couple of decades but also because it covers both a period of strong outperformance (1/1/2008 to 24/10/2008) and underperformance (27/10/2008 to 9/4/2010). The latter observation is quite pertinent as an often overlooked aspect of performance attribution is that it is just as helpful and critical to do when portfolios outperform as it is when they go through a more difficult period.

Figure 19. Historical Performance of CIRA Asia Pacific Ex Japan Strategy Model Portfolio



Source: Citi Investment Research and Analysis

In Figure 20 overleaf we show an attribution of the performance of the model portfolio over the two periods. For each panel, the first column shows the average benchmark relative factor exposures of the portfolio over the period, the second column shows the returns to the QuantIFI factors over the period

and the last column is the product of the difference in exposure and the style index return. This indicates the contribution to total portfolio return coming from any one style factor exposure. As all indices are orthogonal to each other the style factor return contributions are additive. For each period, we see systematic effects dominating residual or stock specific “alpha” as the main driver of benchmark relative returns.

The systematic exposures were helpful in generating portfolio outperformance in the first period but have detracted from performance in the latter period. In the former period, the systematic exposures contributed 17 % of out-performance while unsystematic or residual effects accounted for (3) % of underperformance, resulting in a total outperformance of 14%. While in the subsequent period, systematic effects drive (12.4) % of the (13.7) % underperformance. The defensive tilt of the portfolio is visible throughout (although it has become less defensive in the more recent period) as well as a long tilt to Value and a short tilt to Growth.

Figure 20. Performance Attribution of Model Portfolio using QuantIFI Indices

01/01/2008 - 24/10/2008				27/10/2008 - 9/4/2010			
	Benchmark Relative Factor Exposures	Factor Returns (%)	Contribution to Relative Performance	Benchmark Relative Factor Exposures	Factor Returns (%)	Contribution to Relative Performance	
Profit/Loss			14.0			-13.7	
Systematic Contribution			17.0			-12.4	
Residual Contribution			-3.0			-1.3	
Style Effects			9.6			-5.1	
Size	-0.8	3.6	-0.2	25.9	-6.9	-1.8	
Value	15.9	-0.3	0.1	22.2	8.7	1.9	
Growth	-36.6	-7.9	2.7	-45.3	-3.2	1.2	
Risk	-55.4	-12.5	7.5	-36.4	21.4	-9.8	
Momentum	-9.9	-2.0	-0.3	-20.5	-11.4	3.4	
Quality	-11.8	4.1	-0.4	-7.6	-1.4	0.0	
Sector Contribution			2.4			-2.2	
Consumer Discretionary	-0.3	-4.6	0.0	-2.7	23.4	-0.6	
Consumer Staples	-1.8	8.2	-0.1	-3.2	16.9	-0.5	
Energy	-4.3	0.9	0.1	-0.1	3.2	-0.3	
Financials	3.5	10.3	0.0	12.8	3.0	1.1	
Health Care	-0.8	22.3	-0.2	-1.3	4.4	0.0	
Industrials	-3.8	-15.2	0.6	0.9	-8.1	0.0	
Materials	-5.9	-18.4	1.5	-9.6	26.5	-2.2	
Real Estate	-4.8	-10.1	0.5	-4.7	-13.8	0.7	
TMT	16.8	10.2	1.6	19.7	-21.4	-4.8	
Utilities	4.1	15.8	0.6	0.6	-19.6	-0.2	
Insurance/Other Fin	-5.8	-0.6	0.1	-5.9	-7.8	0.4	
Tech Hardware	0.6	-3.3	-0.2	6.3	23.4	1.9	
Country Contribution			3.7			0.9	
Australia	-3.0	-34.7	0.7	-1.9	11.5	-0.1	
China	0.7	-64.7	-0.7	-0.3	98.2	-0.2	
Hong Kong	-6.7	-56.1	4.9	-0.9	112.1	-4.6	
India	-3.3	-61.3	2.8	-1.9	100.0	-1.5	
Indonesia	-0.8	-56.5	0.6	-0.7	101.0	-0.5	
Malaysia	2.6	-51.7	-1.8	0.5	85.8	1.1	
New Zealand	4.1	-46.5	-2.3	4.2	9.6	0.4	
Philippines	-0.5	-52.3	0.3	-0.5	90.7	-0.4	
Singapore	-0.9	-58.4	1.0	-0.4	95.0	-0.4	
South Korea	2.2	-53.2	-1.4	8.0	58.7	1.2	
Taiwan	3.6	-46.5	-1.7	6.6	34.8	2.3	
Thailand	-0.6	-59.5	0.5	0.0	84.6	0.0	

Source: Citi Investment Research and Analysis

Sector tilts added value only in the first period...

...while country tilts were effective in both.

Appendix A

We can express cross sectional stock returns over any period using the following equation

$$Y_{Nx1} = X_{Mkt,NxC} R_{Mkt,Cx1} + X_{Sector,NxS} R_{Sector,Sx1} + X_{Style,NxM} R_{Style,Mx1} + \delta$$

where Y – Stock returns in local currency in excess of short term interest rates for each country

$N \in$ S&P Pan Asia x Japan Large-MidCap Index

X_{Mkt} – Matrix of the loadings indicating a stocks country membership; and $C=12$

X_{Sector} – Matrix of dummy loadings indicating a stocks sector membership; and $S=12$

X_{Style} – Matrix of betas of the stocks to the 6 Style factors

R – Returns of the pure Style factors, Market & Sector

δ – Stock specific returns

A stocks beta to a style is computed by first winsorizing and then normalizing the underlying descriptor chosen for each style

$$x_{ij} = \sum_{k \in j} w_k \left(\frac{d_{ik} - \overline{d_k}}{\sigma_{d_k}} \right)$$

where w_k is the weight of the descriptor in the style

A weighted least squares solution to the above regression equation can be expressed as

$$R_{(C+S+M) \times 1} = fp_{M \times N} \cdot Y_{N \times 1}$$

Where Y may be of monthly or daily or any other periodically

The factor portfolios (fp) are then computed with a constrain on the sector weights⁸ as

$$fp = (X^T W X)^{-1} \cdot (X^T W Y)$$

where W is a matrix of regression weights computed as a function of each stock's recent liquidity

⁸ As the equation is over described, we constrain the weighted sum of the sectors to be 0 giving precedence to the country factors.

Appendix A-1

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* Daniel Giamouridis is an academic consultant to Citi Investment Research & Analysis and is Athens, Greece based. This research maybe a result of his part input.

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