The Asian Equity Risk Model

This paper describes the Asian equity risk model, which consists of two distinct models – Japanese equity risk model and Asia ex-Japan equity risk model. These models are part of a suite of global cash equity models in POINT, the Barclays Capital portfolio analytics and modeling platform. They incorporate a set of novel methodologies originally implemented in the US equity risk model. This consistent approach allows us to combine regional equity models in an effective way in a global portfolio setting.

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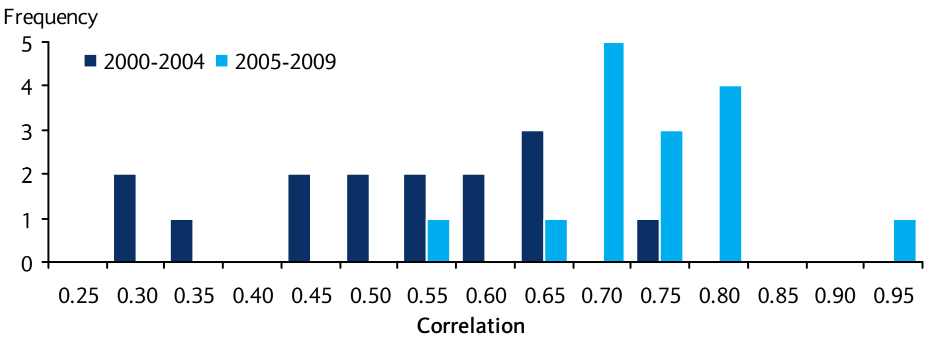
1. Introduction[1]

Asia started becoming a more integrated region in the 1990s, owing to the increased cross-border trades and economic activities. Various regional initiatives have been implemented since then to foster financial integration among the Asian economies. Having said that, the pace of integration in Asia has lagged behind some other regions such as Europe where the European Union and a common currency, the Euro, have contributed to a rapid financial integration. Regional integration has various implications with respect to portfolio risk management both for local and foreign investors. For instance, it allows local investors to diversify their risk more broadly and it makes the financial stability of a country less susceptible to country-specific shocks. On the other hand, it also increases the vulnerability of a country to regional and global financial crises and reduces diversification benefits with respect to country allocation for regional and global investors.

Historically, country allocation used to be central to investing in Asia, and country factors used to be the major drivers of risk for portfolios that invest in this region. Financial integration in Asia has resulted in increasing correlations between local equity markets and decreasing significance of the country factor in the region. Figure 1 illustrates the distribution of correlations between developed country indices in Asia for the first and the second half of the last decade. We see that the equity markets in the

Figure 1: Correlations between Developed Country Indices in Asia ex-Japan (Australia, Hong Kong, New Zealand, Singapore, S. Korea, Taiwan)



Source: Barclays Capital Portfolio Modeling

[1] The author would like to thank Anthony Lazanas, Antonio Silva, and Arne Staal for their valuable suggestions and comments. Zameer Shaik and Gary Wang contributed to the implementation of the model in POINT.

region move much more in tandem in the more recent history[2]. The Asian equity risk model is built to effectively reflect the changing landscape of Asian financial markets while maintaining flexibility to capture potential future changes in market dynamics.

The Asian equity risk model consists of two distinct models – Japanese equity risk model and Asia ex-Japan equity risk model, where the latter covers common stocks in Australia, Hong Kong, New Zealand, Singapore, South Korea, and Taiwan. Each model is calibrated separately to capture the specific characteristics of their markets.

The Asian equity risk model factors are estimated via cross-sectional regressions in a three-step estimation process. Industry factors, the major drivers of risk for a diverse set of Asian equity portfolios, are estimated in the first step on a univariate basis. As a result, the industry factors have a straightforward interpretation – they are statistically very close to the market value-weighted industry indices. This also makes hedging more practical for these factors. Fundamental and technical factors are estimated in the second step of the estimation process in a multivariate regression and they represent major investment themes of portfolio managers (e.g., size, value, momentum). On the third step, we estimate the residual market volatility factor in the Japanese equity risk model, which captures the remaining systematic risk. Residual country factors are estimated in the third step in the Asia ex-Japan equity risk model and represent country effects net of all other factors. Figure 2 illustrates the list of factors and their estimation order in the Asian equity risk models, which is consistent with the structure in the US equity risk model (also shown below).

Figure 2: List of Factors in the Asian/US Equity Risk Models

	US	Japan	Asia ex-Japan
Step 1	Industry (GICS level2)	Industry (GICS level 2)	Industry (GICS level 2)
Step 2	Market Value	Market Value	Market Value
	Corporate Default Probability	Corporate Default Probability	Corporate Default Probability
	Momentum	Momentum	Momentum
	Earnings to Price	Earnings to Price	Earnings to Price
	Earnings Forecast	Earnings Forecast	Earnings Forecast
	Realized Volatility	Realized Volatility	Realized Volatility
	Book to Price	Book to Price	Book to Price
	Share Turnover	Share Turnover	Share Turnover
	Total Yield		Dividend Yield
	Discretionary Accruals		
Step 3	Residual Market Volatility	Residual Market Volatility	Residual Country (6)

Source: Barclays Capital Portfolio Modeling

Asian equity risk models are part of a suite of global cash equity models in POINT. They incorporate a set of novel methodologies originally implemented in the US equity risk model (Silva, Staal, and Ural (2009)). The consistent approach in the methodology and the factor structure among different regional models allows us to combine them in an effective way in a global portfolio setting. Common features include:

- Estimation of monthly exposures to the industry factors (betas) through a proprietary model that incorporates daily data. This methodology renders sensitivities that are robust and yet very dynamic.

[2] This conclusion does not change if we exclude the extreme observations during the credit crisis starting at 2007.

- Proprietary mixed frequency models to estimate monthly systematic and idiosyncratic volatilities. These models also use daily data and produce estimates that are very responsive to changing market conditions.
- A three-step estimation procedure that facilitates a clean interpretation of risk factors.
- Non-linear transformation of the loadings for selected fundamental factors to eliminate systematic biases inherent in standard linear factor models.
- A proprietary factor that accounts for market distress through the use of firm-specific default probabilities (Asvanunt and Staal (2009)).

This paper is organized as follows. In Section 2, we discuss the systematic and the idiosyncratic components of the Asian equity risk models. We describe each systematic factor in detail and explain how we estimate the industry factor sensitivities – betas, systematic factor volatilities, and the idiosyncratic risk. In Section 3, we demonstrate the historical performance of the model for a diverse set of equity portfolios by means of the back-testing ratio test. Section 4 illustrates an implementation of the risk model in the POINT risk report. In Section 5, we conclude with a summary of the major features of the model.

2. Model Specification

This section describes the systematic and the idiosyncratic components of the Asian equity risk model. First, we discuss each systematic factor in detail, namely industry, fundamental, technical, and residual market/country factors. We then describe the models used to estimate the systematic factor volatilities and the idiosyncratic risk for Asian equities. As the Asian equity risk model utilizes a set of methodologies originally implemented in the US equity risk model, please refer to Silva, Staal, and Ural (2009) for details on the set of methodologies described in this section.

Before we start discussing the systematic factors, we would like to outline the data sources used in the development and the monthly calibration of the Asian equity risk models. We use Global Pricing database provided by SunGard-FAME for indicative and technical information including prices and returns, Worldscope for fundamental data, and IBES for earnings estimates. We perform extensive data cleaning and testing procedures before we use these sources and we are very diligent in merging different data sets. We used 1994-2009 period in the development phase of the Asian equity risk model and performed our analyses in different sub-periods to ensure that our conclusions are robust across different market environments.

The Systematic Risk Model

As we mentioned in Section 1, Asian equity risk models incorporate three sets of factors that are estimated in a multi-step process. Industry factors are estimated in the first step, fundamental and technical factors are estimated in the second step, followed by residual market/country factors in the third step. The following equation demonstrates these systematic components along with the idiosyncratic return for both sub-regions (for stock *i* at time period *t*) where *r* is the stock return, I is the industry factor return (GICS level 2), β is the industry factor loading – beta, *F* is the set of fundamental/technical factor returns, ℓ is the set of loadings to these factors, *C* is the residual market/country factor returns respectively for Japan/Asia ex-Japan and ε is the idiosyncratic return.

$$r_i^t = \beta_i^{t-1} I^t + \sum_{j=1}^{n} \ell_{ij}^{t-1} F_j^t + C^t + \varepsilon_i^t$$

The estimation universe is the set of largest 1,000 stocks for both Japan and Asia ex-Japan equity risk models. We use weighted least squares regressions to estimate the systematic factors where the weights are a decreasing function of the realized volatility of daily residual returns. As a result, large and mature companies tend to have more influence in the estimation process as they generally exhibit low residual volatility.

First Step: Industry Factors

In the first step of the estimation process, we regress stock returns to industry factor loadings to estimate the industry factor realizations. Due to the univariate nature of this estimation, implicit industry factors have a straightforward interpretation: they are statistically very close to the market value-weighted industry indices (e.g., correlation between the estimated factor and the index for each industry is greater than 90% for both sub-regions). Each stock loads onto a single industry that corresponds to the GICS (Global Industry Classification Standard) level 2 of the issuer.

We use a proprietary methodology to estimate the industry factor loadings, POINT Mixed-Frequency Betas (PMB). Instead of estimating the beta from monthly observations, we compute realized betas using daily observations within each month in recent history and then combine them by means of an optimized weighting scheme to compute the beta forecast for next month. These weights are determined with respect to the time-series characteristics of the time-varying beta process. The use of daily data allows us to utilize a much larger number of observations (compared to using monthly data), providing more robust estimates of industry betas. It also makes the estimate much more responsive to changing market conditions as we update it with ~20 new observations (heavily weighted) each month and as we require a relatively short history to perform our computations. This robust estimation methodology, along with the broad industry definitions, allows us to predict industry sensitivities in an accurate way (for details, see Silva, Staal, and Ural (2009)).

Second Step: Fundamental and Technical Factors

In the second step of the estimation process, we regress residual returns from the first step to the loadings of fundamental and technical factors on a multivariate basis to estimate the monthly realizations for these factors. The loading to any of these factors is a function of the corresponding firm characteristic (e.g., the loading to the earnings to price factor is a function of the E/P ratio of the stock). We standardize the loadings for these factors within each sub-region such that the loading of the market portfolio (value-weighted portfolio of stocks in the estimation universe) to any of these factors is zero. This approach implies a relative view on these variables with respect to their relationship with stock volatilities. Figure 3 defines the fundamental and technical factors used in the Japanese (JP) equity risk model and Asia ex-Japan (AS) equity risk model.

Figure 3: Definitions of Fundamental and Technical Factors

Factor	Type	Model	Definition
Industry	Sector	AS, JP	GICS level 2 industries
Country	Country	AS	Country of risk
Market Value	Fundamental	AS, JP	Log of market capitalization
Book to Price	Fundamental	AS, JP	Book value over current market capitalization
Earnings to Price	Fundamental	AS, JP	Last one year earnings over current market capitalization
Corporate Default Probability	Fundamental	AS, JP	Next one-year corporate default probability from the proprietary Barclays Capital model
Dividend Yield	Fundamental	AS	Last one year dividends over current market capitalization
Residualized Earnings Forecast	Fundamental	AS, JP	Next one year earnings forecast over current market capitalization – residualized
Share Turnover	Technical	AS, JP	Daily volume traded over common shares outstanding averaged over the past month
Momentum	Technical	AS, JP	Cumulative stock return in the period from month t=-10 to t=-1
Realized Volatility	Technical	AS, JP	Realized volatility of daily returns net-of-industry over the past three months

Source: Barclays Capital Portfolio Modeling

The corporate default probability (CDP) factor in Figure 3 is based on the proprietary CDP model, which was originally developed in POINT to gauge the default risk of fixed income securities. Our research shows that CDP performs better as a factor than distance to default or some more standard measures of leverage in the equity risk models. In distress conditions, it responds very fast to changing market environment whereas leverage is generally slow to react. See Asvanunt and Staal (2009) for details on the CDP model in POINT. Another proprietary factor in the Asian equity risk model is residualized earnings forecast. To prevent potential multicolinearity problems, we regress forecasted E/P to historical E/P and use the residual variable as a loading to the residualized earnings forecast factor. This variable represents the additional predictive power provided by analysts' estimates on top of the historical earnings figures.

We performed extensive univariate and multivariate analyses to select the fundamental and technical factors in the Asian equity risk models. We first analyzed potential factors on a univariate basis to find variables that help us differentiate low and high volatility stocks. This allowed us to eliminate a large number of potential factors and the resulting set of factors went under multivariate testing. In this paper, we illustrate only a selection of these tests; please refer to Silva, Staal, and Ural (2009) for a more complete discussion of tests performed in factor selection. In this selection process, we aimed to be parsimonious as a model with excessive number of factors is likely to produce unstable estimates. As a result of our vigilant selection procedure, fundamental and technical factors can maintain a rather clean interpretation despite being estimated in a multivariate regression. To illustrate this, we estimate each fundamental/technical factor separately on a univariate basis (in the second step of the estimation process) and compare these univariate realizations with the actual multivariate realizations coming out of our model. Figure 4 shows that the correlations between univariate and multivariate realizations for each factor are fairly high for both Japan and Asia ex-Japan.

Figure 4: Univariate/Multivariate Correlations for Fundamental and Technical Factors

	Japan	Asia ex-JP
Earnings to Price	0.88	0.79
Market Value	0.72	0.90
Momentum	0.86	0.90
Share Turnover	0.85	0.89
Realized Volatility	0.75	0.85
CDP	0.69	0.76
Book to Price	0.67	0.70
Earnings Forecast	0.83	0.86
Dividend Yield	N/A	0.75

Source: Barclays Capital Portfolio Modeling

In the context of univariate and multivariate analyses, we observe similar patterns between Asia and other regions (US and Europe) in terms of the behavior of fundamental and technical factors. Factors that perform well in US and Europe tend to perform well also in Asia. It is worth noting that some factors perform exceptionally well in Asia, especially in Asia ex-Japan (e.g., share turnover). To unravel the relationships between fundamental/technical variables and stock volatilities, we perform quintile analysis as part of the univariate testing procedures. At the beginning of every month, we rank the stocks in our estimation universe with respect to the value of the fundamental/technical variable of interest and construct five quintile portfolios in line with this ranking. Then we compute the time-series volatility of these quintile portfolio returns (net-of-industry returns) and look for any significant patterns. Figure 5 illustrates the monotonically decreasing pattern for the market value variable and the U-shaped pattern for the share turnover variable both in Asia and the US: smaller companies tend to be more volatile; very low turnover and very high turnover stocks tend to be more volatile than the rest. We see that in this analysis, share turnover performs significantly better in Asia ex-Japan, compared with the US where very high turnover stocks (Q5) exhibit substantially high volatility relative to other quintiles.

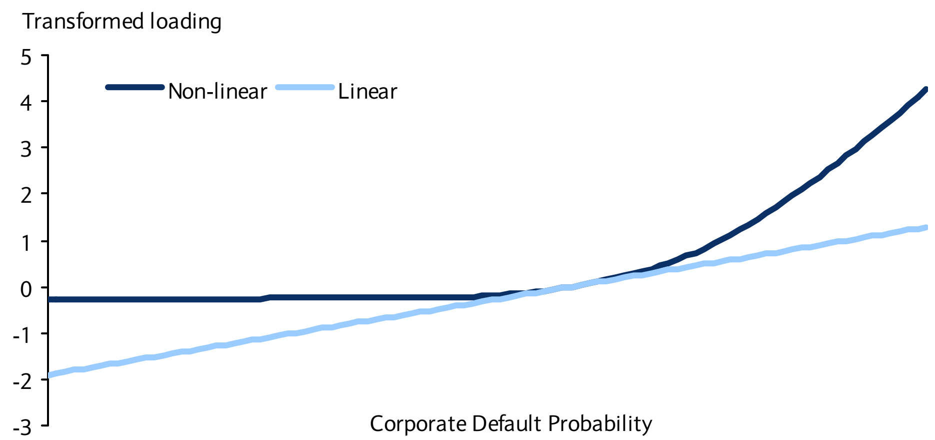
Figure 5: Partial View from the Univariate Analysis Report for Market Value (MV) and Share Turnover (ST) Factors in the US and Japan (JP)/Asia ex-Japan (AS)

	MV - US	MV - JP	ST - US	ST - AS
Q1	3.16%	2.82%	1.37%	2.83%
Q2	2.54%	2.45%	1.06%	1.91%
Q3	1.94%	2.01%	0.84%	1.41%
Q4	1.24%	1.55%	1.04%	3.05%
Q5	0.68%	0.68%	1.92%	6.34%

Source: Barclays Capital Portfolio Modeling

Our research shows that using linear loadings for certain fundamental factors in equity models can result in the underestimation or overestimation of volatility for portfolios tilted toward these investment themes. As an example, we see that using a linear loading for the market value variable results in underestimation of volatility for small-cap portfolios and overestimation of volatility for large-cap portfolios (even after the standard log transformation). To eliminate this bias, we perform non-linear transformations to the loadings of certain fundamental factors (CDP, market value, and earnings to price) and use these transformed loadings in the estimation of fundamental/technical factors. We perform this transformation only when there is overwhelming evidence for an improved risk forecast and when the non-linear transformation makes economic sense. For instance, the aforementioned quintile analysis for the CDP variable shows that there is minimal variation across low to medium default probability stocks in terms of their volatilities, but as we move from medium to high default probability stocks, the volatility increases exponentially. Figure 6 illustrates the non-linear transformation for the CDP factor where the transformed loading is almost constant for low to medium CDP stocks and it increases exponentially as we move from medium to high CDP companies, in line with the observed behaviour of the variable in the quintile analysis.

Figure 6: Non-linear Transformation for the CDP Factor



Source: Barclays Capital Portfolio Modeling

Third Step: Residual Market/Country Factors

In the third step of the estimation process, we regress the residuals from the second step to a unit loading to estimate the residual market/country factors. In Asia ex-Japan equity risk model, there are six residual country factors estimated in the third step on a univariate basis. These factors represent the country effect net of all other factors. In the Japanese equity risk model, we estimate the residual market volatility factor (can also be interpreted as the residual country factor for Japan) in the third step, which captures remaining systematic risk and makes sure that the residuals are mean zero.

As we mentioned in Section 1, financial integration in Asia has resulted in decreasing importance of country factor for portfolios investing in the region. Having said that, country still remains an important risk factor in Asia. In the Continental Europe equity risk model in POINT, which covers developed markets in Europe except the UK, we see substantial variation among residual country factors in terms of their significance where small country factors are much more significant than large country factors (see Ural (2010)). However, in Asia ex-Japan equity risk model, the residual country factors are more uniformly significant. Figure 7 illustrates this behavior where volatilities of residual country factors are relatively comparable.

Figure 7: Residual Country Factor Volatilities (monthly, weighted, as of 4/30/2010)

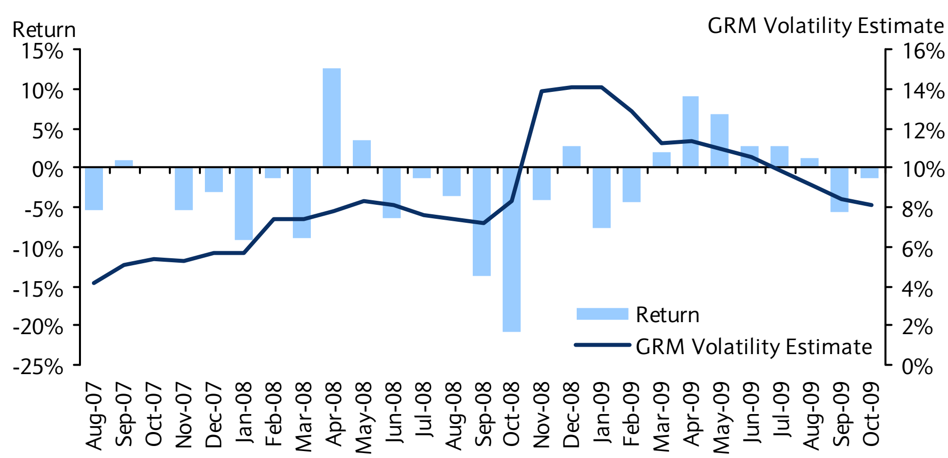
Country	Australia	Hong Kong	New Zealand	S. Korea	Singapore	Taiwan
Factor Volatility	1.07%	1.34%	1.97%	1.65%	2.07%	1.48%

Source: Barclays Capital POINT

Estimation of Factor Volatilities

To estimate the systematic factor volatilities, we use a proprietary methodology, namely the Mixed Frequency Volatility Model (MFVM) (see Silva, Staal, and Ural (2009)). The essence of this approach is the decomposition of the covariance matrix into correlations and volatilities. Correlations are estimated from the historical monthly factor realizations using an exponential weighting scheme. On the other hand, volatilities are estimated using a mixture of a short-term estimate of volatility that is computed by a weighted sum of daily squared factor returns and a slow moving long-run average level of volatility. Estimation of the covariance matrix is central to producing accurate volatility forecasts for portfolios and, hence, to the performance of the risk model. The use of daily data in MFVM provides more robust, yet responsive estimates of systematic factor volatilities. Figure 8 illustrates how well the volatility estimate for the MSCI Japan Index responds to changing market conditions over the course of the recent credit crisis. We see that the volatility estimate for the index doubles in a matter of two months around September 2008 and then starts coming down at a relatively rapid pace after February 2009. We will further demonstrate the performance of the Asian equity risk model in a back-testing context in Section 3.

Figure 8: Realized Return and GRM Volatility Estimate for the MSCI Japan Index



Source: Barclays Capital POINT

Extended Coverage

We have extended coverage in POINT for Asian stocks that are not fully covered by the model. For instance, if a security is missing industry beta but has a GICS level 2 classification, it loads onto the corresponding industry factor with a beta of 1. On the other hand, if a stock does not have an industry classification, it loads onto the market factor with a loading of 1. If a stock is missing any fundamental/technical factor loading, we assign a loading of zero, which is a market average loading for these factors. The users have the ability to switch off the extended coverage when they run the risk model in POINT.

The Idiosyncratic Risk Model

The idiosyncratic risk of Asian equities is modeled at the company level by means of a proprietary methodology that computes the estimate using recent daily residual stock returns overlaid by certain firm characteristics. As is the case with the estimation of systematic risk, it produces responsive estimates of stock-specific risk. The use of daily data is even more relevant in the estimation of idiosyncratic risk as the nature of individual securities can vary significantly over very short periods. Moreover, we can immediately start producing estimates for new issues, as we do not need a long history to compute the idiosyncratic risk.

3. Back-testing the Model

A major use of risk models is to estimate the volatility of portfolios. This section illustrates the performance of the Asian equity risk model by means of the back-testing ratio test where the goal is to assess how well the model predicts the volatility of portfolios. To perform this analysis for a given portfolio, we first need to compute the standardized return of the portfolio each month. The standardized return – u – is defined as the ratio of the realized return – r – of the portfolio in a given month divided by its estimated volatility – σ – at the beginning of that month:

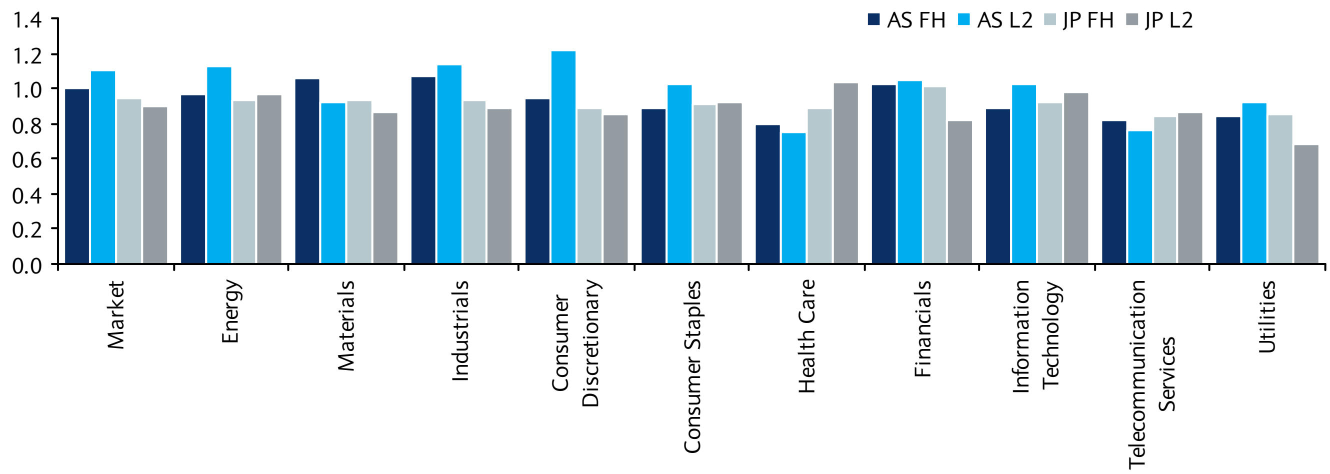
$$u_p^t = \frac{r_p^t}{\sigma_{p,forecast}^t}$$

If the volatility estimates for the portfolio are accurate, the standard deviation of the standardized return should be close to 1. We perform this test for a diverse set of portfolios, namely market and industry portfolios and portfolios tilted toward different investment themes such as value and momentum. We perform separate tests for Japan and Asia ex-Japan to isolate the performance of each model. We analyze various statistics of the distribution of the standardized return, but for the purposes of this illustration, we only present the standard deviation. Figure 9 demonstrates the standard deviation of the standardized return for Japan and Asia ex-Japan market and sector portfolios in the full history (2002-09)[3] and in the past two years (2007-09). Market portfolio is defined as the market value-weighted portfolio of stocks in the estimation universe and sector portfolios are subsets of the market portfolio, composed of stocks in each sector, defined by GICS level 1.

We see that the model performs very well across different portfolios, sub-regions, and time periods. The performance figures are generally very close to 1 with a slight bias in some cases. The results highlight the accuracy of the risk model estimates, underlining the performance of both the factor model structure and the systematic volatility estimation model.

[3] The first covariance matrix available in POINT is for November 2002.

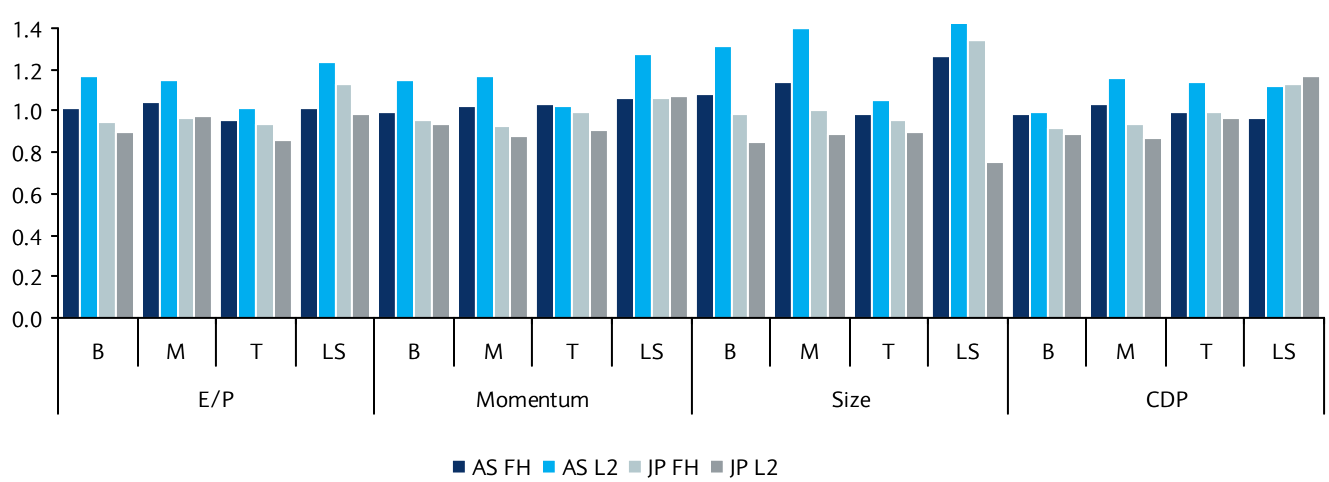
Figure 9: Performance of the Model for Market and Sector Portfolios in Japan (JP) and Asia ex-Japan (AS) for the Full History (FH) and the Past Two Years (L2)



Source: Barclays Capital Portfolio Modeling

We also present the performance of the model for portfolios tilted toward some major investment themes, namely value (E/P ratio), momentum, size, and corporate default probability (CDP). At the beginning of every month, we rank the stocks in our estimation universe with respect to the value of each characteristic (e.g., E/P ratio of the stock) and construct three portfolios corresponding to the bottom, medium, and top third (tercile) of the characteristic value. These portfolios are dynamic in the sense that their composition can change considerably from month to month. We also construct a long-short dollar-neutral portfolio that each month takes a long position in the top tercile and a short position in the bottom tercile portfolio. Figure 10 demonstrates the results of the back-testing ratio test for bottom (B), medium (M), top (T), and long-short (LS) portfolios for each of the aforementioned investment themes in both sub-regions.

Figure 10: Performance of the Model for Portfolios Tilted toward Investment Themes in Japan (JP) and Asia ex-Japan (AS) for the Full History (FH) and the Past Two Years (L2)



Source: Barclays Capital Portfolio Modeling

We see that the Asian equity risk model performs remarkably well also for portfolios tilted toward different investment themes. Most notable deviations from a standard deviation of 1 are in the case of Asia ex-Japan in the past two years for the size-based portfolios where the model underpredicts the volatility.

4. The Risk Report

In this section, we illustrate the risk report in POINT, which incorporates analyses of the portfolio volatility and tail risk from several dimensions. For the purpose of this illustration, we focus on the volatility component of the report. Please refer to Lazanas, Phelps, and Gabudean (2009) for a discussion on the Barclays Capital Tail Risk Model. The risk report is very comprehensive in nature, and in this section we only present a few components of it.

There are various options in running the risk report that allow for extensive customization. For this exercise, we run our reports as of 4/30/2010. We choose "weighted" option for time-weighting, which uses the Mixed Frequency Volatility Model (see Silva, Staal, and Ural (2009)) to estimate the systematic factor volatilities. In all examples, benchmark is cash, hence, the tracking error volatility (TEV) corresponds to the volatility of the portfolio. The security partition report is a component of the POINT risk report that demonstrates the contribution of different security buckets to portfolio volatility. Here the partition is fully flexible; it can be defined by the user or can be a system partition. Figure 11 combines partial views from this report with sector (GICS level 1) partition run for two different indices: 1) Nikkei 225 Index (Japan) with JPY as the base currency. 2) Hang Seng Index (Hong Kong) with HKD as the base currency. We see that there are significant differences between the two indices in terms of the sector contributions to total volatility. This demonstrates the disparity in sector concentrations across different countries in Asia. It is not surprising to see that financial companies are the major contributors to volatility for Hang Seng, as this Hong Kong market index is very heavily weighted in financials (~60%), and these financial companies tend to be more volatile than an average company in this index.

Figure 11: Partial Views from the Security Partition Report in POINT for the Nikkei 225 Index and the Hang Seng Index with Sector (GICS level 1) Partition (in %/month)

	Contribution to TEV	
Security Partition Bucket	**NIKKEI 225**	**Hang Seng**
Total	5.12	7.41
Energy	0.03	1.22
Materials	0.44	0.07
Industrials	1.33	0.23
Consumer Discretionary	1.09	0.18
Consumer Staples	0.25	0.04
Health Care	0.33	0.00
Financials	0.34	4.63
Information Technology	1.18	0.32
Telecommunication Services	0.12	0.61
Utilities	0.00	0.11

Source: Barclays Capital POINT

The factor partition report demonstrates the contribution of different factor groups to total volatility. Figure 12 illustrates a partial view from this report where the portfolio is the S&P/ASX 200 Index (Australia) and the base currency is AUD. Asia ex-Japan industry factors – under the Sector bucket – are by far the major contributors to total volatility, consistent with the dominant role of industry factors for diversified long-only portfolios. The Australian country factor – the dominant factor under the Country bucket – has a small negative contribution to total volatility, owing to its negative correlation with the industry factors. Factor partition report also incorporates an FX component, as this index includes some companies trading in currencies other than the AUD.

Figure 12: Partial View from the Factor Partition Report in POINT for the S&P/ASX 200 Index (in %/month)

Risk Factor Partition Bucket	Contribution to TEV
Systematic – Total	**3.56**
Foreign Exchange	**-0.04**
FX USD	**-0.03**
FX GBP	**-0.01**
FX Other	**0.00**
Equity	**3.60**
Country	**-0.22**
Sector	**4.01**
Fundamental	**-0.08**
Technical	**-0.13**
EMG	**0.02**

Source: Barclays Capital POINT

The factor exposure report in POINT summarizes the exposure, volatility, and the TEV contribution of each individual factor and provides sensitivity analysis. Figure 13 illustrates a partial view of this report where the portfolio is the Nikkei 225 Index and the base currency is JPY. The factor with the largest contribution to total risk is "JP Equity IND Capital Goods", majorly due to the large weight of capital goods stocks in this index. There is substantial variation among the industry factors in terms of their volatilities with "Diversified Financials" being the most volatile industry (6.88%) in Japan. The index has a slight positive exposure to the "Market Value" factor, as it is composed of a group of large-cap companies in Japan. It also has a slight positive exposure to the "Momentum" factor, which implies that an average stock in this index has been performing better than an average stock in our estimation universe (largest 1,000 Japanese companies) in recent history. Among the fundamental and technical factors, "Share Turnover" has the largest contribution to total volatility (4.89bps), majorly due to its relatively high volatility.

Figure 13: Partial View from the Factor Exposure Report in POINT for the Nikkei 225 Index (in bps/month)

Factor name	Sensitivity/ Exposure	Net exposure	Factor volatility	TE impact of an isolated 1 std. dev. up change	TE impact of a correlated 1 std. dev. up change	Marginal contribution to TEV	Percentage of tracking error variance (%)	Contribution to TEV
CURRENCY								
JPY (Japanese Yen)	MW%	0.00	0.00	0.00		0.000	0.00	0.00
EQUITIES DEVELOPED MARKETS								
JP Equity Energy	Empirical Beta	0.007	584.31	3.81	408.88	466.532	0.59	3.04
JP Equity Materials	Empirical Beta	0.076	592.35	44.94	487.43	563.813	8.35	42.77
JP Equity IND Capital Goods	Empirical Beta	0.193	584.76	112.76	489.82	559.309	21.06	107.85
JP Equity IND Commercial	Empirical Beta	0.023	460.86	10.72	466.08	419.437	1.90	9.75
JP Equity IND Transportation	Empirical Beta	0.037	484.28	17.76	327.08	309.312	2.22	11.34
JP Equity CYC Automobiles	Empirical Beta	0.070	652.71	45.38	443.03	564.674	7.67	39.26
JP Equity CYC Consumer Durables	Empirical Beta	0.054	584.72	31.73	481.02	549.228	5.82	29.80
JP Equity CYC Consumer Services	Empirical Beta	0.001	241.61	0.36	416.81	196.654	0.06	0.29
JP Equity CYC Media	Empirical Beta	0.012	484.67	5.72	346.17	327.624	0.75	3.87
JP Equity CYC Retailing	Empirical Beta	0.085	415.59	35.34	441.54	358.330	5.95	30.47
JP Equity NCY Retailing	Empirical Beta	0.020	474.42	9.50	336.12	311.387	1.22	6.24
JP Equity NCY Food	Empirical Beta	0.040	441.94	17.70	411.62	355.227	2.78	14.23
JP Equity NCY Household	Empirical Beta	0.018	423.49	7.76	313.81	259.511	0.93	4.75
JP Equity HLT Health Care	Empirical Beta	0.039	442.08	17.09	432.08	373.001	2.82	14.42
JP Equity HLT Pharmaceuticals	Empirical Beta	0.070	371.01	26.11	391.93	283.946	3.90	19.98
JP Equity FIN Banks	Empirical Beta	0.016	578.94	9.13	325.66	368.162	1.13	5.81
JP Equity FIN Diversified Financials	Empirical Beta	0.013	687.56	8.84	427.31	573.713	1.44	7.37
JP Equity FIN Insurance	Empirical Beta	0.012	545.47	6.28	421.79	449.267	1.01	5.18
JP Equity FIN Real Estate	Empirical Beta	0.031	590.43	18.01	440.14	507.467	3.02	15.48
JP Equity TEC Software	Empirical Beta	0.028	531.31	14.74	385.49	399.946	2.17	11.10
JP Equity TEC Hardware	Empirical Beta	0.139	609.24	84.91	488.02	580.592	15.80	80.92
JP Equity TEC Semiconductors	Empirical Beta	0.043	674.70	28.68	440.43	580.274	4.82	24.66
JP Equity Telecommunication	Empirical Beta	0.047	411.79	19.40	304.32	244.709	2.25	11.53
JP Equity Utilities	Empirical Beta	0.005	334.76	1.69	32.66	21.347	0.02	0.11
JP Equity Corporate Default Probability	CDP	-0.144	44.20	-6.38	51.51	4.446	-0.13	-0.64
JP Equity Share Turnover Rate	Share Turnover	0.295	99.04	29.22	85.64	16.562	0.95	4.89
JP Equity Momentum (9m)	Momentum	0.221	44.67	9.89	-91.19	-7.955	-0.34	-1.76
JP Equity Market Value	Size	0.172	45.28	7.78	-79.04	-6.989	-0.23	-1.20
JP Equity Realized Volatility	Realized Volatility	0.013	58.22	0.78	121.26	13.785	0.04	0.18
JP Equity Earnings to Price	Earnings/Price	0.033	41.26	1.35	-78.99	-6.364	-0.04	-0.21
JP Equity Book to Price	Book/Price	-0.239	51.85	-12.39	138.52	14.025	-0.65	-3.35
JP Equity Earnings Forecast	Earnings Forecast	-0.140	42.38	-5.93	87.75	7.262	-0.20	-1.02
JP Equity Other Market Volatility	MW	1.000	19.63	19.63	150.96	5.787	1.13	5.79

Source: Barclays Capital POINT

As we mentioned at the beginning of this section, the risk report in POINT is very comprehensive. It starts with a high level analysis of the portfolio, including the contribution of different asset classes to TEV, major systematic risk exposures, and summary statistics/analytics for the portfolio and the benchmark. Then it provides a detailed analysis of the systematic component of the model, decomposing TEV into contributions from different risk factor and security buckets, summarizing factor exposures, and providing sensitivity analysis. Furthermore, it provides analyses at the issue and issuer level, including the idiosyncratic risk. Other components of the report include a historical simulation of systematic returns and a summary of warnings and parameters used to run the model.

5. Conclusions

The Asian equity risk model consists of two distinct models – Japanese equity risk model and Asia ex-Japan equity risk model. These models are calibrated separately to capture the specific characteristics of their local equity markets. They incorporate a set of novel methodologies originally implemented in the US equity risk model. These include proprietary techniques to estimate the industry factor sensitivities, systematic factor volatilities, and the idiosyncratic risk and non-linear transformations for certain fundamental factor loadings. A common set of methodologies, along with a consistent factor structure between Asian and other cash equity risk models, allows for an effective combination of regional risk models for global equity portfolios.

Asian equity model factors are estimated by means of a three-step process. Industry factors are estimated in the first step on a univariate basis and, thus, have a very straightforward interpretation. Fundamental and technical factors are estimated in the second step and represent major investment themes of portfolio managers. In Asia ex-Japan equity risk model, we estimate the residual country factors in the third step, which represent country effect net of all other systematic factors. The residual market volatility factor is estimated in the third step in the Japanese equity risk model and captures remaining systematic risk.

The Asian equity risk model performs very well in estimating the portfolio volatility for a diverse set of portfolios in both sub-regions. To demonstrate this, we used the back-testing ratio test and ran that on market and sector portfolios and portfolios tilted toward different investment themes such as size and value. The performance of the model over the recent credit crisis is especially remarkable, owing to the responsive nature of the risk model estimates.

The risk report in POINT incorporates a comprehensive analysis of portfolio volatility and tail risk from several dimensions. This includes decomposition of TEV into contributions from different risk factor and security buckets, a factor exposure report, and analyses at the issue and issuer level. The risk report is also highly customizable and offers various options for the user.

References

A. Asvanunt and A. Staal (2009), *The Corporate Default Probability model in the Barclays Capital POINT platform (POINT CDP)*, Barclays Capital, April 2009.

A. Lazanas, B. Phelps, and R. Gabudean (2009), *Estimating Extreme Negative Portfolio Returns: A Portfolio Manager's Guide to Barclays Capital Tail Risk Model*, Barclays Capital, October 2009.

A.B. Silva, A.D. Staal, and C. Ural (2009), *The US Equity Risk Model*, Barclays Capital, July 2009.

C. Ural, *The European Equity Risk Model*, Barclays Capital, forthcoming.

Analyst Certification(s)

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