

EMERGING MARKET EQUITY BENCHMARKS FOR JAPANESE INVESTORS

Countries, Sectors or Styles?

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Japanese investors maybe considering adding emerging market (EM) equities to their portfolios. What type of baseline EM exposure might be most suitable for Japanese investors? Given recent improvements in benchmark technology, more extensive data coverage, and empirical research in the underlying drivers of equity returns, Japanese investors can consider selecting, or designing, an EM benchmark that is most advantageous.

We show that a traditional market-capitalization EM benchmark (e.g., MSCI EM Index) may not be best-suited. Based on recent research showing that EM returns are influenced by sector and style exposures, in addition to country exposures, we present three alternative EM benchmarks that have provided better diversification, risk-adjusted returns and lower performance drawdowns for Japanese investors, compared to a traditional EM benchmark. Japanese investors should consider adopting one of these alternative EM benchmarks to represent their baseline EM allocation.

Introduction

Emerging market (EM) equities currently comprise 11% of free float, all-country market capitalization, so it is no surprise that many investors include EM as part of their long-term asset allocation.¹ This EM allocation has performed well. Over the last 15 years, although realized risk² in EM was higher than developed market (DM) equities, EM performed better, even on a risk-adjusted basis. An allocation to EM may continue to have return and diversification benefits going forward.

Japanese investors may be considering adding EM to their portfolios. What form should this EM allocation take? Adding a long-term asset allocation to an asset class involves selecting a benchmark to represent this exposure. A benchmark serves not only to represent the asset class' risk and return properties, but also represents the investor's

¹ Source: MSCI. MSCI has not approved, reviewed or produced this report, makes no express or implied warranties or representations and is not liable whatsoever for any data in the report. You may not redistribute the MSCI data or use it as a basis for other indices or investment products.

² No risk management technique can guarantee the mitigation or elimination of risk in any market environment.

baseline exposure. Investors can then choose either passive exposure to that benchmark or employ an active asset manager. Given recent improvements in benchmark technology, more extensive data coverage, and empirical research in the underlying drivers of equity returns, Japanese investors can select, or design, an EM benchmark that is customized for their needs.

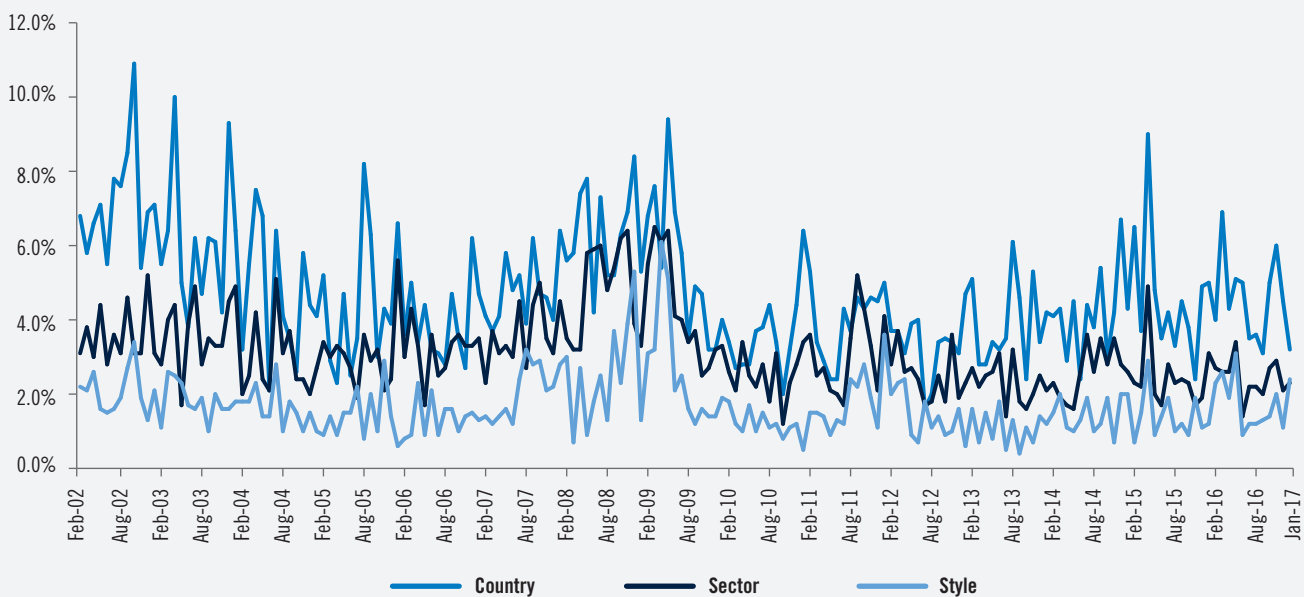
How might a Japanese investor select, or design, an EM benchmark? An obvious choice is a traditional market capitalization-weighted EM index (e.g., the MSCI EM Index comprising large- and mid-capitalization stocks). This type of index uses stocks' market capitalization weights both to combine stocks by country, and then to combine countries. All eligible EM countries are included in the benchmark.

However, the traditional EM benchmark has exposures that may not be ideal for Japanese investors. For example, the MSCI EM Index has more than 50% of its market value represented by just three countries: China, Korea and Taiwan. After the United States, these three neighboring countries are the largest export destinations for Japan. In addition, almost 50% of the traditional EM benchmark is represented by exposure to just two sectors: Financials and Technology. These two sectors are also heavily represented in developed equity markets, with more than a 30% combined weight. Are these EM country and sector concentrations desirable for Japanese investors? After all, the decision to add EM exposure is motivated by a desire for additional portfolio diversification, as well as higher returns.

We examine several alternative EM benchmarks from a Japanese investor's viewpoint. These alternatives are based both on recent research identifying stock attributes that better explain their returns and risk, and portfolio construction techniques that may provide better diversification and risk-adjusted returns. As mentioned, a traditional EM benchmark uses market capitalization weights to both group stocks by country, then to group countries. Grouping EM stocks by country may seem reasonable if a stock's country exposure is the major attribute that drives its returns and the variation of returns across stocks. A benchmark defined in terms of "countries" then helps investors identify their sources of potential returns and risk in terms of their country exposures. A Japanese investor would then be concerned with how these country exposures interact with the rest of their portfolio.

However, research shows that a stock's "sector" (i.e., industry) and "style" (such as value, momentum, size, etc.) exposures are also important attributes that drive its risk, returns, and the variation of returns across stocks.³ While return dispersion across stocks due to country exposure has usually been higher than due to sector or style exposure, in 2010–2012 all three groups were equally responsible for dispersion in returns (see Figure 1). In addition, dispersion due to country exposure has been declining relative to

Figure 1: Country, Sector and Style Return Dispersion
(February 2002 – January 2017)



Note: We define monthly return dispersion as the cross-sectional standard deviation of returns (in JPY, unhedged) of the group's constituents each month. Country group dispersion is measured using 11 cap-weighted country portfolios' returns; Sector group dispersion uses 11 cap-weighted sector portfolios' returns; and Style group dispersion uses seven cap-weighted style portfolios' returns. Chart is provided for illustrative purposes only and does not contain actual results or characteristics of any PGIM-managed portfolio. Source: PGIM IAS, Datastream, MSCI, and S&P Capital IQ

3 See "Drivers of Returns in Emerging Markets Equities: The Growing Importance of Stock Selection", QMA, January 2014.

dispersion due to sector or style exposure. This suggests that EM investors might be better served with a benchmark that focuses less on country groupings and more on sector or style groupings. Japanese investors might reasonably be concerned with how these sector or style exposures interact with the rest of their portfolio.

Given a desired exposure metric (e.g., country, sector or style), how are these exposures to be combined into a benchmark? A traditional EM benchmark uses market capitalization-weights. However, investors can choose alternative weighting schemes that might provide better risk and return properties that better fit the investor’s overall portfolio. We consider two alternative weighting schemes: equal risk contribution (“ERC”) weights and equal weighting (“EW”). There are many other potential exposure weighting schemes, and some may work better than others depending on the economic regime. However, we choose to examine ERC and EW due to their long history and their focus on risk control, which may be desirable for investors in a new and volatile asset class.

The key question we wish to address is whether a Japanese investor might be better served by an alternative EM benchmark compared to the traditional MSCI EM benchmark.⁴ Specifically, we consider alternative benchmarks based on either country, sector or style exposures, which are combined either by equal risk contribution or equal weights. We show how the alternative benchmarks have performed in various economic environments both as a stand-alone investment and in a portfolio as a substitute for a portion of the Japanese investor’s existing DM ex-Japan equity allocation.

Compared to the traditional market capitalization-weighted EM index, the alternative EM benchmarks, using equal risk contribution, appear to be better-suited for Japanese investors. Among the three alternative benchmarks using ERC, we find that the country-based and style-based alternative EM benchmarks, on a risk-adjusted basis, have performed better than the sector-based alternative EM benchmark. If achieving lower volatility is the only investment objective, then the sector-based alternative EM benchmark does better.

Role of EM in Japanese investor portfolios

We first examine the case for adding EM exposure to a Japanese portfolio. For our analysis, we assume⁵ a sample Japanese portfolio allocation represented by a 50% DM equity allocation (25% in domestic (i.e., Japanese) equities and 25% in DM ex-Japan equities) and a 50% bond allocation (35% in Japanese Government Bonds (JGBs) and 15% in global government bonds ex-Japan).⁶ For the moment, we assume EM is represented by the MSCI EM Index. We assume all foreign equity and bond allocation in the Japanese portfolio is unhedged.

Figure 2 shows performance metrics for DM, DM ex-Japan, Japan and EM equities, and global government bonds ex-Japan and JGBs from February 2002 to January 2017.

Figure 2: Asset Class – Performance Metrics
(unhedged JPY returns; February 2002 – January 2017)

	Cap-Weighted					
	DM Equities	DM ex-Japan Equities	Japan Equities	EM Equities	Global Govt. ex-Japan Bonds	Japan Govt. Bonds
Returns (Annualized)	5.6%	5.7%	4.5%	8.7%	4.6%	2.0%
Risk (Annualized)	19.0%	19.6%	18.4%	24.1%	9.5%	2.1%
Sharpe Ratio	0.28	0.28	0.23	0.35	0.47	0.87
Correl to Japan	0.78	0.75	1.00	0.72	0.50	-0.37
Correl to DM	1.00	1.00	0.78	0.88	0.63	-0.26
Correl to EM	0.88	0.87	0.72	1.00	0.54	-0.25
Max. Drawdown	-61.2%	-61.7%	-57.3%	-68.2%	-22.5%	-4.5%

Note: We proxy DM Equities with MSCI World Total Return (TR) Index, DM ex-Japan Equities with MSCI World ex-Japan TR Index. Japan Equities with MSCI Japan TR Index, and EM Equities with MSCI EM Index. We proxy Global Govt. ex-Japan Bonds with J.P. Morgan Global Government Bond ex-Japan Index, and Japan Govt. Bonds (JGBs) with J.P. Morgan Japan Government Bond Index. Past performance is not a guarantee or a reliable indicator of future results. Chart is provided for illustrative purposes only and does not contain actual results or characteristics of any PGIM-managed portfolio.

Source: PGIM IAS, Datastream, MSCI, and S&P Capital IQ

4 All three alternative benchmarks could be constructed and published by index providers.

5 If any assumptions used herein change, the results may vary.

6 We proxy the stock allocation with MSCI equity indexes and bond allocation with J.P. Morgan bond indexes.

What happens to the risk and return characteristics of a Japanese investor's portfolio as the EM allocation increases from 0%? To answer we must specify which existing portfolio allocation is reduced to make room for the new EM allocation. This is an important issue, as a reduction of Japanese equities and/or JGBs and an increase in EM means that the Japanese investor is also increasing foreign currency exposure. To keep the allocation to yen and equities unchanged, we assume EM allocation is made by reducing allocation to DM ex-Japan. Figure 3A and 3B shows, historically, how the overall portfolio's performance would have changed as the allocation to EM was increased.

Overall, we see that a Japanese investor could have benefitted from an allocation to EM equities.

Figure 3A: Returns – Allocation to EM Equities
(unhedged JPY returns; February 2002 – January 2017)

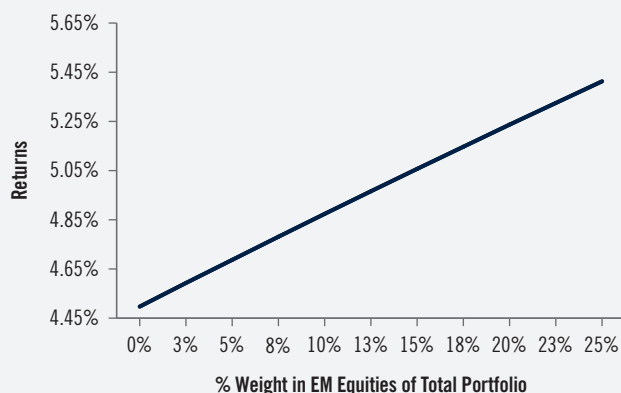
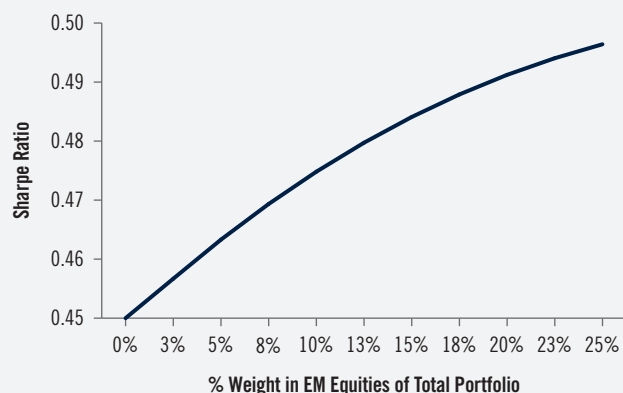


Figure 3B: Sharpe Ratio – Allocation to EM Equities
(unhedged JPY returns; February 2002 – January 2017)



Note: Past performance is not a guarantee or a reliable indicator of future results. Chart is provided for illustrative purposes only and does not contain actual results or characteristics of any PGIM-managed portfolio.

Source: PGIM IAS, Datastream, MSCI, and S&P Capital IQ

Figure 4: EM Country Groups – Performance Metrics
(unhedged JPY returns; February 2002 – January 2017)

	Country Groups (cap-weighted)											Benchmarks (cap-weighted)		
	Brazil	China	India	Indonesia	Korea	Malaysia	Mexico	Russia	South Africa	Taiwan	Thailand	EM Equities	Japan Equities	DM Equities
Returns (Annualized)	11.4%	11.7%	11.9%	17.8%	9.0%	6.4%	7.4%	7.5%	11.1%	4.9%	14.3%	8.7%	4.5%	5.6%
Risk (Annualized)	37.0%	28.0%	30.6%	31.3%	28.2%	19.7%	24.7%	34.6%	26.7%	24.9%	26.7%	24.1%	18.4%	19.0%
Cap-Weights	8.1%	26.8%	8.2%	2.5%	14.7%	2.5%	3.4%	4.3%	6.9%	12.1%	2.3%			
Sharpe Ratio	0.30	0.41	0.38	0.56	0.31	0.31	0.29	0.21	0.41	0.19	0.53	0.35	0.23	0.28
Correl to EM	0.83	0.88	0.82	0.70	0.89	0.79	0.85	0.79	0.85	0.85	0.77	1.00	0.72	0.88
Correl to Japan	0.50	0.62	0.64	0.52	0.64	0.58	0.67	0.61	0.66	0.62	0.60	0.72	1.00	0.78
Correl to DM	0.68	0.74	0.71	0.61	0.78	0.72	0.84	0.70	0.74	0.78	0.68	0.88	0.78	1.00
Max. Drawdown	-69.1%	-71.0%	-72.8%	-70.5%	-73.1%	-53.8%	-67.9%	-81.3%	-62.4%	-66.8%	-64.2%	-68.2%	-57.3%	-61.2%

Note: The cap-weights are as of 1/31/2017 for the MSCI EM Index. To be mindful of the liquidity needs required for rebalancing and the size of a market footprint a large prudent investor may want in any single country, we limit our country list to the 11 largest EM countries (those countries having ~\$100 billion or more in market capitalization). Past performance is not a guarantee or a reliable indicator of future results. Chart is provided for illustrative purposes only and does not contain actual results or characteristics of any PGIM-managed portfolio.

Source: PGIM IAS, Datastream, MSCI, and S&P Capital IQ

The appeal of a traditional market capitalization-weighted index is that it reflects the investable market, so index weights are commensurate with their market weights. In addition, since the larger countries and stocks tend to have lower transaction costs, gaining exposure to a market capitalization-weighted index may likely better control cost. Another advantage is that index weights move automatically with relative market performance, helping to keep turnover low.

However, a cap-weighted EM index has drawbacks. For example, as mentioned above, the traditional EM index has significant country and sector concentrations. Figure 4 shows that for the MSCI EM Index, more than 50% of market value is allotted to just three of the 23 EM countries: China, Korea and Taiwan, of which China has the largest weight of 26.8% (as of 1/31/2017). However, China, Korea and Taiwan are the three largest export destinations for Japan outside of the United States. An economic shock in one or more of these countries would likely have negative reverberations in the domestic Japanese equity market, reducing the potential portfolio diversification benefit of EM exposure if using a traditional EM benchmark.

Alternative EM benchmarks for Japanese investors

If not a traditional market-cap EM benchmark, what type of benchmark might be more suitable for Japanese investors? Given advances in benchmark technology, an investor can select, or design, an alternative benchmark that can provide better baseline exposure in the context of their overall portfolio.

We first consider an EM benchmark that continues to group stocks by country exposures, as does a traditional EM benchmark, but rather than using market capitalization weights the alternative benchmark uses either ERC or EW for the benchmark's construction. We call these **“country-based alternative”** benchmarks to distinguish them from a traditional EM benchmark.

As a second benchmark alternative, we group EM stocks first by sector exposure, irrespective of country. For example, an Indian technology stock and a Brazilian technology stock would be assigned to the same EM technology sector (using market capitalization weights). Then, to construct the alternative benchmark, we again combine the various sectors using ERC or EW. We call these **“sector-based alternative”** benchmarks.⁷

As a third alternative, we take advantage of academic research that has identified style exposures (*e.g.*, momentum and value) as drivers of equity returns. Research suggests economic or behavioral motivations that allow stocks with these style exposures to generate positive, risk-adjusted returns.⁸ To construct **“style-based alternative”** benchmarks, we first classify stocks from a country into style groups depending on their exposures to these styles (using market capitalization weights).⁹ Then, we combine these style groups using ERC or EW. As we show, for Japanese investors a style-based alternative EM benchmark has provided not only better returns, but also lower risk compared to a traditional EM benchmark.

For a given exposure grouping method we construct an alternative benchmark using either ERC or EW. Both construction methodologies follow a set of rules. ERC (also known as “risk parity”) is not new and has been well-studied.¹⁰ ERC produces a risk-balanced benchmark such that each group's contribution to the benchmark's overall risk (volatility) is same for all groups in the benchmark. An investor considering an EM allocation may wish to adopt this approach given the higher risk involved with EM equities. Another benefit of ERC is that it does not rely on expected return assumptions. To construct a benchmark using ERC we need only the volatilities and correlations of the various EM groups which we estimate each month using a widening window of historical data. This generates comparative results that are out-of-sample, providing an unbiased indication of how the various benchmark alternatives might perform going forward. Since the parameters are estimated each month, there is a potential for high turnover as alternative benchmarks are rebalanced. However, as shown below, by using a widening window of data, the degree of turnover is low.

The EW portfolio construction approach provides naïve diversification and does not require estimating any expected return or risk parameters. However, the portfolio has higher risk and since the EM universe is generally very volatile, it may have lower value for Japanese investors.

“Country-based alternative” benchmark approach

Figure 4 shows that the EM country universe is not homogeneous. There is significant performance dispersion. From February 2002 to January 2017, there was almost a 13-percentage point range in total returns (in JPY) across countries. For example, while Indonesia had almost double the performance of the overall EM market (17.8% vs. 8.7%), Taiwan performed meaningfully worse (4.9%). There was also wide variation in EM country risk (as measured by annualized standard deviation

7 Investor may also embark on fundamental bottom-up thematic investing in EM, in new themes like “Modernizing infrastructure”, “EM-EM cross-border trade”, “New domestic consumer class”, or “Fintech, e-commerce and distributional logistics”. Such themes can also be tied to sector-based equity investing. See “Emerging Markets at the Crossroads”, PGIM, June 2017.

8 Refer to E. Fama and K. French, “Dissecting Anomalies with a Five-Factor Model”, *Review of Financial Studies*, 29, 69–103, 2016.

9 Factors are generally interpreted as dollar-neutral long and short portfolios. Since we use long-only construction, to avoid any confusion we refer to our approach as “style-based” benchmarking.

10 See S. Maillard, T. Roncalli, and J. Teiletche, “The Properties of Equally Weighted Risk Contribution Portfolios”, *Journal of Portfolio Management*, 36, 60–70, 2010.

of monthly returns): Brazil had 50% greater risk compared to the overall EM market (37.0% versus 24.1%) while Malaysia had 20% lower risk (19.7%). Most notably, the three largest EM countries had among the highest correlations to Japan and DM ex-Japan. Countries with relatively low weights in the MSCI EM Index (e.g., Indonesia, Malaysia and Thailand) had lower correlations to Japan and DM ex-Japan.

These country-level performance metrics suggest the possibility of constructing a better diversified EM benchmark for Japanese investors by reducing the weights of the larger EM countries and increasing those of the smaller countries. However, moving away from market capitalization weights raises the issue of investability. While some EM countries have free float adjusted market caps that compare favorably with mid-cap sizes in single name US stocks, other EM countries are much smaller. Accordingly, we limit the EM country list to the 11 largest countries (approximately \$100 billion in market capitalization).

We weight these 11 countries to form an ERC “country-based alternative” EM benchmark. Unlike for a market cap-weighted index, due to relative market movements in EM country groups, rebalancing of the benchmark back to the target ERC weights at the end of each month is required. The monthly rebalancing causes the average annual two-way turnover to be 75%.¹¹

Unlike a cap-weighted index we do not observe significant concentration in handful of countries.

The equally-weighted (EW) “country-based alternative” EM equity benchmark is constructed by allocating equally to all 11 countries. Weights are also rebalanced back to equal weights at each month end.

“Sector-based alternative” benchmark approach

We use GICS (Global Industry Classification Standard) to first group all EM stocks into 11 sectors (using market capitalization weights).¹² As with country exposures there is similar concentration among EM stocks in terms of their sector exposures. Almost 50% of EM stocks, by capitalization, belong to the globally-oriented Finance and IT sectors (Figure 5). In contrast, the more defensive and, arguably, more “local” sectors (e.g., Healthcare, Utilities, Telecom and Consumer-Staples) – which have lower correlation with DM ex-Japan – are less than 20%. For investors seeking to benefit from faster internal growth in emerging markets, a weighting scheme tilted towards the smaller, more local sectors might be advantageous. For February 2002 – January 2017, while not as large a range as with EM country groups, we find a returns range, across EM sectors, of 7.4 percentage points.

Figure 5: EM Sector Groups – Performance Metrics
(unhedged JPY returns; February 2002 – January 2017)

	Sector Groups (cap-weighted)											Benchmarks (cap-weighted)		
	Energy	Materials	Industrial	Consumer Discretionary	Consumer Staples	Health Care	Financials	IT	Telecom	Utilities	Real Estate	EM Equities	Japan Equities	DM Equities
Returns (Annualized)	9.5%	9.1%	7.0%	10.9%	11.9%	11.2%	9.0%	7.9%	7.2%	8.2%	4.5%	8.7%	4.5%	5.6%
Risk (Annualized)	29.9%	28.0%	26.6%	25.4%	20.2%	19.8%	26.6%	26.2%	20.4%	22.9%	30.9%	24.1%	18.4%	19.0%
Cap-Weights	7.7%	7.7%	5.7%	10.2%	7.0%	2.4%	24.2%	23.9%	5.8%	2.8%	2.6%			
Sharpe Ratio	0.31	0.32	0.26	0.42	0.58	0.56	0.33	0.29	0.34	0.35	0.14	0.35	0.23	0.28
Correl to EM	0.90	0.93	0.95	0.94	0.93	0.74	0.97	0.88	0.92	0.93	0.86	1.00	0.72	0.88
Correl to Japan	0.63	0.65	0.68	0.69	0.68	0.62	0.70	0.66	0.68	0.67	0.60	0.72	1.00	0.78
Correl to DM	0.75	0.77	0.83	0.84	0.86	0.73	0.86	0.82	0.85	0.83	0.70	0.88	0.78	1.00
Max. Drawdown	-69.8%	-72.3%	-76.7%	-68.1%	-53.3%	-38.1%	-70.6%	-66.8%	-61.3%	-56.9%	-79.7%	-68.2%	-57.3%	-61.2%

Note: The cap-weights are as of 1/31/2017 for the MSCI EM Index. Past performance is not a guarantee or a reliable indicator of future results. Chart is provided for illustrative purposes only and does not contain actual results or characteristics of any PGIM-managed portfolio.

Source: PGIM IAS, Datastream, MSCI, and S&P Capital IQ

¹¹ At portfolio level, 75% annual turnover in EM country groups is negligible (for e.g., at 5% weight in EM equities of total portfolio, the annual turnover would be 3.75%).

¹² In 2016 Real Estate was separated from the Financial sector to form the 11th separate sector as per GICS (Global Industry Classification Standard). As the individual sectors are more than \$100 billion (as of 1/31/2017), we do not attempt to construct sector groups using only stocks from the 11 largest countries we chose for country groups.

Due to relative market movements in EM sector groups, there is a need for monthly rebalancing of benchmark back to ERC target weights. The monthly rebalancing causes average annual two-way turnover to be 66%.

ERC addresses the sector concentration issue. Instead of more than a 24.2% weight to Financials, the weight in sector-based alternative benchmark is only 8.1% (as of 1/31/2017). As the volatility and correlations of Healthcare sector were lower compared with the other sectors, it had the highest weight in the sector-based alternative benchmark (Appendix A2). To put this in context, most recently the Healthcare sector had a 13.1% weight in the sector-based alternative benchmark but only a 2.4% weight in the traditional EM index.

The equally-weighted (EW) “sector-based alternative” EM equity benchmark is constructed by allocating equally to all 11 sectors. Weights are rebalanced back to equal weights at each month end.

“Style-based alternative” benchmark approach

Finally, we consider alternative EM benchmarks based on style exposures. Market fundamentals may vary considerably across EM countries. Anecdotally, Indian equities have typically traded at relatively higher P/E multiples compared to other EM countries like China or Russia. This doesn’t necessarily imply that the Indian equity market is too expensive and should be avoided. Relative to its historical average it may, in fact, be trading at a relatively low multiple and therefore may be of value. Therefore, we construct style groups first at the country level. To do so, we sort the stocks for each country based on a specific style (e.g., Book-to-Price), and the top quintile stocks within a country are combined (using market capitalization weights) to form a country-level style group (e.g., the Brazil Book-to-Price style group).¹³ Similarly, for Size and Low Vol country-level style groups, the top quintile stocks in a given country represent stocks with lowest volatility and lowest log(market capitalization), respectively. Each country-level style group is rebalanced every month using prior month-end data. Then, for each of the seven styles considered here, we combine the 11 country-level style groups using ERC to produce an ERC EM style group. For example, the ERC EM Book-to-Price Value style group is defined as the ERC combination of all 11 country-level Book-to-Price Value style groups.

Figure 6 shows performance metrics for the seven long-only EM style groups (“value” – Book-to-Price and Earnings-to-Price¹⁴; “momentum” – 12-month less one-month price returns; “carry” – Dividend-to-Price; “profitability” – Return-on-Equity; “low volatility” – 12-month volatility; and “size” – log(market capitalization)).¹⁵

The range in returns among the seven ERC EM style groups was 8.0 percentage points, like the EM sector groups. We also observe that the EM Size style group underperformed the traditional EM index (7.2% vs. 8.7%). This is contrary to academic

Figure 6: EM Style Groups – Performance Metrics
(unhedged JPY returns; February 2002 – January 2017)

	Style Groups (Equal Risk Contribution)							Benchmarks (cap-weighted)		
	MOM	B/P	E/P	Size	Low-Vol	D/P	ROE	EM Equities	Japan Equities	DM Equities
Returns (Annualized)	15.2%	11.2%	14.0%	7.2%	9.9%	13.0%	10.7%	8.7%	4.5%	5.6%
Risk (Annualized)	23.8%	27.0%	25.5%	25.9%	19.5%	23.1%	22.5%	24.1%	18.4%	19.0%
Sharpe Ratio	0.63	0.41	0.54	0.27	0.50	0.56	0.47	0.35	0.23	0.28
Correl to EM	0.95	0.95	0.96	0.94	0.95	0.95	0.97	1.00	0.72	0.88
Correl to Japan	0.71	0.69	0.71	0.72	0.75	0.72	0.74	0.72	1.00	0.78
Correl to DM	0.83	0.82	0.85	0.84	0.87	0.83	0.86	0.88	0.78	1.00
Max. Drawdown	-70.6%	-69.1%	-67.6%	-73.3%	-61.7%	-62.0%	-70.5%	-68.2%	-57.3%	-61.2%

Note: Past performance is not a guarantee or a reliable indicator of future results. Chart is provided for illustrative purposes only and does not contain actual results or characteristics of any PGIM-managed portfolio.

Source: PGIM IAS, Datastream, MSCI, and S&P Capital IQ

13 Source: S&P Capital IQ; The country level style portfolio constituents are from S&P Broad Market Index (BMI) universe. For instance, Brazil Momentum, long only style factor is the top quintile portfolio with stocks (from S&P BMI universe and domiciled in Brazil) sorted based on 12 month – 1 month momentum. The constituents are then market capitalization-weighted.

14 We include both Book-to-Price and Earnings-to-Price value styles as their factor correlations are only 0.33, which suggests these are distinct value styles in EM.

15 We chose these seven styles due to their robust performance in the US markets, as demonstrated by the academic literature. US investors have also widely invested in these styles. We now verify their efficacy in an out-of-sample universe – EM equities. Refer to Appendix A3 for style definitions.

findings for DM large cap equities. One might argue that the analysis period of 15 years is too short, as these robust sources of risk premia can go in and out of favor for more than a decade. Nevertheless, we exclude the EM Size style group from the construction of the style-based alternative EM benchmark.¹⁶

Finally, we combine the six EM style groups, using either ERC or EW, to form “style-based alternative” EM benchmarks. Due to relative market movement in EM style groups, the benchmark needs to be rebalanced back to ERC target weights on a monthly basis. The monthly rebalancing causes the two-way average annual turnover to be 62%.

To construct the equally-weighted (EW) “style-based alternative” EM equity benchmark we equally-weight the six ERC EM style groups. The benchmark is rebalanced at each month end.

Performance comparison of EM benchmarks

Figure 7 shows that the returns for all three alternative benchmarks using ERC were highly correlated with the traditional EM index, suggesting that they all adequately captured exposure to the EM market.¹⁷ However, all three alternative benchmarks had better absolute and risk-adjusted performance compared to the traditional EM benchmark.¹⁸ In addition, all three alternative benchmarks had lower absolute return maximum drawdowns, reflecting the contribution of ERC in helping to control risk. The sector-based alternative benchmark had the lowest risk and maximum drawdown, but also the lowest return.

Long-term performance comparison of alternative EM benchmarks

All three alternative ERC EM benchmarks outperformed the traditional EM index (Figure 8A). The style-based alternative benchmark has particularly outperformed the traditional EM benchmark since 2012 (Figure 8B). As shown, the sector-based alternative benchmark has not performed as well as the country-based or style-based alternative benchmarks.

The sector-based benchmark eked out most of its cumulative relative outperformance versus the MSCI EM index during the financial crisis. While the alternative benchmark’s relative overweight to Healthcare and Consumer-Staples helped, its relative overweight to Real Estate hurt, as the sector had the highest volatility and largest maximum drawdown of all sectors. The longest period the sector-based benchmark underperformed relative to the traditional EM index was the five-year period July 2003 to August 2008.

Figure 7: Equal Risk Contribution Weighted EM Benchmarks – Performance Metrics
(unhedged JPY returns; February 2002 – January 2017)

	Benchmarks (Equal Risk Contribution)			Benchmarks (cap-weighted)		
	EM Countries	EM Sectors	EM Styles	EM Equities	Japan Equities	DM Equities
Returns (Annualized)	11.6%	9.7%	11.4%	8.7%	4.5%	5.6%
Risk (Annualized)	23.3%	22.4%	22.8%	24.1%	18.4%	19.0%
Sharpe Ratio (SR)	0.49	0.42	0.49	0.35	0.23	0.28
p-value (SR diff)	0.00	0.08	0.07			
Correl to EM	0.99	0.99	0.98	1.00	0.72	0.88
Max. Drawdown	-66.1%	-64.2%	-66.1%	-68.2%	-57.3%	-61.2%

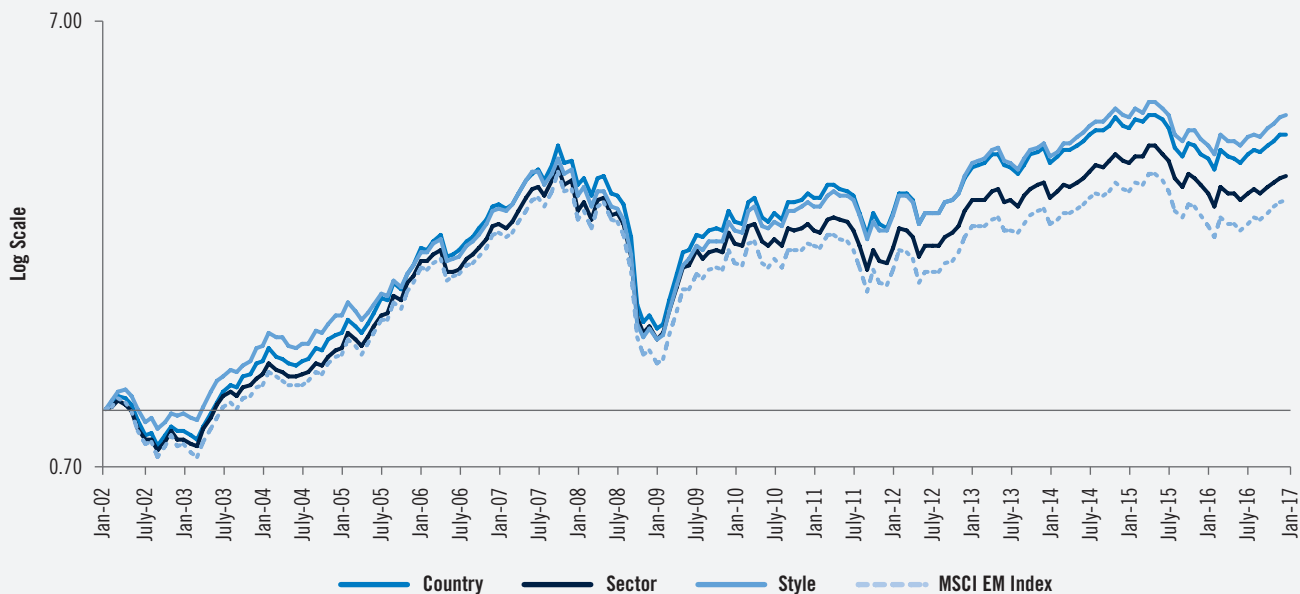
Note: We ignore transaction costs from monthly rebalancing back to ERC weights for the three alternative EM benchmarks. However, performance metrics are reported after deducting estimated transaction cost for country-level style groups, which unlike country or sector market cap-weighted groups, have higher turnover (Appendix A4). We estimate transaction costs using average turnover, bid-ask spreads and taxes. We estimated the cost to be 1%/y for EM Styles. Past performance is not a guarantee or a reliable indicator of future results. Chart is provided for illustrative purposes only and does not contain actual results or characteristics of any PGIM-managed portfolio. Source: PGIM IAS, Datastream, MSCI, and S&P Capital IQ.

16 Unequivocally, this creates a data mining bias effect. However, it doesn't make sense to include Size if it doesn't work in majority of the countries. We believe 'investable', 'governance' and 'cross-listing' premia can be masking size effect. Refer to T. O'Connor, S. Kinsella, and V. O'Sullivan, “[Legal Protection of Investors, Corporate Governance, and Investable Premia in Emerging Markets](#)”, *International Review of Economics & Finance*, 29, 426–439, 2014.

17 Performance results for alternative benchmarks using EW are available on request.

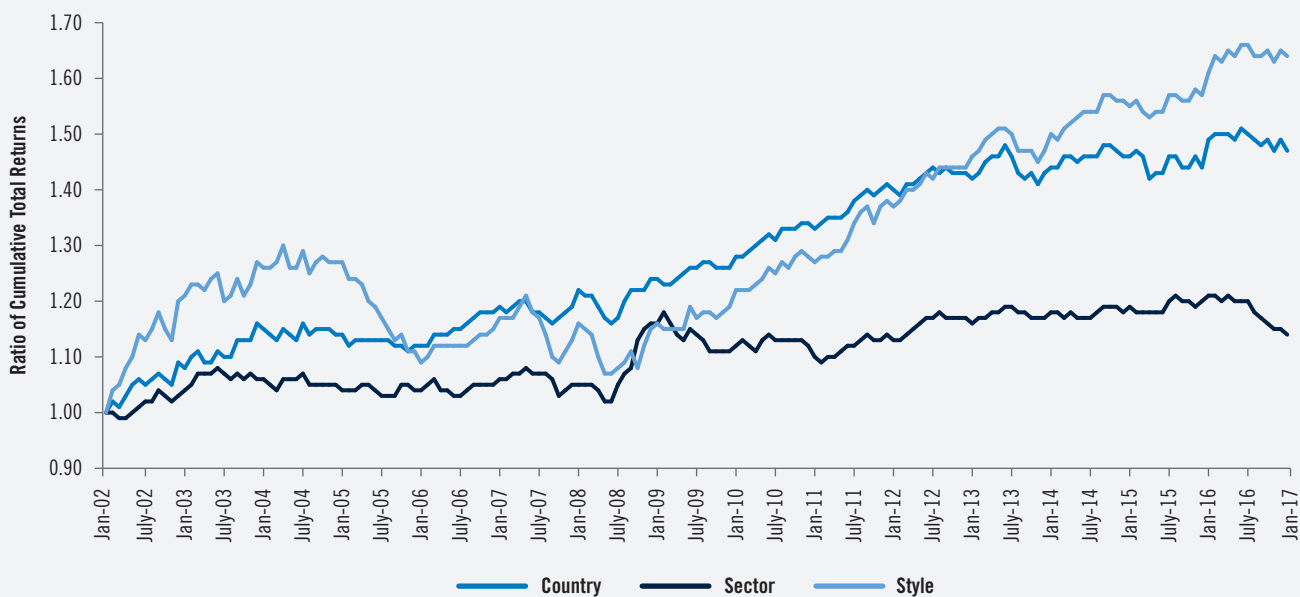
18 Since we are dealing with time-series data and EM equity returns are non-normal, we use HAC (heteroskedasticity and autocorrelation robust kernel estimation) inference to determine if Sharpe Ratios of the three proposed benchmarks are statistically different enough from that for the market capitalization-weighted EM benchmark based on the p-values calculated (see O. Ledoit and M. Wolf, “Robust Performance Hypothesis Testing with Sharpe Ratios,” *Journal of Empirical Finance*, 15, 850–859, 2008). Lower p-value suggests the two Sharpe ratios are different from each other.

Figure 8A: Cumulative Total Returns
(unhedged JPY returns; February 2002 – January 2017)



Note: Past performance is not a guarantee or a reliable indicator of future results. Chart is provided for illustrative purposes only and does not contain actual results or characteristics of any PGIM-managed portfolio.
Source: PGIM IAS, Datastream, MSCI, and S&P Capital IQ

Figure 8B: Cumulative Total Returns Ratio
Alternative Benchmarks Relative to MSCI EM Index
(unhedged JPY returns; February 2002 – January 2017)



Note: Past performance is not a guarantee or a reliable indicator of future results. Chart is provided for illustrative purposes only and does not contain actual results or characteristics of any PGIM-managed portfolio.
Source: PGIM IAS, Datastream, MSCI, and S&P Capital IQ

During the strong EM rally beginning in 2005, all the styles (except momentum) could not keep up with the overall market index. The style-based benchmark underperformed relative to the MSCI EM Index for over seven years from May 2004 to May 2011. From the October 2008 relative underperformance trough, it took almost three years for the alternative style benchmark to regain its relative advantage. Clearly the style-based approach should be adopted by investors with a longer investment horizon.

On relative basis, the country-based alternative benchmark steadily outperformed the MSCI EM index and its longest period of relative underperformance was for only two years, August 2004 to July 2006.

Overall, the country-based and style-based alternative benchmarks, based on their long-term performance, are worthy of consideration by Japanese investors.

Alternative benchmark performance in various economic scenarios

We next evaluate the performance of the three alternative EM benchmarks in a handful of economic scenarios likely to be of interest to a Japanese investor. The scenarios include: macro events like recession and expansions; market events such as commodity and currency price movements; the strength of money flows into EM equity markets; and changes in economic uncertainty as implied by world news.

Figure 9 shows that EM equities were an excellent diversifier to DM ex-Japan and Japan equities in some scenarios such as strong yen or high economic uncertainty. In the US and Japan recession scenarios – which can be categorized as “risk off” events, the style-based alternative benchmark did significantly better than other EM benchmarks. In fact, for the US recession scenario, country-based and style-based benchmarks also outperformed DM ex-Japan equities. In more “risk on” scenarios, both country-based and style-based benchmarks also did better. This analysis supports consideration of country-, sector- or style-based alternative benchmarks by Japanese investors.

Figure 9: Benchmark Performance in Various Economic Scenarios
(unhedged JPY returns; February 2002 – January 2017)

	Benchmarks (Equal Risk Contribution)			Benchmarks (cap-weighted)		
	EM Countries	EM Sectors	EM Styles	EM Equities	Japan Equities	DM ex-Japan Equities
Weak Yen	20.7%	19.7%	21.3%	18.2%	20.3%	18.0%
Strong Yen	5.2%	2.8%	6.1%	2.2%	-6.0%	-2.7%
High Uncertainty	4.5%	2.9%	4.2%	1.5%	-7.3%	-1.8%
Low Uncertainty	17.8%	15.7%	19.7%	15.1%	15.5%	12.4%
Weak Oil	6.6%	6.3%	7.9%	3.5%	5.4%	3.1%
Strong Oil	14.4%	11.6%	15.0%	11.8%	4.0%	7.2%
US Recession	-14.9%	-16.1%	-12.1%	-19.2%	-10.3%	-15.9%
US Expansion	26.5%	24.2%	25.9%	24.8%	12.1%	17.5%
JP Recession	-6.5%	-6.1%	-5.2%	-8.3%	-4.0%	0.4%
JP Expansion	26.2%	22.3%	26.5%	22.4%	10.9%	9.6%
Weak EM Flows	-11.8%	-12.7%	-10.3%	-14.8%	-6.6%	-9.8%
Strong EM Flows	36.4%	33.4%	36.2%	34.0%	15.0%	21.1%

Note: Determination of 'strong' or 'weak' is based on if the value is above or below its 12-month moving average. In case of JPY/USD if the currency is above 12 month moving average, we label the months as 'Weak Yen'. We use the World Economic Policy Uncertainty index from www.economicpolicyuncertainty.com. US and Japan Recession are sourced from FRED (Federal Reserve Bank of St. Louis) based on OECD Composite Leading Indicators following peak – to – trough marked as recession. The Strong EM flows represent higher annual flows in EM than previous year (Source: IIF). Past performance is not a guarantee or a reliable indicator of future results. Chart is provided for illustrative purposes only and does not contain actual results or characteristics of any PGIM-managed portfolio.

Source: PGIM IAS, Datastream, MSCI, and S&P Capital IQ

Systematic risk in the alternative benchmarks

We have showed the risk-adjusted performance of these three alternative EM benchmarks, but what kind of systematic risk do they bear? We can measure that by looking at the systematic exposure (beta) of these benchmarks to the equity exposure currently held by many Japanese institutional investors.

To determine which alternative benchmark had the lowest systematic exposure to a Japanese investor's current equity allocation we regressed each EM benchmark against a 50% DM ex-Japan – 50% Japan market capitalization-weighted equity index. The regression results (Figure 10) show reduced exposure (beta) to the market for the three alternative EM benchmarks and for the traditional EM index. The sector-based benchmark had the lowest beta to the market. The annualized regression alpha for the MSCI EM Index was 3.5%, but the three alternative benchmarks had even higher alphas. Country-based and style-based benchmarks have comparable alphas (6.2% and 6.0%, respectively).

Figure 10: Systematic Market Exposures
(February 2002 – January 2017)

	Relative to 50% DM-ex JP and 50% JP Equities			
	EM Countries	EM Sectors	EM Styles	EM Equities
Beta	1.12	1.09	1.10	1.16
Alpha	6.2%	4.5%	6.0%	3.5%
R-Squared	0.74	0.74	0.73	0.74

Note: EM Country, Sector and Style benchmarks are ERC weighted and EM Equities are market capitalization weighted. The transaction costs are estimated using average turnover, bid-ask spreads and taxes (Appendix A4). We estimate transaction costs to be 1%/y for EM Styles. Chart is provided for illustrative purposes only and does not contain actual results or characteristics of any PGIM-managed portfolio.

Source: PGIM IAS, Datastream, MSCI, and S&P Capital IQ

Alternative EM benchmark in Japanese investor portfolios

To keep the allocation to yen and equities unchanged, we assume EM allocation is made by reducing the allocation to DM ex-Japan from the sample Japanese portfolio. To assess relative risk-adjusted returns we allocate 5% from DM ex-Japan equities to EM equities (*i.e.*, 10% of the overall equity allocation). We also incorporate transactions costs.¹⁹ We find that using any of the four EM benchmarks (*i.e.*, the three alternative ERC benchmarks and the traditional EM benchmark), both risk and return increased (Figure 11). The best performance improvement came from best using the country-based alternative benchmark (an improvement of 31bp, 4.81% vs. 4.50%).

We conducted difference in means test to compare the two Sharpe ratios, one for the portfolio with no EM equity allocation and the other for the portfolio with one of the four EM benchmark equity allocations. A lower p-value for the test would suggest that the Sharpe ratios are indeed different, and the investor may wish to consider the allocation choice with the highest Sharpe ratio. Figure 11 indicates that a Japanese investor may wish to consider either the country- or style- alternative EM benchmarks as superior alternatives. For EW alternative benchmarks, the risk increases slightly without any improvement in the Sharpe ratios (not shown).

To summarize, the three alternative benchmarks (using ERC), after accounting for transaction costs, perform better than the traditional EM index from the Japanese investor's perspective. Not only did the three alternative benchmarks have superior returns when compared with the traditional EM index, but all three improved the sample Japanese portfolio's Sharpe ratio, thereby justifying the consideration of adopting an alternative EM benchmark.

¹⁹ At the portfolio level, we ignore the transaction costs from monthly rebalancing of the alternative benchmarks back to ERC weights as it is negligible. For example, for the country-based ERC alternative benchmark 33bp (avg. transaction cost) × 5% (portfolio weight) × 75% (average annual turnover), adds to 1bp/y at the overall portfolio level. Besides, the country and sector groups used to construct the country-based and sector-based alternative EM benchmark are market capitalization-weighted and therefore they incur negligible transaction costs as well. However, this is not the case for the underlying country-level style groups used to form a EM style group. From month-to-month there can be changes in the set of stocks forming the top quintile of a country's style group, which necessitates turnover. In Appendix A4, we estimate turnover for each of the country-level style groups. Due to high turnover in the country-level style groups we estimate the annual two-way transaction cost to be 1%/y for the EM style-based benchmark; at the portfolio level this adds up to 5bp/y for a 5% EM allocation. While a benchmark rarely includes transaction costs, a portfolio that tracks a benchmark does incur this cost. To be conservative, we assume that a portfolio that adopts a style-based alternative benchmark should account for the likely higher transactions costs. Consequently, to facilitate comparison across the various benchmarks, we report returns for the style-based alternative benchmark after accounting for likely transaction costs.

Figure 11: Sample Portfolio Allocation for a Japanese Investor – Performance Metrics
EM Equities at 5% Allocation
(unhedged JPY returns; February 2002 – January 2017)

	EM Equities at 5% allocation Plan	Plan with EM Equity	Plan with EM Countries	Plan with EM Sectors	Plan with EM Styles
Returns (Annualized)	4.50%	4.69%	4.81%	4.72%	4.80%
Risk (Annualized)	9.59%	9.71%	9.68%	9.65%	9.66%
Sharpe Ratio (SR)	0.45	0.46	0.48	0.47	0.48
p-value (SR diff)		0.45	0.14	0.26	0.17

Note: Country, Sector and Style EM benchmarks are ERC weighted. We ignore the transaction costs from monthly rebalancing of the benchmarks to ERC weights. However, performance metrics are reported after deducting estimated transaction costs for country-level style groups, which unlike country or sector market cap-weighted groups, have higher turnover (Appendix A4). The transaction costs are estimated using average turnover, bid-ask spreads and taxes. We estimated the cost to be 1%/y for EM Styles. Past performance is not a guarantee or a reliable indicator of future results. Chart is provided for illustrative purposes only and does not contain actual results or characteristics of any PGIM-managed portfolio.

Source: PGIM IAS, Datastream, MSCI, and S&P Capital IQ

Conclusion

Japanese investors maybe considering adding EM equities to their portfolios. How might a Japanese investor select, or design, an EM benchmark? We have shown that a traditional market capitalization-weighted EM index has unwanted risk concentrations, both at country-level and sector-level, which may not be desirable for the Japanese investor. We propose “country-based”, “sector-based” or “style-based” alternative EM benchmarks which may be better suited to a Japanese investor’s circumstances. When constructing these benchmarks, we also use alternative weighting schemes – ERC and equal-weight. There are many other potential exposure weighting schemes, and some may work better than others depending on the economic regime.

For Japanese investors, adding EM equities in lieu of DM ex-Japan equities increases portfolio risk, but it came with a two-fold benefit: portfolio diversification and performance enhancement. Japanese investors may find limited improvement in their overall portfolio’s risk-adjusted returns using a traditional market capitalization EM benchmark to serve as their baseline allocation. Instead, Japanese investors may have done better using an EM alternative benchmark.

All the three alternative benchmarks had a significantly higher Sharpe ratio than the traditional EM index. While all three alternative benchmarks had better performance than the traditional EM index, the country-based and style-based alternative benchmarks performed better than the sector-based alternative benchmark. With the trend of improved EM equity data and coverage, and reduction of transaction costs, Japanese investors may wish to consider adopting an alternative EM benchmark for their new EM allocation.

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APPENDIX

Figure A1: Country-based and Style-based Benchmarks – Average Weights
(February 2002 – January 2017)

	Average Weights by Country											
	EM Styles	Brazil	China	India	Indonesia	Korea	Malaysia	Mexico	Russia	South Africa	Taiwan	Thailand
EM Countries		8%	9%	12%	7%	9%	10%	10%	6%	11%	10%	8%
EM Styles		8%	10%	11%	7%	9%	10%	10%	6%	10%	10%	8%
MOM	17%	8%	11%	10%	8%	9%	10%	9%	6%	10%	9%	8%
B/P	14%	9%	8%	12%	7%	8%	8%	11%	7%	12%	11%	7%
E/P	15%	9%	9%	10%	7%	8%	11%	11%	6%	11%	10%	8%
Low Vol	21%	7%	11%	12%	7%	9%	11%	10%	5%	9%	10%	10%
D/P	17%	7%	7%	12%	7%	10%	11%	10%	6%	10%	12%	9%
ROE	17%	7%	11%	12%	9%	8%	11%	10%	6%	11%	7%	7%
<i>MSCI EM Index</i>		<i>11%</i>	<i>15%</i>	<i>7%</i>	<i>2%</i>	<i>16%</i>	<i>4%</i>	<i>6%</i>	<i>6%</i>	<i>9%</i>	<i>12%</i>	<i>2%</i>

Note: We show monthly average of the weights by countries for country-based ERC EM benchmark and average weight by country and by styles for style-based ERC EM benchmark. The table also shows country weights for each of the six EM styles. MSCI EM Index average country weights add up to 90% of the MSCI EM Index weight as these are only the 11 of 23 countries we use in our country-based and style-based benchmark construction. Weights may not add to 100% due to rounding.

Source: PGIM IAS, S&P CapitalIQ, MSCI and Datastream

Figure A2: Sector-based Benchmark – Average Weights
(February 2002 – January 2017)

	Average Weights by Sector										
	Energy	Materials	Industrial	Consumer Discretionary	Consumer Staples	Health Care	Financials	IT	Telecom	Utilities	Real Estate
EM Sectors	8%	9%	9%	8%	11%	13%	8%	8%	9%	9%	8%
<i>MSCI EM Index</i>	<i>13%</i>	<i>13%</i>	<i>7%</i>	<i>7%</i>	<i>7%</i>	<i>2%</i>	<i>21%</i>	<i>15%</i>	<i>10%</i>	<i>4%</i>	<i>1%</i>

Note: We show monthly average of the weights by sectors for sector-based ERC EM benchmark. Weights may not add to 100% due to rounding.

Source: PGIM IAS, S&P CapitalIQ, MSCI and Datastream

Figure A3: Style Definitions

Methodology - At country level, top 20% of stocks (quintile 1) are picked from the equity universe based on below measures and then cap-weighted to form country-level style group.

Low Volatility - Low Vol – universe sorted based on volatility measure with quintile 1 having lowest volatility stocks
We use 12M Realized Price Volatility as volatility measure – The annualized volatility of monthly stock returns over the prior twelve months.

Book-to-Price (B/P) - Value – universe sorted based on book-to-price measure with quintile 1 having highest book-to-price stocks
Book to Price is the ratio of book value to market value of common equity. Most recently available book value is used.

Earnings-to-Price (E/P) - Value – universe sorted based on earnings-to-price measure with quintile 1 having highest earnings-to-price stocks
Earnings to Price is the ratio of trailing four-quarter earnings per share to current stock price.

Dividends-to-Price (D/P) - Value – universe sorted based on dividends-to-price measure with quintile 1 having highest dividends-to-price stocks
Dividends to Price is the ratio of trailing four-quarter dividends per share to current stock price.

Size - Size – universe sorted based on log market capitalization measure with quintile 1 having lowest size stocks
We use Log Market Cap as the size measure – The natural logarithm of market capitalization (month-end number of shares outstanding multiplied by month-end price per share)

Momentum (MOM) - Price Momentum – universe sorted based on momentum measure with quintile 1 having highest momentum stocks
We use 12M - 1M Price Momentum as the momentum measure – The cumulative percentage stock price change from twelve months ago to the current month, minus the percentage price change from the previous month to the current month

ROE - Capital Efficiency – universe sorted based on ROE measure with quintile 1 having highest ROE stocks
Return on Equity
The ratio of trailing four quarter income before extraordinary items available for common equity to average book value of common equity over the same period.

Figure A4: Average Rank Turnover and Cost Estimate for Style-based Approach (January 2012 – December 2016)

	Average Country-level EM Style Group Turnover											Combined Turnover	Cost
	Brazil	China	India	Indonesia	Korea	Malaysia	Mexico	Russia	South Africa	Taiwan	Thailand		
MOM	552%	565%	552%	561%	558%	473%	514%	568%	521%	495%	484%	530%	1.7%
B/P	247%	205%	192%	247%	268%	221%	169%	227%	250%	214%	219%	222%	0.7%
E/P	274%	250%	236%	341%	369%	303%	289%	322%	341%	348%	310%	307%	1.0%
Low Vol	251%	239%	220%	296%	197%	215%	307%	279%	305%	165%	204%	239%	0.8%
D/P	277%	257%	232%	426%	502%	264%	312%	346%	226%	325%	290%	311%	1.1%
ROE	161%	174%	131%	196%	205%	173%	133%	240%	132%	147%	204%	168%	0.6%
EM Styles												296%	1.0%
Bid-Ask	0.10%	0.10%	0.05%	0.60%	0.20%	0.25%	0.10%	0.05%	0.15%	0.20%	0.40%		
Tax and Fees	0.07%	0.13%	0.20%	0.10%	0.15%	0.13%	0.20%	0.20%	0.13%	0.15%	0.01%		

Note: We report average two-way annual turnover for each of the country-level styles. Based on the turnover and the transaction costs from Credit Suisse Global Equity Market Handbook, 2012, we compute “Cost” for the EM style groups and for the EM style-based benchmark (EM Styles). The transaction cost calculation is only a rough estimate as these costs would vary significantly based on market conditions. Chart is provided for illustrative purposes only and does not contain actual results or characteristics of any PGIM-managed portfolio.

Source: PGIM IAS, S&P CapitalIQ, MSCI and Datastream

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