Emerging Markets Equity: Structural Opportunities for Investors

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Introduction

Optimal portfolio structure is one of the most important decisions investors make. In this context, exposure to emerging markets equity poses a conundrum for investors. On one hand, seemingly outsized returns should present opportunities for investors. For example, in 2005 the MSCI Emerging Markets (EM) Index posted returns of 34.5%, versus 4.9% for the S&P 500 Index.

On the other hand, concern about the "true" nature of emerging markets equity risk has curbed some enthusiasm. Fears of so-called "contagion effects" (similar to the experience of the Russian crisis of 1998) still influence the thinking of many investors. In addition, many investors also seem to believe that the diversification benefits of emerging markets equity has diminished.

Our belief is that institutional investors should have more significant positions in the asset class than they presently do. The extraordinary performance of emerging markets equity could be interpreted as a by-product of a chronic mis-pricing, which investors can exploit by increasing their exposure to the asset class. We believe that investor fears about "contagion effects" and loss of diversification benefits are overstated.

In this paper we discuss the role of emerging markets equity in a portfolio. The paper begins with a series of observations about emerging markets equity returns, and discusses how these observations are consistent with extraordinary returns from emerging markets equity exposure. Next, we offer an alternative interpretation of contagion and changes in correlation. Finally, the paper addresses the practical aspects of increasing emerging markets equity exposure, and suggests that investors should increase their exposure to actively managed emerging markets equity.

I. Historically, Emerging Markets Have Performed Well

Typically, emerging markets equity performance is evaluated using index data—the MSCI Emerging Markets Index (MSCI EM) is the most commonly used source.

But, we need to put the returns of the MSCI in context. In our opinion, the ideal reference point represents a broad investment opportunity set and is consistent with modern principles of finance. For these reasons, we have chosen the MSCI All Country World Index (or MSCI ACWI). A summary of the key characteristics of both Indices are shown in *Exhibit 1*.

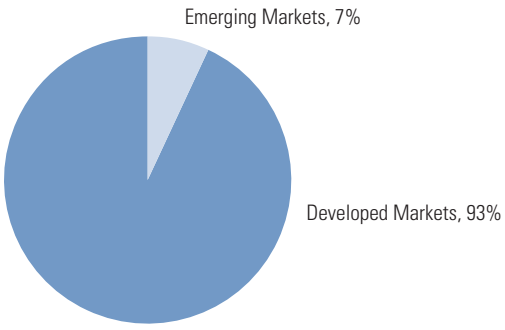
Exhibit 1 – Understanding the MSCI Emerging Markets Index and the MSCI All Country World Index

	MSCI Emerging Markets Index	MSCI All Country World Index
Description:	Free float-adjusted market capitalization index designed to track the performance in global emerging markets. Index returns calculated on a daily basis.	Free float-adjusted market capitalization index designed to track the performance in global developed and emerging markets. Index returns calculated on a daily basis.
Number of Countries:	26	49
Number of Securities:	828	2,623
Pricing:	The prices used to calculate the index are the official exchange closing prices.	The prices used to calculate the index are the official exchange closing prices.
Availability:	Local and other major currencies.	Local and other major currencies.

Source: GSAM, MSCI

The MSCI ACWI is a useful reference point because it represents the returns to a capitalization-weighted portfolio of global equity holdings. And, from a theoretical perspective, it is consistent with notions of capital market equilibrium. *Exhibit 2* shows the capitalization weights for the MSCI ACWI[1] and the allocations to emerging and developed equity markets. Here, emerging markets equity represents a relatively small percentage of available investment opportunities versus developed markets.

Exhibit 2 – Emerging markets equity represents only 7% of the MSCI ACWI



Source: Datastream

[1] Represents capitalization weights of the MSCI ACWI as of February 2006.

The fact that emerging markets equities have performed well relative to global equities is virtually incontrovertible, and illustrated in *Exhibit 3*. It shows that the cumulative returns on the MSCI EM outpace those of the MSCI ACWI. Indeed, the average annual return on the MSCI EM was 21.1% over this period, relative to 10.5% on the MSCI ACWI. Because we are interested in understanding *relative* equity market performance, we have considered each Index on a currency-hedged basis.[2]

Of course, it could be argued that emerging markets equity returns are not necessarily higher than developed equity market returns once we adjust for risk. This issue can be addressed through a theoretical asset pricing model like the Capital Asset Pricing Model or CAPM.[3] In the CAPM, all assets are priced according to their covariances with a market capitalization-weighted portfolio. Any returns in excess of those consistent with the market capitalization-weighted portfolio can be viewed as evidence of a potential pricing anomaly. These pricing anomalies, in turn, represent an opportunity for investors, if they can be skillfully identified and exploited.

Exhibit 3 – Returns of emerging markets equities have outpaced developed markets equities since 1993

Source: Datastream

One way to evaluate the return potential for emerging markets equity is to regress the returns on the MSCI EM on the returns of the MSCI ACWI. *Exhibit 4* summarizes the results of this regression.[4] Historically, we see that emerging markets equity returns have had a beta of 1.2 relative to the MSCI ACWI. This means that MSCI EM excess returns should be 120% of those of the MSCI ACWI, all else equal. For example, if the MSCI ACWI returned 10% above the risk-free rate, then the MSCI EM should return 12% above the risk-free rate. Indeed, if CAPM pricing held, all the variation in the returns to emerging markets equities could be accounted for by returns to global equities.

But, CAPM pricing does not hold. This is further evidenced in *Exhibit 4*. Here, the regression alpha in *Exhibit 4* is simply the return to emerging markets equity in excess of the CAPM return. This figure, 8.9%, is interpreted as a premium over the CAPM return. From January 1993 to January 2006, the MSCI EM and the MSCI ACWI returned 20.7% and 10.0% respectively on an annualized basis. The MSCI EM return can be decomposed as (1.2) x 10.0% plus 8.9%.

[2] Exhibit 3 considers the basket of local market returns without the impact of currency, while the capitalization weights in Exhibit 2 contain both local market values and currency effects. In our experience, investors rarely, if ever, hedge the currency risk associated with emerging markets equity investing.

[3] A model that describes the relationship between risk and expected return, often used in the pricing of securities considered to have more risk.

[4] The regression period is Jan. 1993 - Jan. 2006. The period was chosen using the Chow test for structural breaks.

Exhibit 4 – Historically, emerging markets equities have offered a premium over global equities

	Alpha (Annualized)	Beta
Coefficient	8.9%	1.18
t-statistic	2.20	14.14
R^2	0.56	

Source: GSAM

The simple CAPM test results are interesting because they help to do two things: (1) frame the portfolio choice questions that investors face and (2) identify possible areas for investor concern. Let's look at each of these in turn.

The portfolio choice question is simple: should investors overweight emerging markets equity relative to its capitalization-weight-exposure in the MSCI ACWI? If the premium that we've identified is sustainable and correctly identified, then the answer to this question is clearly yes. This is because the decision to hold emerging markets equity at the Index capitalization weights would result in the investor giving up premium.

Setting aside the issue of sustainability of the premium, the mere identification of a premium is important because it focuses our discussion on risk-related issues. For example, it may be that what we've identified is not a premium but rather, we've simply underestimated the "true" beta. If the "true" beta were higher, then the diversification benefits from emerging markets equity would decline and the fraction of total emerging markets equity performance explainable by market returns would increase. Later in this paper, we will argue that the diversification benefits from the asset class have not declined.

Now, let's address the possible areas for investor concern. One of the most widely-held concerns about emerging markets equity is the issue of contagion. It could be argued that the premium we think we've identified is really just a return to a risk factor that is not fully accounted for in CAPM pricing, like "contagion risk." However, we do not believe this is the case and, in subsequent sections, we will show that contagion effects have subsided.

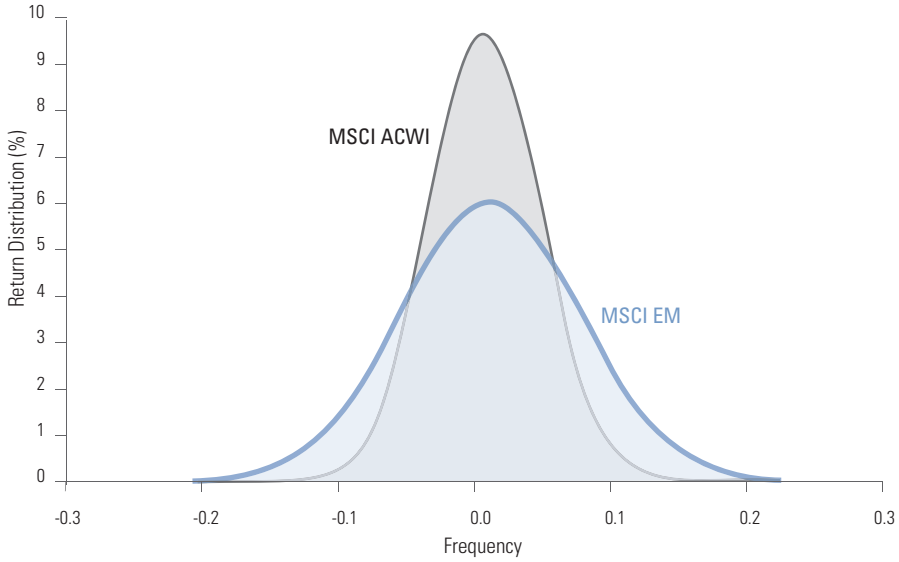
II. Non-Normal Returns Can Spell Opportunities for Investors

A useful starting point for understanding the risk characteristics of emerging markets equity returns is to look at simple summary statistics. We do this in *Exhibit 5*, which compares the probability distributions of MSCI EM returns with those of the MSCI ACWI. To facilitate discussion of the risk characteristics, the distributions have been normalized to a common return of zero.

As shown in the distribution depicted in *Exhibit 5*, emerging markets equity returns are characterized by "fat tails." Or, more specifically, relative to a normal distribution, emerging markets equities are more likely to have both abnormally high and abnormally low returns versus global equities. Incidentally, this same point can be made by looking at a "quantiled" plot of returns. Please see Appendix D for an illustration.

Exhibit 5 – Emerging markets equities offer a greater return potential than global equities

Comparison of probability density functions –
MSCI All Country World Index vs. MSCI Emerging Markets Index (Unhedged to USD)



Source: GSAM

The fact that emerging market returns are not normally distributed is well documented and uncontroversial. But, from an investment perspective, what does non-normality of returns mean? Is the non-normality of emerging markets equity returns necessarily a bad thing?

Simply stated, non-normality implies that market anomalies could be the result of market inefficiencies. Ineffiencies can exist for many reasons including: language and cultural barriers, lack of transparency, dissemination of information, and analyst coverage, to name a few. But regardless of why they exist, as shown in *Exhibit 5*, by exploiting these inefficiencies, emerging markets equities, with their "fat tail" distributions, offer more opportunities to add value than developed markets equities.[5]

As discussed earlier in Section I, we could interpret the observed premium as either compensation for risks such as "contagion effects" or as a result of a mis-specified beta. These issues are addressed in the following section.

[5] One interpretation of the non-normality of returns is that investors face an incomplete market. Securities markets are said to be complete when there are securities that span the set of all possible states of the world: the securities market is effectively operating as a large insurance market. Under this interpretation, there are states of the world in emerging markets equity for which securities do not exist. In our view, this is not necessarily a bad thing: opportunities exist for investors as new securities and/or strategies are developed to help complete markets. Under this interpretation, the premium we have observed in emerging markets equity returns would be expected to persist as long as we do continue to have incomplete markets.

III. Diversification Benefits Remain Intact

Analysis of whether the beta for emerging markets equity is too low is equivalent to an analysis of whether we expect emerging markets equity to continue to offer diversification benefits. A simple way to start this analysis is to look at a time series of rolling correlations for the MSCI EM against the global developed equity markets (i.e., MSCI ACWI less MSCI EM).

Exhibit 6 presents a rolling time series of the correlation between the emerging markets and developed markets equity returns. The graph covers the time period from January 1991 to January 2006, with each correlation estimated over the preceding 36 months of data. From Exhibit 6, we see that the long-term average correlation is around 0.6, with some time variation around this figure from February 1988 to January 2006. Thus, we can conclude that there are indeed diversification benefits, but that those benefits may be time dependent.

Exhibit 6 – Time variations may determine diversification benefits of emerging markets equity

Correlation between emerging and developed equity markets (rolling 36 months)

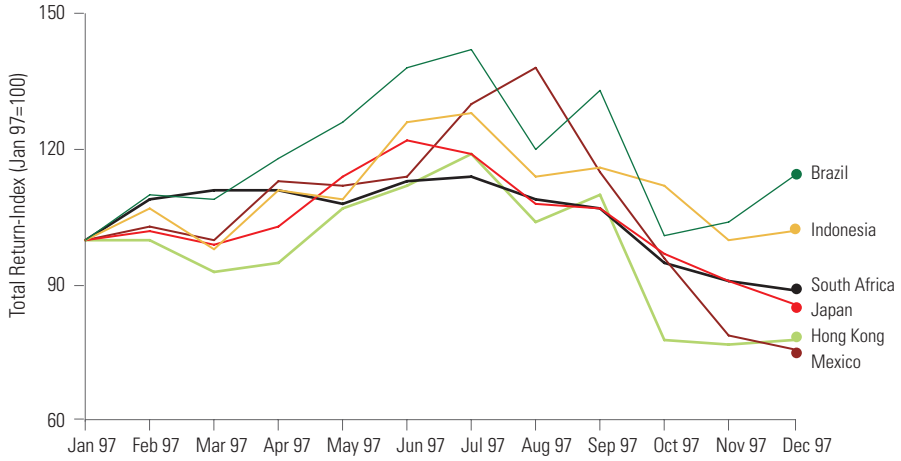
Source: GSAM

Our correlation analysis is an important part of understanding emerging markets equity risk. This analysis, however, focuses on the diversification benefits of a *basket* of emerging equity markets (as represented by the MSCI EM) versus a *basket* of developed equity markets (represented by the MSCI World, a free float-adjusted market capitalization index that is designed to measure global developed market equity performance.) That is why this analysis abstracts from any statements about the co-movement of emerging equity market returns amongst themselves. In particular, the correlation analysis of this section does not address the existence of so-called "contagion effects" which we cover in the next section.

IV. Contagion Fears Are Overblown

Broadly speaking, these spill-over effects, or fears of so-called "contagion," refer to the following phenomenon: a financial crisis hits one economy and the shock is propagated to other economies. Some of the most notorious examples include the Mexican "tequila" crisis in 1994-95, the Asian crisis of 1997, the Russian crisis of 1998, Brazil in 1999 and Argentina in 2002. While the economic damage of such episodes can be severe, these events are most often characterized by abnormally low returns, significant increases in volatility and apparent increases in correlation across markets. *Exhibit 7* illustrates some of the effects usually associated with contagion by plotting index levels on selected equity markets in the period covering the Asian crisis of 1997. This exhibit illustrates the idea that contagion is associated with increases in correlation among emerging equity markets during periods of financial stress. Thus, it is worthwhile to study whether or not these types of changes in correlation are present.

Exhibit 7 – The concern about contagion in emerging markets is overstated



Notes: Figure depicts (MSCI) stock market indices during 1997, the year of the onset of the Asian financial crisis. Indices are rebased to equal 100 in January 1997 for comparability and are transformed to US dollar values.
Source: Datastream.

To study changes in correlation during periods of financial stress more fully, we define contagion as: *that correlation in excess of what can be explained by underlying factors following a shock to those factors.*

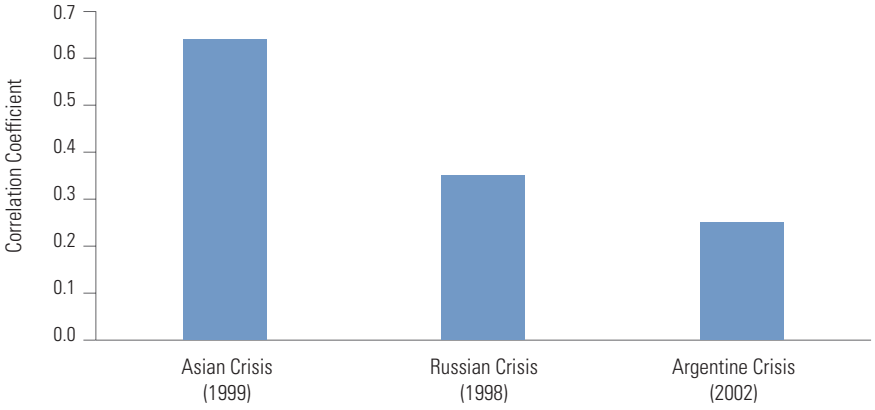
The basic idea our definition seeks to convey is that individual equity markets will vary in their exposure to a set of common factors. In this setup, the correlation between the returns of two markets reflects both the common factor exposures, and exposures that are idiosyncratic to each market. Clearly, if the factor exposures change, the correlation between the two markets will also change. However, the correlation between the two markets could also increase simply because the volatility of the common factors has increased.

In this structure, the analytic question is then: are changes in correlation between two markets due to changes in factor volatility or changes in factor exposure? We would argue that contagion is meant to refer to changes in factor exposure. As extreme market events occur, the structure of financial markets change and the correlation of returns increases. So, to measure contagion we can look at bias-adjusted estimates of correlation during periods of financial stress, with the bias-adjustment meant to correct for increases in common factor volatility.

Exhibit 8 shows the average bias-adjusted correlation across the 26 emerging equity markets showing in Exhibit 9 for three periods of financial stress: the Asian crisis of 1997, the Russian crisis of 1998 and the Argentine crisis of 2002. The figures in the chart in Exhibit 8 show the average bias-adjusted correlations during the periods before, during and after the crisis.

Exhibit 8 – Evidence of contagion effects is declining

Average bias-adjusted correlations indicate a decline in contagion effects



Source: GSAM

As the figures in *Exhibit 8* illustrate, some evidence of contagion effects existed during the Asian crisis of 1997. However, contagion was much less evident during both the Russian and the Argentine crises. (Please see Appendix B and C for more detail on both the estimation of bias-adjusted correlations and more data on the actual correlation levels themselves.)

The figures in *Exhibit 8* suggest that contagion effects in emerging markets equity returns are declining. Although it is dangerous to draw too many conclusions from such a small sample, a partial list of explanations could include more integrated financial markets and more clarity in regulatory structures in some emerging markets. In this context, the role of active investment management is to determine the pace of change in emerging equity markets and position portfolios accordingly.

V. Optimal Portfolio Structures Should Reflect Emerging Market Premia and Active Management

Optimal portfolio structures should reflect views about the returns and risks associated with different asset classes and active strategies. In this paper, we have argued that emerging equity markets are characterized by a "structural premium," i.e., a return in excess of the return associated with a CAPM equilibrium.

We also believe that emerging equity markets offer opportunities to add value through active management. An economic interpretation would be that active management adds value through understanding the pace of integration of emerging equity markets into the global economy. Economically, the pace of integration is reflected, for instance, in the pace of change in regulatory frameworks, or the level of analyst coverage. These changes, in turn, are reflected in financial prices through factors such as valuation and momentum effects and security mis-valuations. The role of active management is to use such financial signals to add value for investors. It is our belief (as discussed in our paper, "Active Risk Budgeting in Action: Evaluating Historical Characteristics of Traditional Managers," Oct. 2003) that the risk-adjusted active performance for emerging markets equity managers often exceeds that of other types of strategies.

One mechanism that we can use to explore the pace of integration is to look at the constituents of the MSCI EM and decompose their returns into idiosyncratic and common factors. *Exhibit 9* shows this decomposition, where we've used as the common factors the S&P 500, monthly changes in oil prices and monthly changes in the dollar/yen and dollar/euro exchange rates.[6] The exhibit shows the contribution of both the common factors and the idiosyncratic component to each country's return during stable and volatile market environments. Around 25% of the variation in stock market returns during stable periods can be explained by common factors. During periods of market volatility, this figure increases, but only to about 35% on average. The exhibit also suggests that idiosyncratic factors cannot easily be clustered regionally. These results are consistent with the findings that indicate that contagion effects are dissipating.

Exhibit 9 – Common versus idiosyncratic factors in emerging markets equity returns

Country	Tranquil Periods Idiosyncratic	Tranquil Periods Common	Volatile Periods Idiosyncratic	Volatile Periods Common	Decline in Idiosyncratic Component During Volatile Periods
Argentina	74.1	25.9	70.2	29.8	3.9
Brazil	78.0	22.0	65.8	34.2	12.2
Chile	72.1	27.9	62.3	37.7	9.8
China	81.4	18.6	79.5	20.5	1.9
Colombia	75.4	24.6	61.6	38.4	13.8
Czech Republic	70.1	29.9	58.0	42.0	12.1
Egypt	85.4	14.6	66.6	33.4	18.8
Hungary	66.8	33.2	62.5	37.5	4.3
India	82.7	17.3	75.4	24.6	7.3
Indonesia	65.4	34.6	58.9	41.1	6.5
Israel	73.5	26.5	63.3	36.7	10.2
Jordan	84.6	15.4	76.2	23.8	8.4
Korea	76.4	23.6	64.8	35.2	11.6
Malaysia	83.4	16.6	72.1	27.9	11.3
Mexico	71.2	28.8	66.8	33.2	4.4
Morocco	63.7	36.3	63.3	36.7	0.4
Pakistan	75.4	24.6	68.7	31.3	6.7
Peru	77.9	22.1	65.4	34.6	12.5
Philippines	72.3	27.7	65.3	34.7	7.0
Poland	66.5	33.5	53.7	46.3	12.8
Russia	70.0	30.0	58.4	41.6	11.6
South Africa	72.2	27.8	72.0	28.0	0.2
Taiwan	78.4	21.6	61.8	38.2	16.6
Thailand	70.4	29.6	61.4	38.6	9.0
Turkey	79.2	20.8	62.9	37.1	16.3
Venezuela	71.4	28.6	66.0	34.0	5.4
Average	**74.5**	**25.5**	**65.5**	**34.5**	**9.0**

Notes: Decompositions are based on a latent factor model – for details see the Appendix. The common factor component is proxied by S&P 500 returns, monthly changes in oil prices and monthly changes in a trade-weighted average of the yen-dollar and euro/dollar exchange rates. Sample for estimation varied but in most cases started from 1980 (January) to 2005 (April). Source: GSAM estimates. We only report results for country returns included in the MSCI EMF index. Results for the broader IFC composite index are available upon request.

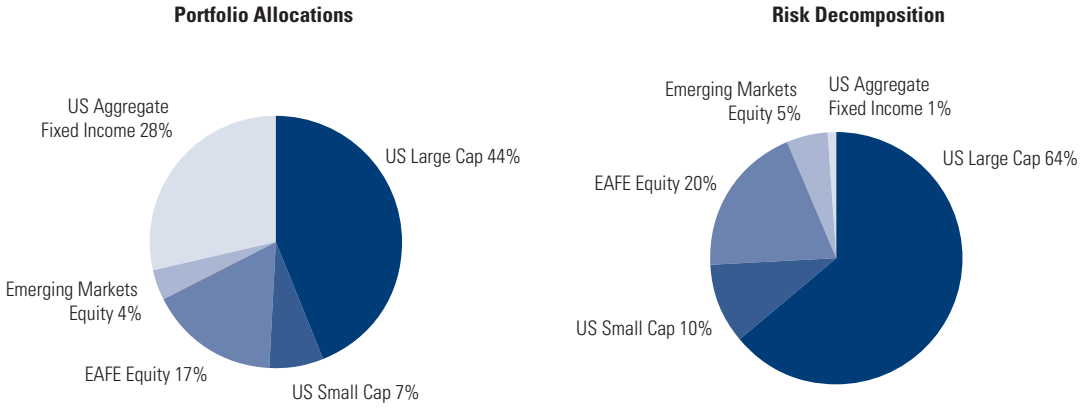
Source of data: Morgan Stanley Capital International (MSCI) database, IMF CD-ROM, Goldman, Sachs & Co.

[6] The inclusion of factors such as exchange rates and oil prices increases the explanatory power somewhat, but not significantly.

The intention of this paper is not to provide point estimates of the returns available to investors through active management, but rather, to discuss how an optimal portfolio can be structured. We believe that optimal investment policy should have more significant exposures to emerging equity markets, and will use a portfolio optimization to illustrate the potential benefits. As a starting point, it is important to remember that the key ingredients in any optimization are target levels for portfolio return and risk, return and risk assumptions for the asset classes and strategies under consideration, and constraints.

To help us set a target return level, we use the characteristics of a portfolio representing a stylized version of a typical US pension investor as a reference point. As shown in *Exhibit 10*, the portfolio has a "home bias" in the equity exposure,[7] a small allocation to emerging markets equity and an allocation to US fixed income.

Exhibit 10 – Allocations and risk decomposition for representative portfolio



Source: GSAM

The impact on portfolio characteristics such as risk and return can be approached through the use of a portfolio optimizer. In this setting, the optimal portfolio allocations will depend on the assumptions we make about the expected return to emerging markets equity. More precisely, the optimal allocations will depend upon the emerging markets equity premium relative to CAPM returns.

Recall that in our analysis of historical emerging markets equity returns this premium was about 8.9% (see also page 3). In our view, this figure should be treated as indicative of a premium, but not as the definitive premium. Global capital markets are, in all likelihood, more integrated than in the sample period for our historical analysis. Thus, we believe that it is important to shrink the premium towards zero (i.e. shrink the emerging market equity return towards the CAPM return). To illustrate our points, we will use premia of 75 bps and 150 bps versus the CAPM returns.

Exhibit 11 shows the results of three optimizations. Specifically, the exhibit shows the allocations and risk/return characteristics under three alternative assumptions about the emerging markets equity premium. In the first, we simply made use of the standard GSAM assumptions,[8] while in the second, we assumed that emerging markets equities have a structural premium of 75 basis points above the CAPM return. The final optimal portfolio assumes that the structural premium for emerging markets equity is 150 basis points above the CAPM return. For ease of comparison, the *Exhibit* also includes the original portfolio.

[7] A home bias occurs when the portfolio allocations are overweight domestic markets relative to the global capitalization weights.

[8] Calculated using the standard GSAM assumptions about risk and return of asset class and assuming a constant information ratio across strategies. (Please see also Appendix A.)

All portfolios were optimized to achieve the same expected return as the representative portfolio. The optimizations were further constrained to exclude alpha portability.[9] There were two reasons for this constraint. First, and most broadly, we wanted to isolate the impact of adding emerging markets equity, and allowing for general alpha portability makes it more difficult to interpret the results. Second, and more specifically, because index futures do not exist for emerging markets equity, alpha portability can be expensive.

Exhibit 11 – Allocations, risk and return for the four portfolios

	Typical Portfolio	Optimized with no premia	Optimized with 75 bps of premia	Optimized with 150 bps of premia
Allocations				
US Large Cap	44%	23%	21%	19%
US Small Cap	7	8	4	1
EAFE Equity	17	31	25	19
Emerging Equity	4	8	16	21
US Aggregate Fixed Income	28	30	34	40
Total	100	100	100	100
Risk Decomposition				
US Large Cap	64%	30%	28%	25%
US Small Cap	10	13	8	2
EAFE Equity	20	42	33	25
Emerging Equity	5	14	30	46
US Aggregate Fixed Income	1	1	1	2
Total	100	100	100	100
Expected Return	7.5%	7.5%	7.5%	7.5%
Volatility	10.5%	10.3%	9.9%	9.5%
Sharpe Ratio	0.28	0.29	0.30	0.32

Source: GSAM

Exhibit 11 shows that the allocation to emerging market equity increases as the expected premium increases. Even when we assume that there is no premium to the CAPM return, the optimal portfolio holds more emerging market equity to reduce to the home bias in the typical portfolio. When a positive premium is assumed, the emerging market equity holdings increase even more. As the emerging markets equity holdings increase, portfolio volatility declines. Furthermore, total portfolio risk becomes more broadly diversified as well. Consequently, portfolio efficiency (as measured by the Sharpe Ratio) improves as emerging markets equity holdings increase.

[9] Alpha portability specifically refers to the process of using index futures to "port" the alpha from one asset class benchmark to another. More generally, alpha portability can be taken to refer to the ability of investors to gain exposure to an asset class synthetically (eg. futures or swaps).

VI. Conclusions

We believe that investors should constantly be on the lookout for opportunities to improve the efficiency of their portfolios, through either increasing expected returns at a constant risk or reducing risk level. This paper has argued that emerging markets equity can provide such opportunities.

- First, we believe that both historical performance and economic principles suggest the existence of a structural premium in emerging markets equity. Investors can gain access to this premium through increased allocations to emerging markets equity.
- Second, we believe that diversification benefits to emerging markets equity remain intact and that contagion effects have diminished. Consequently, increased allocations to emerging markets equity should not necessarily expose investors to significantly increased risks.
- Third, we believe that the continued existence of structural differences implies that active management can add value in emerging markets equity. Value added can come through strategies that exploit mis-pricings in individual securities or through country selection strategies that exploit factors such as valuation and momentum.

Optimal portfolio structure is the most significant choice that investors can make. We believe that, rather than posing a conundrum for investors, the evidence supports an increased allocation to actively managed emerging markets equity.

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References

Bekaert, G. (1995), Market integration and investment barriers in emerging equity markets, *World Bank Economic Review*, 9, 75-107.

Bekaert, G. and C.R. Harvey (2002), Research in emerging markets finance: Looking to the future, *Emerging Markets Review*, 3, 429-448.

Bekaert, G. and C.R. Harvey (2003), Emerging markets finance, *Journal of Empirical Finance*, 10, 3-55.

Bera, A.K. and C. Jarque (1981), An efficient large sample test for normality of observations and regression residuals, *Australian National University Working Papers in Economics and Econometrics*, 40.

Bhattacharya, U., H. Daouk, B. Jorgenson, and C.-H. Kehr, (2000), When an event is not an event: The curious case of an emerging market, *Journal of Financial Economics*, 55, 69-101.

Caporale, G.M., A. Cipollini and N. Spagnolo (2005), Testing for contagion: a conditional correlation analysis, *Journal of Empirical Finance*, 12, 476-489.

Fama, E.F. and K.H. French (1998), Value versus growth: International evidence, *Journal of Finance*, 53, 1975-2000.

Frashure, R. D. and C. H. Wang (2002), Emerging markets: Has their time finally come?, *Perspectives*, Vol. 3(4), OYCF.

Caporale, G.M., A. Cipollini and N. Spagnolo (2005), Testing for contagion: a conditional correlation analysis, *Journal of Empirical Finance*, 12, 476-489.

Forbes, K.J. and R. Rigobon (2002), No contagion, only interdependence: Measuring stock market comovements, *Journal of Finance*, 57, 2223-2261.

Goetzmann, W., L. Li and G. Rouwenhorst (2005), Longer term global market correlations, *Journal of Business*, to appear.

Harvey, C.R. (1995), Predictable risk and return in emerging markets, *Review of Financial Studies*, 8, 773-816.

Ladekarl, J. and S. Zervos (2004), Housekeeping and plumbing: the investability of emerging markets, *Emerging Markets Review*, 5, 267-294.

Li, K., A. Sarkar and Z. Wang (2003), Diversification benefits of emerging markets subject to portfolio constraints, *Journal of Empirical Finance*, 10, 57-80.

Michelfelder, R.A. and S. Pandya (2005), Volatility in stock returns: emerging and mature markets, *Managerial Finance*, 31, 66-86.

O'Neill, J., V. Malpass, R. Masih and D. Wilson (2002), Introducing the Global Leading Indicator, Global Economic Paper 74, *Goldman Sachs & Co.*, May.

Rigobon, R. (2003), On the measurement of the international propagation of shocks: is it stable?, *Journal of International Economics*, 61, 261-283.

Rouwenhorst, K.G. (1999), Local return factors and turnover in emerging stock markets, *Journal of Finance*, 54, 1439-1464.

van der Hart, J.V., E. Slagter and D. Van Dijk (2003), Stock selection strategies in emerging markets, *Journal of Empirical Finance*, 10, 107-134.

Warnock, F.E. and C. Cleaver (2002), Financial centers and the geography of capital flows, Working Paper, *Board of Governors of the Federal Reserve System*.

Appendix

Appendix A: Risk and return assumptions

	Expected Excess Passive Return	Alpha	Passive Volatility	Tracking Error
US Large Cap	3.5%	0.5%	15.2%	3.3%
US Small Cap	3.8%	0.9%	19.5%	6.3%
EAFE Equity	3.2%	0.8%	14.4%	5.3%
Emerging Equity	3.8%	1.1%	22.3%	7.3%
US Aggregate Fixed Income	0.1%	0.1%	4.3%	0.8%

Correlation assumptions	US Large Cap	US Small Cap	EAFE Equity	Emerging Markets Equity	US Aggregate Fixed Income
US Large Cap	1.00	0.79	0.78	0.56	0.00
US Small Cap	0.79	1.00	0.72	0.64	-0.05
EAFE Equity	0.78	0.72	1.00	0.67	-0.14
Emerging Equity	0.56	0.64	0.67	1.00	-0.09
US Aggregate Fixed Income	0.00	-0.05	-0.14	-0.09	1.00

Source: GSAM

Note: Active risk and return assumptions for generic investment managers reflect GSAM Global Investment Strategies estimates for active managers and are based on a historical study of the results of active management [see Active Risk Budgeting in Action: Evaluating Historical Characteristics of Traditional Managers by Yoel Lax, Tarun Tyagi, and Kurt Winkelmann (GSAM Strategic Research, October 2003)].

All numbers reflect GSAM Global Investment Strategies strategic assumptions as of a certain date. Strategic long-term assumptions are subject to high levels of uncertainty regarding future economic and market factors that may affect future performance. They are hypothetical indications of a broad range of possible returns. Please see additional disclosures.

Appendix B: Bias-adjusted correlation coefficients

Consider that returns in two markets are linked by the following linear relationship:

(1) $$y_t = \theta + \beta z_t + \varepsilon_t$$

Also assume that errors (ϵ_t) have a zero mean, and a fixed, finite variance, i.e. E (ϵ_t^2) = *f*, and that the correlation between the errors and returns is zero i.e. E[z_t, ϵ_t] =0. If we now consider two samples [one corresponding to the higher volatile (V) period and the other to the lower volatility or tranquil (T) period], and that the variance of z_t is lower in one group and higher in the other ($\sigma_{zz}^V > \sigma_{zz}^T$) then:

$$\beta^C = \frac{\sigma_{yz}^V}{\sigma_{zz}^V} = \frac{\sigma_{yz}^T}{\sigma_{zz}^T} = \beta^T$$

as $\sigma_{yz}^V > \sigma_{yz}^T$ and $\beta^V = \beta^T$ by definition. It follows from (1) that:

(2) $$\sigma_{yy} = \beta^2 \sigma_{zz} + \sigma_{\varepsilon\varepsilon}$$

and $\left(\frac{\sigma_{zz}}{\sigma_{yy}}\right)^V > \left(\frac{\sigma_{zz}}{\sigma_{yy}}\right)^T$. This result occurs since the residual variances is assumed constant over time implying that the increase in the variance of y between the two samples is less than

proportional to the increase in variance of z. Hence, if we substitute in for the definition of the correlation coefficient, we will arrive at the expression for ρ as:

$$\rho = \frac{\sigma_{zy}}{\sigma_z \sigma_y} = \beta \frac{\sigma_z}{\sigma_y}$$

but since $\left(\frac{\sigma_{zz}}{\sigma_{yy}}\right)^V > \left(\frac{\sigma_{zz}}{\sigma_{yy}}\right)^T$ it follows that $\rho^V > \rho^T$ i.e. the correlation coefficient between the two market returns will increase when the variance of one market increases even though the true relationship between the two markets is kept fixed. If we then use standard correlation coefficients to measure contagion, the result may be misleading as the coefficient will be distorted by the increase in the variance and conditional on the variance of one market.

A simple adjustment can then be made [see Forbes and Rigobon (2002)], writing the conditional correlation as:

$$(3) \qquad \rho^* = \rho\left[\frac{1+\delta}{1+\delta\rho^2}\right]^{0.5}$$

where ρ^* and ρ are the conditional and unconditional correlation coefficients, and $\delta = \frac{\sigma_{zz}^V}{\sigma_{yy}^T} - 1$.

We define the unconditional correlation coefficient as that correlation which underlies the cross-market relationship. Note that the conditional correlation coefficient is an increasing function of δ. This implies that the conditional coefficient will exceed the unconditional correlation coefficient during volatile periods, even though the unconditional correlation coefficient remains constant during the entire period. Since the conditional correlation coefficient will tend to increase following a crisis, the bias will tend to be persistent during these events.

The above discussion demonstrates that contagion could be posed as a question of whether the increase in a correlation is truly indicative of an increase in the unconditional correlation or purely market volatility. Towards arriving at a more appropriate measure, simple manipulation of (3) with the definition for δ leads to an approximation of the unconditional correlation coefficient as:

$$(4) \qquad \rho = \frac{\rho^*}{[1+\delta(1-(\rho^*)^2)]^{0.5}}$$

Note that the adjustment to the bias as it appears above is conditional on a few assumptions. These include that z_t itself is not endogenous i.e. there are no feedback influences from z to y, and that there is an absence of any exogenous or global shocks. These assumptions are necessary to identify the bias as other it is not possible to estimate the extent of the bias. However, despite these deficiencies, this adjustment is a fairly accurate estimate of the unconditional correlation.

Appendix C

As an application, to illustrate whether perceived periods of high correlation were due to contagion (given our definition) we use this bias-adjusted measure to compute the correlation amongst the country MSCI EM indices. Rather than report the results in a tabular format, we've developed color heat maps that translate the correlations according to its weight in terms of different shades of a color.

Exhibits C1, C2 & C3 display correlation color heat maps for three "high volatility" episodes: the Asian crisis, the period following the Russian currency devaluation, and the period following the Argentine debt and currency crisis. *The heat maps show significant evidence of contagion during the Asian crisis, but a distinct lack of contagion during the Argentine crisis.*[10] Using our bias adjusted correlation measure, since the last bouts of contagion in Asia and Russia during 1997/98, higher than expected volatility has diminished across emerging markets.

The significance of these results deserves some emphasis, especially for investors skeptical of exposing themselves to emerging markets equity.

Exhibit C1. Bias adjusted conditional correlation heat maps: Asian crisis (1997)

Notes: Color shades are based on Forbes-Rigobon bias-adjusted conditional correlations between each market. Bright orange indicates correlation in excess of 0.5, the next lighter shade between 0.4 and 0.5, etc down the lightest shade (near yellow) which is representative of a correlation lower than 0.05.

Source: GSAM estimates.

[10] For supporting evidence, see Caporale, Cipollini and Spagnolo (2005), Rigobon (2003), Bekaert, Harvey and Ng (2004).

Exhibit C2. Bias adjusted conditional correlation heat maps: Russian crisis (1998)

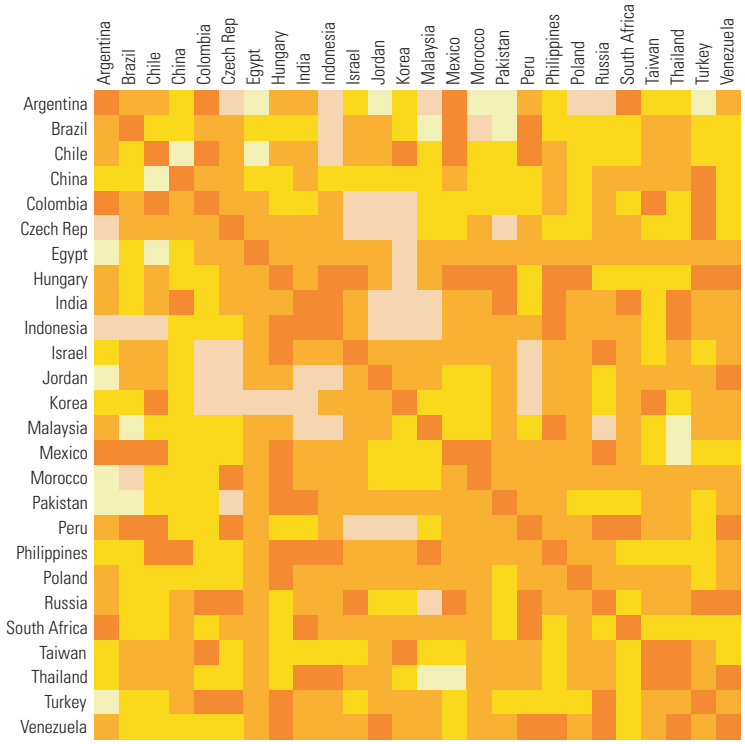
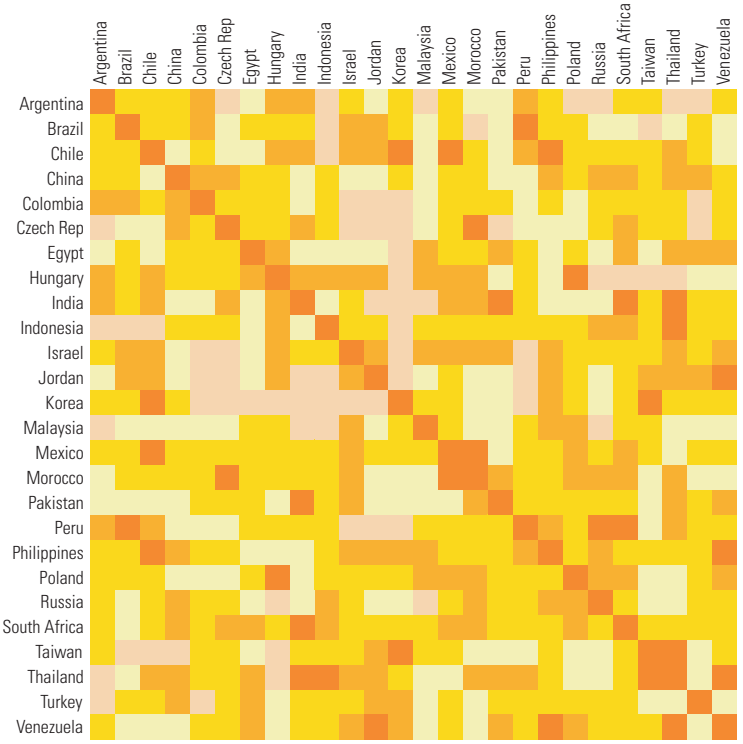


Exhibit C3. Bias adjusted conditional correlation heat maps: Argentine crisis (2001)

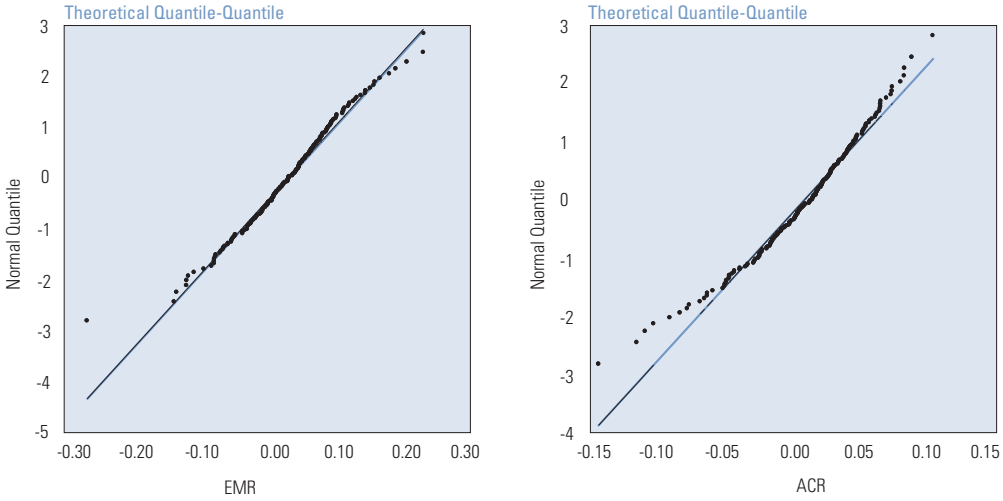


Notes: Color shades are based on Forbes-Rigobon bias-adjusted conditional correlations between each market. Bright orange indicates correlation in excess of 0.5, the next lighter shade between 0.4 and 0.5, etc down the lightest shade (near yellow) which is representative of a correlation lower than 0.05.

Source: GSAM estimates.

Appendix D. Quantile plots of emerging market and developed market equities

This "quantiled" plot of returns shows MSCI EM and MSCI ACWI returns and compares them with what returns would be if they followed a normal distribution. The plots clearly illustrate that there is a higher frequency of abnormally high and abnormally low returns for emerging markets equity than if returns were normally distributed.[11]



Source: GSAM

[11] A more formal test of normality, the Jacque-Bera test rejects normality in emerging market returns at the 99% level.

Disclosures

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