

# Emerging Markets: A Quantitative Perspective

*Contrary to popular belief, investing in emerging markets can actually reduce risk.*

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Soaring returns and sanguine prospects for economic growth have fueled a recent surge of interest in investing in “emerging” markets. Such markets have become more accessible to the global investor. Today, there are several country funds through which investors can participate in even “closed” or restricted markets. Investment will become easier as more countries dismantle barriers to direct foreign investment.

This article presents recent research into the emerging markets from a quantitative point of view. We have developed a model for understanding the forces that drive these markets, which affords some insights for global investors.

We find that while the emerging markets are more volatile than developed markets, they tend to be relatively uncorrelated with each other and with developed markets. Thus, contrary to popular belief, modest investment in the emerging markets leads to lower, rather than higher, portfolio risk for the global investor (see also Brown [1991]). Over the past five years, a global investor who put 20% in an emerging markets index fund would have reduced overall annual portfolio risk from 18.3% to 17.5% while increasing annual return from 12.6% to 14.7%.

One unexpected result of our research is that stock returns in the emerging markets tend to be more homogeneous than in developed markets, implying that a strong market force dominates industry and stock-specific influences. In short, when the market moves, everyone goes along for the ride.

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## WHICH MARKETS ARE CONSIDERED EMERGING MARKETS?

Just what is considered an emerging market is frequently a matter of opinion. Narrowly defined, an emerging market:

- Has securities that trade in a public market.
- Is not a developed market (as defined by countries covered within the Morgan Stanley Capital International Indices or Financial Times Indices).
- Is of interest to global institutional investors.
- Has a reliable source of data.

Exhibit 1 lists the countries that we consider to be emerging markets. They fall into three regions: Asia, Latin America, and Europe/Middle East/Africa. Singapore and Hong Kong fall into most definitions of developed markets, but are included here because they are closely related to the other Asian markets. Colombia, Pakistan, Nigeria, Jordan, and Zimbabwe are not of great institutional interest at present, although Pakistan has recently opened up its economy and financial markets to foreign investors and may well be next on the list of emerging markets to attract institutional interest. Finally, Japanese over-the-counter (OTC) stocks are included in the list because they tend to behave (and are perceived) differently from listed Japanese stocks.

## RETURNS AND RISKS OF EMERGING MARKETS

The casual reader of the financial press knows there have been stories of incredible returns (high and low) in the emerging markets. The Venezuelan stock market was up about 450% in U.S. dollar terms during 1990. On the other hand, the Taiwanese Stock Exchange Index started out 1990 at about the 5,000 level, went up to 12,600 during the first quarter and collapsed to near 2,500 during the third quarter. What makes this even more interesting is that the Taiwanese market is only the fourth or fifth most risky emerging market! During the first half of 1991, Latin American countries dominated all others; in U.S. dollar terms, they were up over 100%.

Overall, the emerging markets have done better than the developed markets over the past five years. During this period, the annualized total return to the

**EXHIBIT 1**  
Emerging Market Characteristics

Country	Annual Standard Deviation(%) <sup>a</sup>	Market Capitalization (Million U.S.\$) <sup>b</sup>	Turnover Ratio <sup>c</sup>
Argentina	108	\$ 5,195	26%
Brazil	74	\$ 25,112	34%
Chile	29	\$ 19,563	6%
Colombia	21	\$ 1,437	5%
Greece	56	\$ 17,010	26%
Hong Kong	31	\$ 83,600	42%
India	31	\$ 27,487	57%
Indonesia	39	\$ 7,998	49%
Japan OTC	20	\$ 89,575	NA
Jordan	19	\$ 2,166	20%
Korea	29	\$ 105,051	67%
Malaysia	30	\$ 58,738	22%
Mexico	56	\$ 39,070	37%
Nigeria	13	\$ 1,507	1%
Pakistan	10	\$ 3,169	8%
Philippines	46	\$ 8,940	21%
Portugal	61	\$ 9,838	18%
Singapore	33	\$ 55,000	59%
Taiwan	63	\$ 124,038	710%
Thailand	31	\$ 34,996	96%
Turkey	84	\$ 18,819	31%
Venezuela	44	\$ 9,332	27%
Zimbabwe	20	\$ 2,399	2%
Developed Markets			
Japan	22	\$ 2,917,679	54%
U.K.	19	\$ 867,599	32%
U.S.	17	\$ 3,072,303	58%

<sup>a</sup>Predicted annual standard deviation in %, based on BARRA's Emerging Markets Equity Model.

<sup>b</sup>As of June 30, 1991.

<sup>c</sup>This is defined as the ratio of annual trading volume (in U.S.\$) divided by beginning of year market capitalization (in U.S.\$), for 1990. Source: International Finance Corporation.

International Finance Corporations (IFC) Emerging Markets Composite Index was 19.7%, as compared to 12.6% for the Financial Times World Index.<sup>1</sup>

Exhibit 1 shows predicted risks according to BARRA's risk model of each of the emerging markets as well as for a few developed markets. Clearly, these

markets are extremely risky when compared with developed markets. Apart from the obvious risks (political instability, insider trading, etc.), there are a number of possible reasons why these markets are extremely volatile.

First, they tend to be fairly concentrated; that is, the larger stocks have a high proportion of the overall market capitalization. As a result, there are fewer opportunities for diversification, and returns to these large stocks dominate the overall market return. Second, unlike the developed markets, which tend to have forces that affect diverse sectors of the economy differently, the emerging markets tend to have a strong market-related force that affects all stocks within a market. This tends to accentuate volatility.

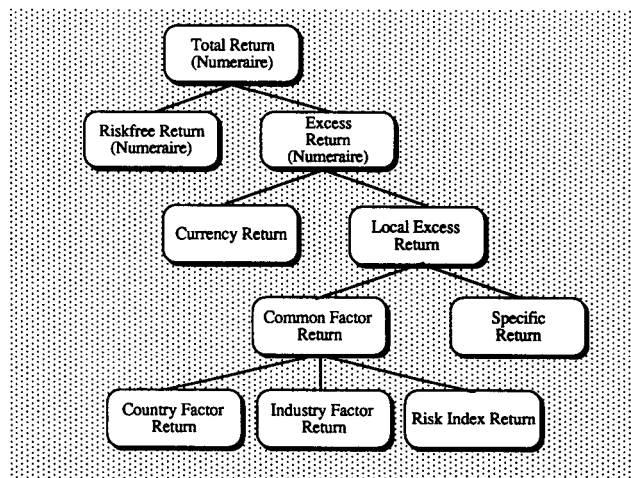
There are some apparent anomalies in these results. Pakistan, Jordan, Colombia, Nigeria, and Zimbabwe appear to have had relatively low risk over the last five years. We believe that these low figures reflect the lack of liquidity in these markets, so observed volatilities (and correlations with other markets) must be viewed with caution. When we look at the turnover ratio (value traded/market capitalization) for each market, we find that these five markets rank in the bottom six (shown in Exhibit 1). The real volatility is likely to be much higher, if and when these markets become more liquid.

When we look at the emerging markets as a group (the BARRA Emerging World Universe of about 4,000 stocks), we find that it has much lower volatility than most of the individual markets. This is because of low correlations between these markets. The diversification that these low correlations offer the global investor is one of the biggest benefits of investing in the emerging markets. The volatility (over the past five years) of the BARRA Emerging World Universe was about 28.0%, as compared to about 18.8% for the S&P 500 or 22.8% for the Morgan Stanley Europe, Australia, and the Far East (EAFE) index.

## A MODEL TO UNDERSTAND RISK AND RETURN

To analyze risk and return in these markets, we developed a multi-factor model similar to one previously constructed for the developed markets (see Grinold, Rudd, and Stefek [1989]). At the core of the model is a hierarchical decomposition of portfolio return into various components. This is illustrated in Exhibit 2.

**EXHIBIT 2**  
**EMERGING MARKETS MODEL**



We focus on excess return, return beyond the risk-free rate. This return is initially broken down into currency return and excess return earned in local markets. Local excess return is decomposed further into country factor return, industry return, and return accruing to salient attributes of the companies in the portfolio, e.g. the price/earnings ratio. These latter sources of return are called risk indexes.

The return to a global portfolio depends on the numeraire or home country of the investor. More precisely, the excess return to an investment abroad is the product of the return of the investment in its local market,  $1 + r_l$ , and the exchange return  $1 + r_x$ . With a little manipulation, this can be expressed as the sum of three components:

$$\text{Excess Numeraire Return} = (r_x + r_l - r_f) - (r_l - r_f) + r_x \times r_l, \text{ or,} \quad (1)$$

$$\text{Currency Return} - \text{Local Excess Return} + \text{Cross-Product}$$

where  $r_f$  is the risk-free rate of return in the country of the investor, and  $r_l$  is the risk-free rate in the market where the investment is being made. The first term in Equation (1) is the currency return, reflecting both the exchange return and the differential in interest rates between countries. The second term is the local excess return of the investment in its own market.

The final term,  $r_x \times r_l$  (also known as the cross-product) poses a problem for development of a linear model. For most countries, this cross-product term is

typically small and can be disregarded for the purposes of forecasting risk. For example, ignoring the cross-product reduces the annual risk of the Korean market by 51 basis points (from 29.62% to 29.11%), and of the Taiwanese market by 103 basis points. In such cases, one can safely ignore the cross-product because it is small relative to overall market risk.

This is not true for Argentina or Brazil, where there are huge swings in exchange rates. Over the past five years, ignoring the cross-product would have changed the annual risk of the Argentinean market by 17% and the Brazilian market by 4%.

To circumvent this difficulty, we do not try to decompose the Brazilian and Argentinean asset returns into local and currency components but rather model these assets from the U.S. perspective. In other words, we translate the prices of Brazilian and Argentinean assets into U.S. dollars and model the U.S. dollar-denominated returns of these assets. Happily, this approach is consistent with investors' tendency to think of these assets in U.S. dollars.

Next, local excess return is broken down into three components: country factor return, industry return, and risk index return. The amount of an asset's return arising from each component depends on its exposure to that source. The exposure of an asset to the country factor is its beta with respect to that market. Moreover, assets are exposed only to their own local markets. In contrast, industry and risk indexes are global factors in the model, i.e., it is assumed that these factors apply equally across countries.

Industry exposure is defined using the Financial Times World industry classification. Each asset is assigned to exactly one of the thirty-six industry categories.

The risk indexes include size, success, yield, variability in markets, earnings-to-price ratio, book-to-price ratio, and liquidity. Exposures to these risk indexes are normalized within each country. Thus, these exposures measure how an asset compares to the rest of its local market.

A formal statement of our model for monthly local excess return is for asset  $n$ :

$$r_1(n) - r_f(n) = \sum_k \beta(n,k)h(k) + \sum_j y(n,j)g(j) + \sum_i x(n,i)f(i) + u(n). \quad (2)$$

Local Excess = Country Factor + Industry Factor + Risk Index Factor + Specific Return

$k = 1$ , number of countries  
 $j = 1$ , number of industries  
 $i = 1$ , number of risk indexes

where  $\beta(n,k)$ ,  $y(n,j)$ , and  $x(n,i)$  are the exposures of asset  $n$  to the  $k$ th country factor, the  $j$ th industry, and the  $i$ th risk index, respectively. Variables  $h(k)$ ,  $g(j)$ , and  $f(i)$  are returns to these factors. In estimating the factor returns, the exposures are determined from the beginning of month data. The part of the return that is not explained by these factors is called the specific return,  $u(n)$ ; it is unique to the company.

The model was estimated for assets from the twenty-three markets listed in Exhibit 1 over the period February 1986 to July 1991. Data are drawn from numerous sources including the International Finance Corporation and proprietary sources in thirteen countries.

The results of the modeling process reveal some interesting differences between emerging and developed markets. The overall proportion of variance explained by the emerging markets model (adjusted  $R^2$ ) is 50%, as compared with 38% for a similar model that covers the developed markets (countries covered by the Financial Times Indices). At first glance it may seem surprising that a quantitative model would explain a greater proportion of return in the emerging markets than the developed markets. In order to understand this further, we looked at two submodels.

The first submodel was built using only industry factors; i.e., we looked at what proportion of return is explained by the industry that a company is in, ignoring the country factors and risk indexes. Thus, a definition of this model is:

$$r_1(n) - r_f(n) = \sum_j y(n,j)g(j) + u(n). \quad (3)$$

Local Excess Return = Industry Factor + Specific Return

We find the adjusted  $R^2$  for this model for the emerging markets to be 16%, compared with 22% for the developed markets. This is a measure of how "global" or integrated industries are across countries. It stands to reason that the developed markets have industries that are better integrated than the emerging ones, but the fact that the difference is small implies that there are cross-country industry commonalities in the emerging markets as well.

The second submodel was built using only

country factors. Thus, we looked at what proportion of return is explained by country factors alone, ignoring the industry factor and risk indexes. The definition of this model is:

$$r_i(n) - r_f(n) = \sum_k \beta(n,k)h(k) + u(n). \quad (4)$$

Local Excess Return = Country Factor +  
Specific Return

The adjusted  $R^2$  for this model for the emerging markets is 46% compared with 30% for the developed markets. Clearly, this country factor is the major force driving emerging markets. As one would expect, industries play a larger part in explaining return in the developed markets, while country differences play a larger role in the emerging markets.

## HOMOGENEITY WITHIN MARKETS

The fact that country factors explain such a large proportion of variance (in absolute terms and when compared with the developed markets) in the emerging markets bears a closer look. That is, stock returns tend to be more homogeneous (within a market) in the emerging markets than in developed markets. In other words, when the market moves, there is a strong tendency for all stocks in the market to move with it.

This difference in the proportion of return explained by the market factor (46% in emerging markets versus 30% in developed countries) is not a function of capitalization weighting (which leads to larger companies dominating the regression). Even when we equally weight each stock in the regression we find the same effect persists. The comparable  $R^2$  when equally weighting all stocks in the emerging markets is 42% (compared with 29% in the developed markets).

At first appearance, it may seem odd that the proportion of variance explained by the market factor is so large in these markets. In order to understand this, we look at various effects that may cause this to happen.

First, it may result from a concentration effect, a few large companies so dominating the market that they are, in effect, the market. Second, it may well be that these markets are actually more homogeneous (i.e., all the stocks tend to move together). Finally, there tends to be a positive correlation between the magnitude of returns within a market and the  $R^2$ , i.e.,

to some extent, the high  $R^2$  is a natural by-product of high volatility.

We first look at the concentration effect; that is, whether these markets tend to be dominated by a few large stocks. Exhibit 3 shows the proportion of market capitalization that the top ten stocks represent in each market.

Most emerging markets are more concentrated than the developed markets. Hong Kong and Singapore, perhaps the two most developed of the emerging markets, are highly concentrated by this measure. On the other hand, Malaysia, Brazil, India, and Korea are not significantly more concentrated than the U.K. Of course, simply looking at the biggest ten stocks in a market is not a particularly insightful way to judge concentration because it ignores all the other companies.

Exhibit 3 shows two other more meaningful measures of concentration: asset concentration and sector concentration. Concentration is defined as (similar to Roll [1990]):

$$\text{Concentration} = [(N/N - 1) \times \sum (h_n - 1/N)^2]^{0.5} \quad (5)$$

where:

$N$  = Total number of stocks (or industries), and  
 $h_n$  = Weight in asset (or industry)  $n$ .

Asset concentration looks at how different a market is from being equally weighted. If each stock in the market had exactly the same market capitalization, this measure would be zero. If the entire market capitalization were concentrated in one company, the measure would be one.

In an extremely diversified market like the U.S., the score is 0.08. Looking at this measure for the emerging markets, we can clearly see that they are more concentrated, but that the larger ones (Taiwan, Korea, Thailand, Malaysia, etc.) tend to have numbers that are not much larger than the developed markets. The average for these four markets is 0.13. Thus, while asset concentration plays an important role in understanding why these markets appear homogeneous, there must be other factors at work as well.

Another measure of concentration is sector concentration. If most of the stocks in a market are concentrated in one industry, it would make sense that they would tend to move together. Exhibit 3 shows a measure of sector concentration, defined in a similar

**EXHIBIT 3**

## Emerging Market Statistics

Country	Proportion of Capitalization in Top 10 Companies(%)*	Asset Concentration Factor	Sector Concentration Factor	Average Correlation Between Stocks
Argentina	65.60	0.26	0.43	0.92
Brazil	26.60	0.17	0.38	0.70
Chile	50.90	0.18	0.26	0.59
Colombia	75.10	0.18	0.39	0.34
Greece	50.40	0.18	0.44	0.72
Hong Kong	45.20	0.17	0.44	0.69
India	29.40	0.13	0.48	0.55
Indonesia	53.40	0.17	0.43	0.71
Japan OTC	28.40	0.15	0.32	0.34
Jordan	66.20	0.55	0.62	0.21
Korea	28.90	0.16	0.28	0.56
Malaysia	25.10	0.12	0.28	0.57
Mexico	38.40	0.21	0.42	0.70
Nigeria	52.50	0.17	0.66	0.23
Pakistan	24.40	0.14	0.33	0.17
Philippines	65.20	0.33	0.57	0.70
Portugal	44.20	0.17	0.40	0.80
Singapore	54.50	0.18	0.46	0.75
Taiwan	41.30	0.13	0.37	0.77
Thailand	32.70	0.11	0.42	0.47
Turkey	53.10	0.23	0.36	0.81
Venezuela	64.20	0.26	0.49	0.60
Zimbabwe	41.20	0.25	0.43	0.25
Developed Markets				
Japan	16.70	0.08	0.29	0.46
U.K.	25.50	0.11	0.30	0.56
U.S.	11.90	0.08	0.32	0.49

\*Source: International Finance Corporation

fashion as asset concentration. A score of zero implies that companies are equally distributed across all industries, while a score of one implies that all the companies are in one industry.

The indication is that the emerging markets are more concentrated than the developed markets, but not much more so (although there is a popular perception that many emerging market countries are highly concentrated in certain sectors). In fact we see that Korea, Chile, and Malaysia have less sector concentration than the U.S., U.K., and Japan. The countries that are most highly concentrated in a few sectors are the smaller ones like Jordan and Nigeria. It seems clear

from these results that the emerging markets are quite diversified across industries; the perception that their returns are driven by the fortunes of a single sector (like natural resources) is erroneous.

What then explains the fact that stocks in these markets tend to move together? We looked at the possibility that these markets are indeed more homogeneous, after adjusting for the concentration effect. One way to do this is to look at the average correlation of total monthly stock returns within a market, over a period of time. Exhibit 3 shows the average (i.e., unweighted) correlation between all stocks within each market (over the past five years).

This is clearly higher for most of the emerging markets than the developed markets. With the exception of the Japanese OTC market, all the other large emerging markets have high average correlations. Taiwan has an average correlation of 0.77, Turkey 0.81, and Brazil 0.70. By comparison, the U.S. has an average correlation of 0.49 and Japan 0.46. Because these correlations are unweighted, market capitalization does not play a role in determining this number.

This implies that a single market force tends to have a large impact on the movement of stock prices in these markets. Even though we saw that these markets are fairly well-diversified across industries, these industry differentials are overwhelmed by the dominant market force.

Another reason for the high  $R^2$  numbers in the emerging markets is the fact that there is likely to be a positive relationship between  $R^2$  and market volatility. For example, if the market moves up 50% in a month, the likelihood is that almost all stocks in that market will also move up. Thus, one would expect to see higher  $R^2$  for the more volatile markets. We find that this is indeed true; if one excludes the most risky markets (Argentina, Brazil, Turkey, and Taiwan), and the low liquidity ones (Pakistan, Jordan, Colombia, Nige-

ria, and Zimbabwe) the average  $R^2$  for the emerging markets is similar to that for the developed markets.

Overall, from a global investor's viewpoint, this homogeneity phenomenon implies that being in the right market at the right time is more important than the ability to pick good stocks within that market. Clearly, if you are going to be in Brazil in a month when the market moves up 50%, the high within-market correlations (0.70 for Brazil) are likely to ensure that any diversified portfolio will experience high positive returns. From a global investor's point of view, the impact of this conclusion is accentuated by the low across-market correlations.

## HETEROGENEITY ACROSS MARKETS

This phenomenon of homogeneity does not apply across markets. In fact, we see that the emerging markets are much less correlated with each other than are the developed markets. Exhibit 4 shows the correlations of emerging markets with each other. While we see that some markets tend to move together (Malaysia, Hong Kong, and Singapore), most markets tend to have very low correlations with each other. In fact, the average correlation between the emerging

### EXHIBIT 4

Correlations Between Emerging Markets

(February 1986 - March 1991)

Source: BARRA.

	ARG																						
Brazil	0.02 BRA																						
Chile	0.02	0.21	CHI																				
Colombia	-0.12	-0.09	0.30	COL																			
Greece	0.12	0.03	0.13	0.38	GRE																		
Hong Kong	-0.14	0.20	0.42	0.19	0.21	HKE																	
Indonesia	-0.29	-0.28	0.15	0.14	0.19	0.23	IDN																
India	0.20	0.03	-0.16	-0.07	-0.01	-0.08	0.03	IND															
Jordan	-0.18	-0.15	0.07	0.15	0.15	0.20	0.51	-0.02	JOR														
Japan OTC	-0.13	0.03	-0.07	0.19	0.20	0.60	0.20	0.17	0.25	JPE													
Korea	-0.24	-0.08	-0.05	-0.04	-0.20	0.12	0.07	-0.07	-0.08	0.37	KOR												
Malaysia	-0.01	0.14	0.23	0.01	0.05	0.64	0.47	0.04	0.09	0.63	0.18	MAE											
Mexico	0.13	-0.04	0.25	0.08	0.08	0.36	0.18	-0.16	0.00	0.61	0.27	0.40	MEE										
Nigeria	0.10	0.00	0.11	0.05	0.14	-0.10	0.21	-0.03	-0.04	0.36	0.04	-0.18	-0.11	NIG									
Pakistan	-0.03	-0.06	0.03	0.11	-0.12	0.08	-0.10	0.09	-0.02	0.18	0.14	-0.17	0.07	-0.07	PAK								
Philippines	-0.12	0.13	0.25	0.08	0.10	0.34	0.47	-0.10	0.25	0.36	0.20	0.33	0.14	0.10	-0.11	PHI							
Portugal	0.02	0.03	0.13	0.27	0.41	0.35	0.16	-0.18	-0.09	0.47	0.07	0.30	0.41	-0.21	-0.01	-0.05	POR						
Singapore	0.00	0.14	0.25	0.00	0.07	0.68	0.44	-0.04	0.15	0.68	0.21	0.90	0.43	-0.22	-0.17	0.37	0.31	SIE					
Taiwan	0.02	0.04	0.28	0.11	0.02	0.29	0.35	-0.09	0.17	0.24	0.01	0.25	0.37	-0.22	-0.03	0.04	0.45	0.35	TAI				
Thailand	0.13	0.14	0.33	0.11	0.28	0.56	0.37	-0.05	0.14	0.69	-0.01	0.50	0.44	-0.03	0.00	0.33	0.37	0.58	0.40	THA			
Turkey	0.25	0.13	0.02	0.02	0.24	0.13	0.29	0.14	-0.09	0.32	0.01	0.31	0.24	0.04	-0.08	0.11	0.32	0.31	0.13	0.24	TUR		
Venezuela	-0.05	-0.26	-0.13	-0.10	-0.07	-0.07	-0.15	0.15	-0.14	-0.45	-0.11	-0.14	-0.19	-0.03	-0.01	-0.22	-0.08	-0.13	-0.28	-0.32	-0.15	VEN	
Zimbabwe	-0.26	-0.06	0.00	0.24	-0.04	-0.08	-0.15	-0.04	0.06	-0.20	-0.07	-0.17	-0.19	-0.05	0.21	0.00	0.08	-0.30	-0.13	-0.17	0.01	0.06	

markets was 0.07 over the past five years, implying that they are essentially uncorrelated.

We propose two explanations as to why they have been uncorrelated with each other. First, many of the emerging markets have (or had) few economic and trade links with each other. Consequently, their economies tend to be unrelated to each other.

Second, many have (or had) severe restrictions on outsiders participating in their markets. Therefore, they are somewhat insulated from worldwide (or even regional) patterns in stock market returns. For example, in October 1987, while the world's markets were crashing, the Indian stock market was up modestly.

Now the current trend is for most of the emerging economies to develop greater trade links with the developed world and each other. Most of the countries that are closed to foreign participation in their stock markets are also in the process of liberalizing rules for foreigners to participate in their markets. With these increasing links between markets, we should expect to see correlations between the emerging markets increase in the future.

When we contrast these low correlations with the correlations between developed markets (Exhibit

5), we see that they have much higher correlations with each other. A quick glance at Exhibits 4 and 5 confirms that the developed markets are much more correlated with each other than the emerging markets are. The average correlation between the developed markets was 0.49 (over the same five-year period). While all the correlations between the developed markets were positive, 89 of the 276 correlations between the emerging markets were negative (over this five-year period).

From a global investor's point of view, a more interesting question is not so much how the emerging markets relate to each other, but how they relate to the developed markets, individually and as a group. Overall, the correlation between the IFC Emerging Markets Composite Index and the Financial Times World Index was 0.35 over the past five years.

Exhibit 6 shows the cross-correlations between emerging markets and developed markets. As far as individual countries are concerned, correlations between the U.S. market and emerging markets range from -0.14 for India to 0.70 for Malaysia. As one would expect, Japan is most highly correlated with countries with which it has

## EXHIBIT 5

Correlations Between Developed Markets

(February 1986 - March 1991)

Source: BARRA.

	AUS																			
Austria	0.18	AUT																		
Belgium	0.33	0.31	BEL																	
Canada	0.64	0.19	0.57	CAN																
Denmark	0.17	0.33	0.52	0.34	DEN															
Finland	0.50	0.48	0.39	0.51	0.34	FIN														
France	0.29	0.40	0.76	0.47	0.61	0.36	FRA													
Germany	0.30	0.64	0.74	0.39	0.54	0.41	0.76	GER												
Ireland	0.42	0.43	0.52	0.47	0.51	0.51	0.50	0.46	IRE											
Italy	0.22	0.46	0.64	0.42	0.52	0.33	0.69	0.64	0.41	ITA										
Japan	0.12	0.15	0.53	0.27	0.45	0.34	0.51	0.34	0.47	0.48	JPN									
Netherlands	0.43	0.39	0.73	0.71	0.49	0.46	0.66	0.75	0.59	0.57	0.45	NET								
Norway	0.49	0.43	0.55	0.61	0.37	0.61	0.46	0.54	0.49	0.38	0.30	0.66	NOR							
New Zealand	0.76	0.26	0.28	0.47	0.05	0.40	0.20	0.31	0.41	0.25	0.11	0.39	0.52	NZE						
South Africa	0.51	0.33	0.37	0.51	0.31	0.59	0.34	0.41	0.32	0.35	0.28	0.44	0.50	0.41	SAF					
Spain	0.44	0.40	0.58	0.47	0.45	0.51	0.54	0.47	0.54	0.46	0.60	0.56	0.45	0.42	0.31	SPA				
Sweden	0.48	0.38	0.55	0.41	0.29	0.57	0.47	0.51	0.56	0.50	0.51	0.52	0.53	0.52	0.35	0.55	SWE			
Switzerland	0.43	0.44	0.67	0.59	0.53	0.44	0.67	0.78	0.53	0.65	0.45	0.77	0.54	0.48	0.43	0.62	0.59	SWI		
United Kingdom	0.56	0.38	0.56	0.67	0.45	0.61	0.51	0.54	0.66	0.50	0.47	0.73	0.66	0.43	0.45	0.57	0.61	0.67	UKI	
USA	0.49	0.14	0.55	0.82	0.30	0.42	0.48	0.39	0.47	0.34	0.25	0.69	0.55	0.39	0.24	0.49	0.46	0.61	0.67	USA



## EXHIBIT 6

Correlations Between Developed and Emerging Markets

(February 1986 - March 1991)

Source: BARRA.

	ARG	BRA	CHI	COL	GRE	HKG	IDN	IND	JOR	JPN	KOR	MAL	MEX	NIG	PAK	PHI	POR	SIN	TAI	THA	TUR	VEN	ZIM
Australia	0.06	0.13	0.08	-0.01	0.13	0.61	0.12	0.14	0.20	0.31	0.08	0.50	0.33	-0.17	0.02	0.13	0.24	0.54	0.29	0.48	0.14	-0.08	-0.30
Austria	-0.10	0.12	0.15	0.20	0.24	0.31	0.70	0.12	0.12	0.57	0.12	0.36	0.05	0.11	0.15	0.24	0.14	0.31	0.23	0.26	0.27	-0.28	-0.02
Belgium	0.00	0.02	0.20	0.06	0.23	0.47	0.23	-0.06	0.10	0.60	0.18	0.44	0.43	0.06	-0.07	0.32	0.21	0.55	0.21	0.55	0.16	-0.07	-0.23
Canada	0.04	-0.01	0.30	0.05	0.15	0.59	0.22	-0.02	0.12	0.19	0.31	0.62	0.38	0.08	-0.12	0.28	0.18	0.63	0.18	0.48	0.04	-0.03	-0.25
Denmark	0.10	0.03	-0.05	0.07	0.11	0.16	0.30	0.23	0.17	0.59	0.10	0.29	0.04	0.19	0.02	0.19	0.11	0.30	0.06	0.25	0.20	-0.17	0.04
Finland	-0.18	0.20	0.22	0.10	0.14	0.46	0.54	0.02	0.22	0.59	0.33	0.48	0.32	-0.02	0.01	0.22	0.27	0.46	0.35	0.37	0.12	-0.29	-0.14
France	0.04	-0.05	0.17	-0.02	0.30	0.39	0.15	0.07	0.10	0.69	0.07	0.38	0.25	0.05	-0.06	0.21	0.17	0.41	0.20	0.40	0.02	-0.14	-0.20
Germany	-0.04	0.02	0.19	0.10	0.21	0.35	0.40	-0.05	0.11	0.63	0.06	0.36	0.23	0.15	0.03	0.25	0.13	0.41	0.17	0.46	0.12	-0.25	-0.16
Ireland	-0.12	0.15	0.31	0.12	0.22	0.63	0.36	-0.06	0.34	0.72	0.42	0.55	0.37	0.08	0.09	0.38	0.35	0.57	0.27	0.49	0.22	-0.26	-0.02
Italy	-0.02	0.02	-0.04	0.02	0.33	0.30	0.41	0.01	0.16	0.69	0.06	0.41	0.09	0.06	-0.07	0.22	0.24	0.47	0.07	0.42	0.04	-0.23	-0.16
Japan	-0.12	0.01	-0.02	-0.01	0.09	0.27	-0.16	-0.16	0.11	0.68	0.37	0.30	0.24	0.04	0.01	0.23	0.33	0.39	0.25	0.32	0.07	-0.21	0.03
Netherlands	-0.06	0.04	0.19	0.07	0.23	0.54	0.20	-0.07	0.09	0.58	0.33	0.56	0.34	0.22	-0.03	0.36	0.22	0.59	0.07	0.48	0.12	-0.15	-0.21
Norway	-0.12	0.11	0.22	-0.03	0.17	0.52	0.47	0.00	0.05	0.40	0.20	0.62	0.39	-0.03	-0.04	0.13	0.38	0.60	0.27	0.45	0.24	-0.13	-0.08
New Zealand	0.13	0.22	0.10	-0.01	0.20	0.56	0.07	0.01	0.01	0.30	0.13	0.40	0.27	-0.17	-0.02	0.18	0.36	0.50	0.25	0.56	0.16	-0.17	-0.32
South Africa	-0.01	-0.04	-0.03	-0.10	0.12	0.22	0.38	0.04	0.17	0.37	0.25	0.26	0.21	-0.05	-0.08	0.11	0.22	0.32	0.25	0.29	0.27	-0.10	-0.14
Spain	0.07	0.15	0.22	0.24	0.35	0.59	-0.08	0.00	0.08	0.70	0.19	0.43	0.36	0.25	0.11	0.32	0.36	0.51	0.24	0.44	0.32	-0.17	-0.11
Sweden	0.02	0.34	0.11	0.04	0.26	0.52	0.11	-0.04	0.18	0.74	0.26	0.57	0.42	-0.23	0.06	0.24	0.30	0.64	0.21	0.58	0.14	-0.22	-0.12
Switzerland	0.05	0.05	0.21	0.18	0.30	0.48	0.16	-0.16	0.19	0.61	0.10	0.48	0.31	0.22	-0.16	0.27	0.22	0.55	0.09	0.54	0.12	-0.25	-0.18
United Kingdom	-0.15	0.07	0.11	0.18	0.19	0.62	0.09	-0.05	0.24	0.57	0.27	0.67	0.24	0.05	-0.03	0.19	0.33	0.63	0.21	0.40	0.08	-0.04	-0.01
USA	0.09	0.09	0.33	0.09	0.15	0.59	0.14	-0.14	0.08	0.25	0.22	0.70	0.48	0.11	-0.28	0.24	0.20	0.70	0.23	0.45	0.05	-0.06	-0.32
All Emerging Mkts	-0.01	0.23	0.38	0.10	0.11	0.65	0.42	-0.03	0.16	0.60	0.19	0.59	0.53	-0.17	-0.01	0.24	0.43	0.68	0.82	0.60	0.27	-0.33	-0.24
FT-World	-0.06	0.08	0.15	0.06	0.18	0.57	-0.01	-0.15	0.16	0.68	0.36	0.63	0.41	0.08	-0.11	0.29	0.36	0.69	0.31	0.51	0.11	-0.20	-0.15

strong economic links, such as Singapore, Korea, Thailand, Hong Kong, and Taiwan. A closed market (and economy) such as India had negative correlations with ten out of the twenty developed markets. In fact, its average correlation with the developed markets was -0.01, with the highest being 0.23 with the Danish market!

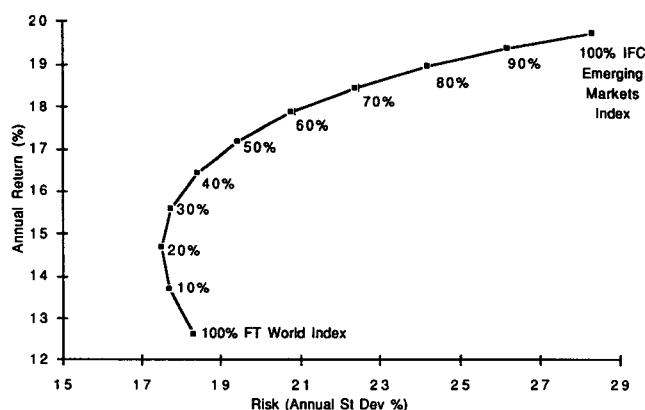
Clearly, the fact that the emerging markets (individually, and as a group) have low correlations with the developed markets implies that there is an opportunity for diversification. We can illustrate this with an example. Exhibit 7 shows the risk and return (over the past five years ending March 1991) of a global portfolio as varying proportions of the IFC Emerging Markets Index are stirred into the Financial Times World Index.

Until reaching about 20% in the Emerging Markets Index, the risk of the overall portfolio decreases, because of the low correlations between the two. After that, portfolio risk starts increasing as the higher overall volatility of the Emerging Markets Index kicks in. Thus, even if one does not expect the emerging markets to outperform the developed markets, an investment of up to 20% would have

## EXHIBIT 7

IMPACT ON PORTFOLIO RISK FOR A GLOBAL INVESTOR

Risk and Return for Mixes of FT World and IFC Emerging Markets Indices  
(5 Years Ending March 1991)



reduced (rather than increased) risk for a global investor.

During this five-year period, the emerging markets outperformed the developed markets, so a 20% investment in emerging markets would not only have reduced annual risk by 0.81%, but would

have increased the annual return by 2.1% as well.

## IMPLICATIONS FOR PORTFOLIO MANAGERS

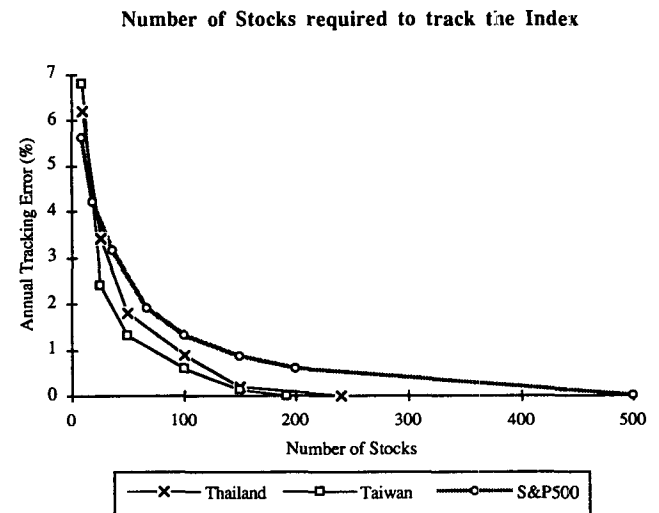
Even though emerging markets are risky individually, low correlations between them and with developed markets lead to risk reduction for modest investments. As these markets develop greater links (financial and trade) with the developed markets, they will undoubtedly become more highly correlated. Thus, there is a "diversification free lunch" currently available — one should indulge while the opportunity exists. One does not need to have high return forecasts for these markets to enjoy the fruits of diversification.

The flip side of the low correlations across markets and homogeneity within markets is that country selection becomes more important for the active manager. There is greater volatility and greater return associated with country selection than in the developed markets. Managers interested in entering the emerging markets arena should give great consideration to their country allocation process, perhaps more so than they do in the developed markets. This does not imply that stock selection by active managers is any less important or easier, simply that country selection has a bigger impact on overall portfolio returns.

To the extent that one decides to focus on country selection rather than stock picking, the homogeneity within markets comes to one's aid. A consequence of the homogeneity within markets is that one can construct baskets of stocks that will mimic the performance of the overall market index with relatively low tracking error. This is particularly important in the emerging markets, because the smaller stocks tend to be extremely illiquid. Thus, one can form baskets of relatively liquid stocks that will track the overall index fairly well.

Exhibit 8 shows the number of stocks required to track the SET index in Thailand, the TAIEX Index in Taiwan, and the S&P 500. If one wants to construct a basket of stocks whose performance will track the relevant index to within 1% per year (with a two-thirds probability), one would need about 75 stocks in Taiwan, 90 in Thailand, and 135 in the U.S.<sup>2</sup> When one accounts for that fact that the Thai and Taiwanese

## EXHIBIT 8 COMPARISON OF TRACKING ERROR IN DIFFERENT MARKETS



indexes have fewer stocks than the S&P 500, all three require about the same proportion of stocks to track the index with similar tracking error.

Finally, given that many of the emerging markets are projected to have higher real economic growth than the developed markets, one would expect that stock market return (over the medium to long term) would reflect this. Coupled with the diversification benefit, one can make a strong case for global investors to add investments in the emerging markets to their portfolios.

## ENDNOTES

<sup>1</sup>Sources: "Emerging Stock Markets Factbook 1991," published by the International Finance Corporation; BARRA.

<sup>2</sup>According to BARRA's Emerging Markets Equity Model.

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