Predictable Risk and Returns in Emerging Markets

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The emergence of new equity markets in Europe, Latin America, Asia, the Mideast and Africa provides a new menu of opportunities for investors. These markets exhibit high expected returns as well as high volatility. Importantly, the low correlations with developed countries' equity markets significantly reduces the unconditional portfolio risk of a world investor. However, standard global asset pricing models, which assume complete integration of capital markets, fail to explain the cross section of average returns in emerging countries. An analysis of the predictability of the returns reveals that emerging market returns are more likely than developed countries to be influenced by local information.

In recent years, a number of new equity markets have emerged in Europe, Latin America, Asia, the Mideast, and Africa. Little is known about these markets other

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than that the expected returns can be impressive and these markets are highly volatile. Importantly, the correlations of these equity returns with developed countries' equity returns are low. As a result, it may be possible to lower portfolio risk by participating in emerging markets.

This article has a number of goals. First, the average or unconditional risk of these equity returns is studied. While previous authors have documented low correlations of the emerging market returns with developed country returns, I test whether adding emerging market assets to the portfolio problem *significantly* shifts the investment opportunity set. I find that the addition of emerging market assets significantly enhances portfolio opportunities.

Second, I explore reasons why the emerging market equities have high expected returns. In the framework of asset pricing theory, high expected returns should be associated with large exposures to risk factors. However, I find that the exposures to the commonly used risk factors are low. The asset pricing model, as specified, is unable to explain the cross section of expected returns. One possible reason for this failure is the implicit assumption of complete integration of world capital markets. Some evidence is offered that points to a violation of this assumption.

Third, the time variation in the emerging market returns is studied. Emerging markets contrast with developed markets in at least two respects. I offer evidence that the emerging market returns are generally more predictable than the developed market returns. In addition, it is more likely that the emerging market returns are influenced by local rather than global information variables.

One interpretation of the influence of local information is that the emerging markets are segmented from world capital markets. A second interpretation is that there is important time variation in the risk exposures of the emerging markets. For countries with stable, developed industrial structures, many researchers studying time-varying asset returns have assumed that risk loadings are constant. This is a far less reasonable assumption for developing countries. The country risk exposure reflects the weighted average of the risk exposures of the companies that are included in the national index. As the industrial structure develops, both the weights and the risk exposures of the individual companies could change. This may induce time variation in risk exposures. In addition, the risk exposures are likely influenced by local rather than global information variables.

I study a conditional asset pricing model where the expected returns are functions of global and local information variables, the world risk premiums are dependent only on global information, and the conditional risk is a function of both global and local information.

In contrast to the unconditional models, this specification allows for time-variation in the risk exposures and the expected returns.

Tests of the conditional asset pricing model suggest that the risk exposures significantly change through time for a number of the countries. An examination of the time-varying risk functions suggests that the exposures in some countries move with the time-varying conditional correlations of the countries' returns and a benchmark world return. However, the asset pricing model's restrictions are rejected, which implies that this formulation is unable to explain the predictability of the returns nor the cross-section variation of the expected returns.

The article is organized as follows. The second section provides a description of the data and some summary statistics for the 20 emerging market index returns. In the third section, an analysis of the cross-country correlations of the emerging and developed returns is presented. The section includes tests of whether adding emerging markets to the portfolio problem significantly changes portfolio opportunities. The average risk exposures to prespecified world economic risk factors are also presented and interpreted. The rejection of the asset pricing theory is characterized in mean-variance space. The fourth section details the predictability of the emerging market returns. Conditional asset pricing models are estimated with the goal of trying to explain the predictability and to understand the sources of model rejection. Some concluding remarks are offered in the final section.

1. Characterizing the Returns and Volatility of Emerging Markets

1.1 Data sources

Data on more than 800 equities in six Latin American markets (Argentina, Brazil, Chile, Colombia, Mexico, Venezuela), eight Asian markets (India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Taiwan, Thailand), three European markets (Greece, Portugal, Turkey), one Mideast market (Jordan), and two African markets (Nigeria, Zimbabwe) form the Emerging Market Data Base (EMDB) of the International Finance Corporation (IFC), which is part of the World Bank. Monthly value-weighted index returns are calculated, with dividend reinvestment, for these 20 countries. These markets are labeled "emerging" as a result of their low- or middle-income status by the World Bank. In 1991, a per capita GNP of US$635 or less implied low income and per capita GNP between US$636 and US$7910 defined middle income status.

Table 1 provides some basic statistics regarding the composition of the indices. For each market in June 1992, the market capitaliza-

Table 1
Summary statistics for emerging and developed markets' U.S. dollar returns through June 1992

Country	First month in sample	Market capitalization (US$ billion)	Firms in index	Annualized means US$ (%)	Annualized means Local currency (%)	Annualized std. dev. (%)	Autocorrelations ρ_1	Autocorrelations ρ_2	Autocorrelations ρ_{12}	Coefficients of skewness	Coefficients of excess kurtosis	p-value test of normality
Latin America												
Argentina	1976.02	25.5	27	71.79	155.22	105.06	0.05	0.06	−0.10	1.92	6.95	0.00
Brazil	1976.02	50.7	67	21.71	123.82	60.70	0.03	−0.03	0.03	0.53	0.99	0.00
Chile	1976.02	37.0	35	39.64	61.61	39.64	0.18	0.26	0.09	0.92	3.12	0.10
Colombia	1985.02	5.1	20	46.09	72.38	32.54	0.49	0.15	0.04	1.68	3.90	0.00
Mexico	1976.02	128.9	56	30.52	62.60	44.99	0.25	−0.08	−0.01	−0.83	3.60	0.05
Venezuela	1985.02	9.0	16	38.08	64.23	47.52	0.27	0.18	−0.07	0.08	3.18	0.00
Latin America	1985.02	256.2	221	35.67	—	39.39	0.25	−0.04	−0.10	−0.11	0.74	0.25
East Asia												
Korea	1976.02	85.9	77	18.52	21.41	31.38	0.01	0.07	0.11	0.99	2.26	0.00
Philippines	1985.02	15.8	30	49.90	54.44	38.64	0.34	0.02	0.06	0.37	2.07	0.01
Taiwan	1985.02	135.9	70	40.93	33.88	53.99	0.06	0.04	0.13	0.15	0.81	0.31
South Asia (U.S$ returns)												
India	1976.02	69.9	60	20.45	24.02	26.56	0.09	−0.10	−0.09	0.74	2.65	0.04
Indonesia	1990.02	11.7	66	−11.40	−6.22	34.01	0.25	0.16	0.26	0.05	−0.38	0.73
Malaysia	1985.02	78.3	62	13.24	13.19	26.89	0.05	0.07	−0.10	−0.62	1.98	0.56
Pakistan	1985.02	8.3	54	25.86	32.47	22.37	0.27	−0.24	0.13	2.61	11.04	0.00
Thailand	1976.02	43.8	43	21.75	23.00	25.67	0.12	0.16	0.06	−0.12	3.42	0.00
Asia	1985.02	449.6	462	19.31	—	26.27	0.01	0.18	0.13	−0.74	1.26	0.20

Table 1
Continued

Country	First month in sample	Market capitalization (US$ billion)	Firms in index	Annualized means US$ (%)	Annualized means Local currency (%)	Annualized std. dev. (%)	Autocorrelations ρ_1	ρ_2	ρ_{12}	Coefficients of skewness	Coefficients of excess kurtosis	p-value test of normality
Europe/Mideast/Africa												
Greece	1976.02	13.3	32	9.43	19.03	36.25	0.12	0.18	−0.05	1.87	7.37	0.01
Jordan	1979.02	2.8	25	10.29	16.12	18.03	0.00	0.03	−0.01	0.47	0.91	0.00
Nigeria	1985.02	1.1	24	2.44	35.02	37.19	0.09	−0.13	−0.08	−1.76	10.90	0.00
Portugal	1986.03	11.6	30	40.71	38.38	51.43	0.28	0.03	0.03	1.50	4.59	0.07
Turkey	1987.02	11.6	25	44.32	85.65	76.25	0.24	0.10	−0.18	0.98	0.68	0.00
Zimbabwe	1976.02	0.9	17	9.74	21.79	34.25	0.13	0.15	−0.04	0.26	1.93	0.14
Composite	1985.02	747.1	836	20.36	—	24.70	0.15	0.07	0.08	−0.71	1.27	0.10
Developed												
United Kingdom	1976.02	1030.1	145	18.69	18.85	22.80	−0.00	−0.08	−0.15	−0.02	0.80	0.25
Japan	1976.02	2119.7	266	17.69	11.49	23.35	0.01	−0.03	0.12	0.22	0.80	0.14
United States	1976.02	3707.3	332	13.63	—	15.24	−0.00	−0.07	−0.00	−0.48	2.91	0.17
Benchmarks												
MSCI World	1976.02	9,198.1	—	13.91	—	14.36	0.03	−0.07	0.02	−0.42	1.71	0.33
G−10 FX	1976.02	—	—	11.36	—	9.85	−0.05	0.12	−0.01	−0.02	0.29	0.63

All statistics based on monthly U.S. dollar returns except for one of the annualized means which is based on local currency returns. The emerging markets data are from the International Finance Corporation. The developed market returns are from Morgan Stanley Capital International (MSCI). The world market return is the U.S. dollar return on the MSCI value-weighted world market portfolio. G-10 FX is the U.S. dollar return to holding a trade-weighted portfolio of Eurocurrency deposits in 10 countries (G-10 countries minus United States plus Switzerland) [details of construction are found in Harvey (1993)]. Normality tests of the country returns are conducted using the generalized method of moments by imposing the restriction that the coefficients of skewness and excess kurtosis are jointly equal to zero. The χ^2 test statistic has two degrees of freedom. The probability values from the test statistic are reported in the final column. Multivariate tests were also conducted and are reported in the text.

tion in U.S. dollars is provided.[1] First, the emerging markets are small relative to the U.S., Japan, and U.K. equity markets. However, some emerging markets are larger than one might think. For example, capitalizations of Mexico and Taiwan are similar to those of the markets in Italy and the Netherlands. There are 10 emerging markets that are larger than the smallest European market (Finland US$13.6 billion). The total capitalization of the emerging markets is US$747.1 billion. This represents 8 percent of the Morgan Stanley Capital International (MSCI) world capitalization.

Similar to the MSCI method for calculating country equity indices, the IFC uses a subset of the stocks trading in the emerging market. Stocks are selected for inclusion in the index based on size, liquidity, and industry. The IFC targets 60 percent of the total market capitalization of the country and 60 percent of the total trading volume. The indices do not include stocks whose issuing company is headquartered in an emerging market but listed only on foreign stock exchanges. In addition, if several stocks meet the size and liquidity hurdle, the IFC selects stocks that represent industries that are not well represented in the index. A detailed description of the selection criteria and the index construction is contained in IFC (1993).

Table 1 contains the number of stocks used for each of the IFC country indices which ranges from 77 for Korea to 17 in Zimbabwe. These numbers seem small compared to the United Kingdom, Japan, and the United States. However, these portfolio sizes are comparable to the MSCI portfolios for developing countries. For example, Harvey (1991) reports that 15 of the 20 MSCI developed markets have fewer than 77 companies included in their indices.

Naturally, one might be concerned with the possibility of some biases being introduced as a result of infrequent trading of the some of the index stocks. However, the trading activity of many of the emerging markets is impressive compared to the developed markets. For example, Harvey (1995a) reports that five emerging markets have higher turnover than the average turnover in the United States, Japan, and the United Kingdom and 10 emerging markets have higher turnover than the United Kingdom. However, to mitigate the possible influences of infrequent trading, I concentrate the analysis on monthly rather than weekly data.

[1] For most markets, the exchange rate conversion is based on a rate quoted on the last day of the month in the *Wall Street Journal* or the *Financial Times*. When a number of exchange rates exist, the IFC uses the nearest equivalent "free market" rate or a rate that would apply to the repatriation of capital or income. In some cases, even the newspaper rates are not used and the IFC relies on their correspondents in the particular market. See IFC (1993).

1.2 Analysis of monthly returns

Some summary statistics of the 20 emerging market returns are presented in Table 1. All statistics are calculated in U.S. dollar terms (translated using the effective rate on the last trading day of the month) except for the means which are calculated in both U.S. and local currency terms. Annualized mean U.S. dollar returns range from 71.8 percent for Argentina to −11.4 percent for Indonesia (whose sample only begins in February 1990). High average returns are often associated with high volatility. For example, both Argentina and Turkey have annualized standard deviations over 75 percent. Taiwan, whose average return is 40.9 percent, has a standard deviation of 53.9 percent.[2]

In the overall sample, the average return on the emerging markets composite index is 20.4 percent with a standard deviation of 24.9 percent. The average returns are roughly 50 percent higher than the MSCI world composite index (13.9 percent arithmetic, same sample), and the standard deviation is about 80 percent higher than the MSCI world index (14.4 percent).

Although this study concentrates on U.S. dollar returns, it is informative to consider the magnitude of the local currency returns. In many countries, especially in Latin America, these returns are dramatically different as a result of high inflation. For example, the average annualized return in Argentina is 228.8 percent in local currency terms with a volatility of 155.2 percent. The average return in local currency for the Brazilian index is 155.5 percent.

Table 1 also reports the serial correlation of the monthly returns. In contrast to the developed markets, the first-order serial correlation coefficients are higher for the emerging markets. Twelve of the 20 emerging markets have serial correlation coefficients greater than 10 percent and 8 of the markets have coefficients above 20 percent. The first-order autocorrelation in Colombia is an astonishing 49 percent. The approximate standard error for those countries whose data begins in 1976:02 is 7.1 percent. These statistics are in sharp contrast to the three developed markets reported at the end of Table 1 whose first-order serial correlation averages less than 1 percent.[3]

To further investigate the properties of the data, the coefficients of skewness and excess kurtosis are reported. If the data are normally distributed, then these coefficients should be equal to zero. To test

[2] Given the high volatility, geometric and arithmetic average returns will be much different. The geometric mean represents the average return to a buy and hold strategy in the particular market with dividend reinvestment. For example, the arithmetic mean return for the Latin American Index is 35.7 compared to the geometric mean return of 27.6 percent. The arithmetic mean return for Brazil is 21.7 percent, whereas the geometric mean return is only 3.7 percent.

[3] Harvey (1995a) finds that some of the cross section of serial correlation can be explained by measures of the asset concentration within each index.

for normality, the following system of equations is estimated for each asset i:

$$\begin{aligned} e_{1it} &= r_{it} - \mu_i \\ e_{2it} &= (r_{it} - \mu_i)^2 - \mathcal{V}_i \\ e_{3it} &= [(r_{it} - \mu_i)^3]/\mathcal{V}_i^{3/2} \\ e_{4it} &= [(r_{it} - \mu_i)^4]/\mathcal{V}_i^2 - 3 \end{aligned} \tag{1}$$

where μ is the mean, $\mathcal{V}$ is the variance, $\mathbf{e}_t = \{e_{1it}, e_{2it}, e_{3it}, e_{4it}\}$ represents the disturbances and $E[\mathbf{e}_t] = \mathbf{0}$. There are two parameters and four orthogonality conditions leaving a χ^2 test with two degrees of freedom. The test statistic results from setting the coefficient of skewness and excess kurtosis equal to zero in the third and fourth equations. This forms a joint test of whether these higher moments are equal to zero.[4]

The results suggest that null hypothesis of normality can be rejected at the 5 percent level in 14 of the 20 emerging markets. However, normality cannot be rejected in any of the three developed markets reported. Multivariate tests not reported in the table suggest that the emerging markets are not normally distributed. For the eight emerging countries with data from 1976:02, the test statistic with 16 degrees of freedom is 68.52 (p-value $<$ 0.1 percent). For the three developed countries over the same sample period, the statistic with six degrees of freedom is 9.36 (p-value = 15.4 percent). When the data are sampled from 1986:03, there are 18 emerging market indices and the test statistic is 75.79 (p-value $<$ 0.1 percent). Over the same period, the test statistic for the developing countries is 12.99 (p-value = 4.3 percent).

The summary statistics provide a number of contrasts between emerging markets and developed markets. Emerging markets have higher average returns and volatility than developed markets. Many of the markets have serial correlation that is much higher than one would expect based on knowledge of the serial correlation in developed markets returns. Finally, the returns in the emerging markets depart from the normal distribution. These findings will be important in later sections when interpreting both the cross section of average returns and the predictability of the returns.

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[4] A related test is presented in Richardson and Smith (1993). Their system contains parameters for the coefficients of skewness and excess kurtosis and the test statistic is analytically obtained by imposing the null distribution when calculating the asymptotic variance-covariance matrix of the estimators.

1.3 Survivorship bias in the emerging markets sample

There are a number of potential sources of survivorship bias in the sample of emerging markets. First, there are many possible countries that might have been included in the sample. Indeed, the World Bank considers any stock market in a developing country as an "emerging market." However, the small number of countries that are included in the sample are the winners.

The second source of bias arises from the methodology used in constructing the indices. While the IFC does not explicitly select stocks on the basis of historical financial performance or expected future performance, their size and liquidity criteria implicitly reveal information about the past history of the company. This type of survivorship bias in the index stocks, however, will also hold for more conventional indices, such as the MSCI or FT-Actuaries.

A more serious problem is the backtracking of some of the indices. The EMDB was established in early 1981 and the initial indices were based on stocks selected in 1981. For a number of countries, these indices were backtracked to December 1975. The first 60 months of data are potentially plagued with a lookback bias. That is, to be selected in 1981, the companies had to be successful (or at least solvent). As a result, one might expect the first 5 years of data to reveal high average returns. Indeed, some firms that may have existed in December 1975 and that dropped out of the market by January 1981 are not included in the IFC index. Fortunately, the backtracking problem is isolated to the pre-1981 data. Careful attention is paid later in the article to separately analyzing the full sample (1976–1992) and a 'no backtracking' sample.

2. Average Returns and Risks

2.1 Frontier intersection tests

A number of researchers have suggested that the low correlations between emerging markets and developed markets imply portfolio investment opportunities.[5] However, one obvious question arises: does the addition of emerging markets to the portfolio selection problem *significantly* shift the investment opportunity set?

First, consider the cross-country correlations of the emerging market stock returns in Table 2. The sample period is 1986:03 through 1992:06 (75 observations) for 18 markets, shorter samples are reported for Indonesia and Turkey. In contrast to the cross-country correlations

[5] For an early example, see Errunza (1983), and more recently the Fall 1992 *Journal of Portfolio Management*.

Table 2
Correlations of the emerging market U.S. dollar returns based on monthly data from March 1986 to June 1992 (75 observations)

	ARG	BRA	CHI	COL	MEX	VEN	KOR	PHI	TAI	IND	INO	MAL	PAK	THA	GRE	JOR	NGR	POR	TUR	ZIM	Lat Am	Asia	Comp
ARG	—																						
BRA	-.15	—																					
CHI	-.05	.15	—																				
COL	-.10	.11	-.02	—																			
MEX	.14	-.02	.31	.00	—																		
VEN	.03	-.22	-.24	.11	-.10	—																	
KOR	-.16	.05	.03	-.05	.20	-.09	—																
PHI	-.10	.14	.15	.13	.09	-.16	.16	—															
TAI	-.03	.07	.30	.11	.34	-.22	.02	.04	—														
IND	.24	.04	.04	-.12	.06	.04	-.09	-.13	-.10	—													
INO	-.29	.06	.09	.25	.04	.01	.00	.50	.30	.07	—												
MAL	-.04	.12	.26	.06	.46	-.13	.17	.35	.25	.05	.46	—											
PAK	.02	-.03	-.13	.44	-.05	.01	-.03	-.01	-.07	-.12	.05	-.08	—										
THA	.05	.07	.27	.14	.39	-.19	.03	.28	.43	.07	.42	.52	.01	—									
GRE	.07	.02	.12	.22	.13	-.04	-.13	.12	.10	.02	.36	.08	-.10	.30	—								
JOR	-.10	-.10	.01	.11	-.02	-.05	-.14	.17	.16	-.01	.20	.08	.12	.15	.10	—							
NGR	.13	.00	-.03	.14	-.11	.12	.05	.09	-.15	-.16	-.10	-.17	.01	-.12	.12	-.03	—						
POR	-.02	.10	.21	.14	.35	-.07	.10	.02	.39	-.11	.24	.24	.03	.35	.41	-.03	-.20	—					
TUR	.15	.07	.02	.13	.17	-.10	.02	.12	.17	.09	.28	.26	.04	.29	.28	-.12	.08	.27	—				
ZIM	-.19	-.05	-.09	-.16	-.02	.11	-.03	-.02	-.01	-.24	.04	-.04	-.11	-.10	.03	.00	.05	.12	.01	—			
Lat Am	-.03	.11	.33	.05	.44	-.26	.27	.20	.90	.05	.32	.48	-.07	.49	.05	.13	-.14	.29	.24	-.10	—		
Asia	.02	.81	.38	.07	.38	-.22	.14	.09	.23	.06	-.08	.27	-.04	.20	.02	-.12	-.02	.27	.13	-.14	.28	—	
Comp	.00	.39	.42	.09	.47	-.30	.26	.16	.82	.06	.31	.45	-.06	.46	.07	.08	-.11	.40	.27	-.16	.90	.63	—
Average	.03	.12	.15	.12	.20	-.04	.08	.15	.22	.04	.20	.22	.04	.24	.15	.07	.02	.20	.17	.00	.26	.19	.29
Developed	.01	.14	.15	.07	.24	-.09	.15	.24	.15	-.06	.26	.44	.04	.36	.15	.12	.06	.25	.10	-.06	.22	.24	.28
MSCI world	-.06	.18	.14	.08	.33	-.10	.33	.31	.21	-.21	.07	.55	.02	.41	.15	.13	.11	.40	.05	-.02	.30	.31	.36

The monthly returns for emerging markets are from the International Finance Corporation (IFC). Lat Am is the composite index for Latin American countries, Asia is the composite for Asian countries, and Comp is the IFC emerging markets composite index. Average denotes the average cross-correlation between the country and the other emerging markets. Developed is the average cross-correlation between the country and 18 Morgan Stanley Capital International (MSCI) developed market returns. MSCI world is the correlation with the MSCI value-weighted world market portfolio return.

of the developed market returns, most of the correlations are low and many are negative. Harvey (1991) reports that the average cross-country correlation in 17 developed markets is 41 percent over the 1970:02 to 1989:05 sample. The average cross-country correlation of the emerging country returns is only 12 percent. Argentina, Venezuela, Korea, India, Pakistan, Jordan, Nigeria, and Zimbabwe have about zero average correlation with the other emerging countries. Surprisingly, Brazil has a negative correlation with Argentina, Venezuela, and Mexico. Perhaps not surprisingly, India and Pakistan are negatively correlated.

Table 2 also reports the average correlation of each of the emerging country returns with the 18 MSCI developed market returns. Similar to the results among the emerging markets, there are many low average correlations between developed and emerging markets. Argentina, Colombia, Venezuela, India, Pakistan, Nigeria, and Zimbabwe have effectively zero average correlation with developed markets. The overall average correlation between emerging and developed markets is only 14 percent. The final line reports the correlation of the emerging country returns with the MSCI world market return. Similar to the results which equally weight the correlations in the 18 developed markets, the average correlation of the emerging markets and the world market return is only 15 percent.

Figure 1 presents unconditional minimum standard deviation frontiers based on data from 1986:03 to 1992:06. In the first panel, the dotted curve is based on 18 MSCI country indices. The solid curve shows the effect of adding 18 emerging country indices to the problem. Indonesia and Turkey are not included in the sample because of their short histories. At the global minimum variance portfolio, the standard deviation is reduced by 6 percent (from 13 percent to 7 percent) by adding the emerging market assets.

The second panel of Figure 1 repeats the minimum standard deviation analysis with the constraint of no short selling imposed. This may be a particularly appropriate constraint for the emerging market sample where it could be operationally difficult to short a basket of securities. Interestingly, the analysis does not substantially change. The minimum variance portfolio with 18 developed returns has a standard deviation of 14.5 percent. When the 18 emerging market returns are added, the minimum variance portfolio has a standard deviation of 7.5 percent.

The graphical analysis does not answer the question of whether the frontier significantly shifts when the emerging market assets are added to the problem. Following Shanken (1986), Huberman and Kandel (1987), and Jobson and Korkie (1989), let $\boldsymbol{r} = \{\boldsymbol{r}_1, \boldsymbol{r}_2\}$ where $\boldsymbol{r}_1$ is the matrix of returns in 18 developed markets and $\boldsymbol{r}_2$ represents

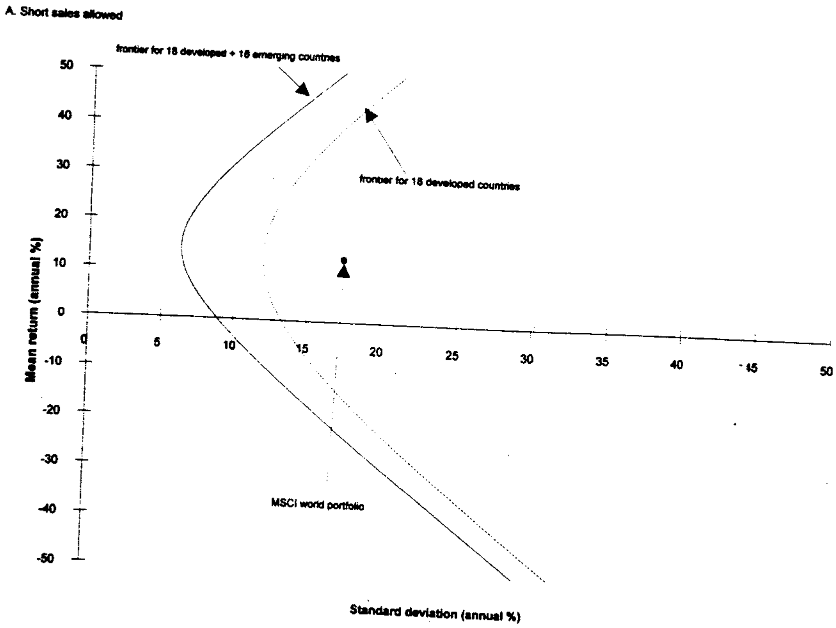

Figure 1
Minimum standard deviation frontier
The monthly returns for 18 emerging markets are from the International Finance Corporation. The 18 developed market returns are from Morgan Stanley Capital International (MSCI). The world market return is the MSCI value-weighted world market portfolio. All returns are computed in U.S. dollars. The sample is from 1986:03 to 1992:06. In panel A, unrestricted short sales are allowed. In panel B, short sales are prohibited.

the returns in the 18 emerging markets. The test is whether one set of assets (developed returns) spans the frontier of both developed and emerging markets by estimating the following moment condition:

$$\eta_t = r_{2t} - \alpha - \beta r_{1t} - \delta r_{0t} \tag{2}$$

where r_0 is the return on the minimum variance portfolio constructed from $\boldsymbol{r}$ (all 36 assets), $\boldsymbol{\alpha}$ and $\boldsymbol{\delta}$ are 1×18 parameter vectors, $\boldsymbol{\beta}$ is a 18×18 parameter matrix, $\boldsymbol{\eta}$ defines the disturbances and $E[\eta | 1, \boldsymbol{r}_1, r_0] = \mathbf{0}$. Let the set of minimum-variance portfolios generated by $\boldsymbol{r}_1$ be efficient with respect to the assets $\boldsymbol{r}$. From Roll (1977), we know that a regression of $\boldsymbol{r}_2$ on $\boldsymbol{r}_1$ and the global minimum variance portfolio return should yield zero intercepts if $\boldsymbol{r}_2$ intersects the efficient set. The slope coefficients should also sum to unity.

Table 3 reports the results of a test that the two frontiers intersect, based on the F-statistic proposed in Shanken (1986) and Jobson and

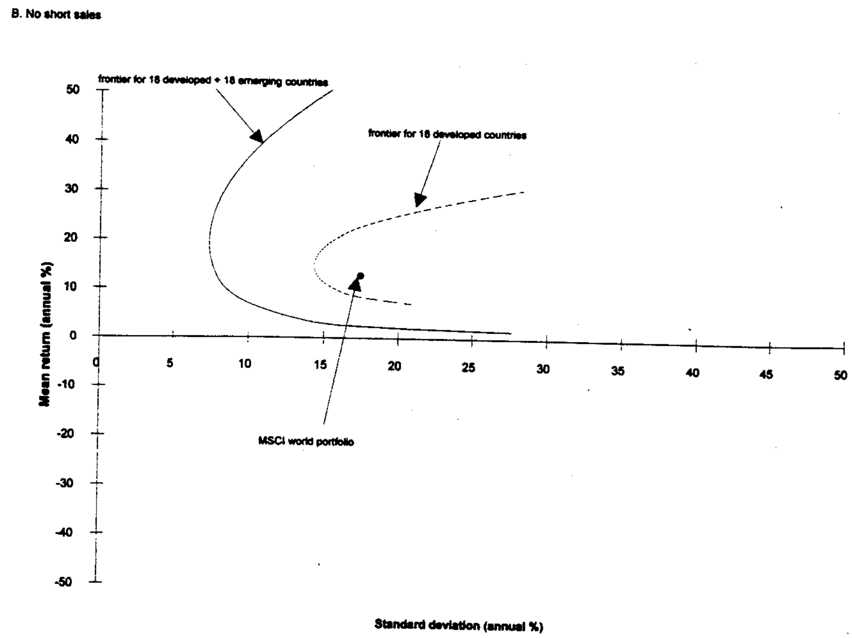

Figure 1
(continued)

Korkie (1989). I report three different versions of the test statistic, all of which use a heteroskedasticity-consistent variance-covariance matrix. The first does not correct for autocorrelation, whereas the second and third versions correct for a moving-average process of 15 months using Bartlett weights [Newey and West (1987)] and Parzen weights [Andrews (1991)]. All three versions of the test statistic provide evidence against the null with p-values less than 0.1 percent.

The F-test relies on the multivariate normality assumption for the returns. Yet the evidence in Table 1 strongly suggests departures from multivariate normality. In principle, Equation (2) could be directly estimated with the generalized method of moments. However, the dimension of the weighting matrix is over 300, which makes this method infeasible unless simplifying assumptions are made on the covariance structure.[6] An alternative is to conduct a Monte Carlo analysis to assess the empirical distribution of the test statistic.

[6] See the discussions in Ferson, Foerster, and Keim (1993) and Ferson (1993). De Santis (1993) presents an alternative approach that tests whether the stochastic discount factor that prices the developed country returns also prices the emerging country returns.

Table 3
Frontier intersection tests

A. Test statistic

Moving average structure	F-statistic {p-value}
None	6.943 {< 0.001}
15 lags Barlett	8.013 {< 0.001}
15 lags Parzen	8.183 {< 0.001}

B. Empirical distribution

Percentile	F-statistic
1%	0.80
5%	1.04
10%	1.15
90%	4.29
95%	4.78
99%	5.82

The test statistic reported in panel A is due to Shanken (1986) and Jobson and Korkie (1989) is

$$\phi_z = \frac{(T - N - 1)}{(N - N_1 - 1)} \frac{(\hat{a}_z - \hat{a}_{z1})}{(1 + \hat{a}_{z1})}$$

where

$$\hat{a}_z = (\bar{\boldsymbol{r}} - \bar{r}_z \iota)' \hat{\boldsymbol{V}}^{-1} (\bar{\boldsymbol{r}} - \bar{r}_z \iota)$$

$$\hat{a}_{z1} = (\bar{\boldsymbol{r}}_1 - \bar{r}_z \iota_1)' \hat{\boldsymbol{V}}_{11}^{-1} (\bar{\boldsymbol{r}}_1 - \bar{r}_z \iota_1)$$

$$\bar{r}_z = (\hat{b} - \hat{b}_1)/(\hat{c} - \hat{c}_1)$$

$$\hat{b} = \bar{\boldsymbol{r}}' \hat{\boldsymbol{V}}^{-1} \iota$$

$$\hat{c} = \iota' \hat{\boldsymbol{V}}^{-1} \iota$$

and $\bar{\boldsymbol{r}}$ represents the mean returns, $\hat{\boldsymbol{V}}$ is a heteroskedasticity consistent estimator of the variance-covariance matrix and ι is a vector of ones. The p-value is computed by assuming that the test statistic follows an F-distribution with $(T - N - 1)$ and $(N - N_1 - 1)$ degrees of freedom where T is the number of observations, N is the total number of assets, and N_1 are the assets in $\boldsymbol{r}_1$. The intuition behind the test is that a line originating from $\bar{r}_z$ in mean-variance space should have the same slope when it is tangent to the frontier of $\boldsymbol{r}_1$ assets and when it is tangent to the frontier of all $\boldsymbol{r}$ assets. The test statistic essentially measures the difference in the slopes. A more detailed description can be found in Jobson and Korkie (1989).

The empirical distribution function of the Jobson and Korkie frontier intersection test is determined assuming that the asset returns have a 36-variate noncentral t distribution (matching the variance-covariance matrix as well as the skewness). Each sample has 1000 observations and 5000 replications are used. Similar results were also obtained with an alternative simulation (which is not reported) based on 76 observations and 100,000 replications.

The U.S. dollar monthly returns for emerging markets are from the International Finance Corporation. The developed U.S. dollar market returns are from Morgan Stanley Capital International (MSCI). The sample is from 1986:03 to 1992:06.

Table 3B reports the empirical distributions of the test statistic. I sample returns from a 36-variate noncentral *t* distribution. This distribution allows for the matching of the variance-covariance matrix, the skewness, and approximate matching of the kurtosis.[7] The Monte Carlo analysis confirms that the p-value for the test statistic is less than 0.1 percent. Hence, the intersection test tells us that the shift in the frontier in Figure 1 is genuine rather than an artifact of sampling variation.[8]

2.2 Risk exposure

Complete integration means that two assets with the same risk in different markets command the same expected returns. In the framework of a world capital asset pricing model with purchasing power parity, the covariance with the world portfolio is the risk and determines the cross section of expected returns.

However, it is reasonable to suspect that many emerging markets are not fully integrated into world markets. Factors such as taxes, investment restrictions, the timeliness of trading information, foreign exchange regulations, the availability and accuracy of accounting information, the number of securities cross-listed on developed exchanges, market liquidity, political risk, and the institutional structures that protect investors all contribute to the degree of integration. It is likely that the degree of integration varies across different countries and through time.[9] As such, it is unlikely that any asset pricing model that assumes complete integration of capital markets will be able to fully account for the behavior of security prices in these different markets. Nevertheless, it makes sense to first investigate the restrictions imposed by a model that imposes the null hypothesis of complete integration.

Table 4 provides tests of a single factor Sharpe (1964)–Lintner (1965) specification for the full sample. The single factor is the excess return on the MSCI world market portfolio. The null hypothesis is that this world portfolio is the Sharpe-Lintner tangency portfolio. All returns are calculated in U.S. dollars in excess of an Eurodollar deposit with 30 days to maturity. This model is consistent with the world CAPM investigated in Cumby and Glen (1990), Harvey (1991), and one of the models in Dumas and Solnik (1995).

[7] No attempt was made to match the coskewness or cokurtosis. The kurtosis is only approximate because one would need very large sample sizes to get close to the kurtosis in the data. The multivariate noncentral *t* is used because it can exhibit negative or positive skewness and the arbitrary kurtosis. The formula follows from Siddiqui (1967) and Johnson and Kotz (1970).

[8] Harvey (1994) examines the conditional mean-variance intersection tests.

[9] Bekaert (1995) and Harvey (1995b) detail investment restrictions in 20 emerging markets. Bekaert and Harvey (1994) offer evidence that the degree of market integration changes through time.

Table 4
Unconditional factor model tests

A. Single-equation results

Country	First month in sample	One factor model: Intercept (annualized)	One factor model: β world return	One factor model: $\bar{R}^2$	Two factor model: Intercept (annualized)	Two factor model: β_1 world return	Two factor model: β_2 FX return	Two factor model: $\bar{R}^2$
Latin America								
Argentina	1976.02	63.42	−0.17	−0.00	64.06	−0.03	−0.60	−0.01
		[2.40]	[−0.40]		[2.43]	[−0.06]	[−0.96]	
Brazil	1976.02	10.71	0.39	0.00	11.38	0.53	−0.63	0.01
		[0.73]	[1.20]		[0.78]	[1.59]	[−1.41]	
Chile	1976.02	29.66	0.17	−0.00	29.41	0.11	0.23	−0.00
		[2.94]	[0.81]		[2.91]	[0.47]	[0.77]	
Colombia	1985.02	37.34	0.15	−0.01	35.41	0.11	0.23	−0.01
		[3.01]	[0.80]		[2.84]	[0.60]	[0.72]	
Mexico	1976.02	17.60	0.79	0.06	18.70	1.03	−1.03	0.10
		[1.60]	[3.18]		[1.76]	[3.94]	[−2.67]	
Venezuela	1985.02	34.19	−0.38	0.01	30.33	−0.46	0.46	0.01
		[1.86]	[−1.12]		[1.68]	[−1.31]	[1.31]	
Latin America	1985.02	22.54	0.64	0.06	31.84	0.84	−1.10	0.14
		[1.60]	[2.08]		[2.42]	[3.07]	[−2.89]	
East Asia								
Korea	1976.02	6.93	0.51	0.05	7.23	0.58	−0.29	0.05
		[0.93]	[3.55]		[0.97]	[3.84]	[−1.20]	
Philippines	1985.02	35.69	0.76	0.09	37.92	0.80	−0.26	0.09
		[2.58]	[2.75]		[2.77]	[2.85]	[−0.85]	
Taiwan	1985.02	27.17	0.71	0.04	39.58	0.97	−1.47	0.11
		[1.34]	[1.67]		[2.01]	[2.51]	[−3.42]	
South Asia								
India	1976.02	11.53	−0.05	−0.00	10.96	−0.18	0.54	0.03
		[1.73]	[−0.41]		[1.68]	[−1.30]	[2.70]	
Indonesia	1990.02	−16.65	0.21	−0.02	−12.97	0.27	−0.41	−0.05
		[−0.78]	[0.51]		[−0.57]	[0.66]	[−0.56]	

Table 4
(continued)

Country	First month in sample	One factor model: Intercept (annualized)	One factor model: β world return	One factor model: $\bar{R}^2$	Two factor model: Intercept (annualized)	Two factor model: β_1 world return	Two factor model: β_2 FX return	Two factor model: $\bar{R}^2$
Malaysia	1985.02	−0.81 [−0.09]	0.74 [3.51]	0.20	5.38 [0.65]	0.87 [4.61]	−0.73 [−3.01]	0.27
Pakistan	1985.02	18.01 [2.14]	0.05 [0.37]	−0.01	13.58 [1.76]	−0.04 [−0.27]	0.52 [2.28]	0.04
Thailand	1976.02	10.67 [1.63]	0.40 [2.06]	0.05	10.80 [1.67]	0.43 [1.83]	−0.12 [−0.46]	0.04
Asia	1985.02	7.76 [0.77]	0.46 [1.98]	0.07	14.63 [1.59]	0.61 [2.86]	−0.81 [−3.33]	0.17
Europe/Mideast/Africa								
Greece	1976.02	−1.57 [−0.18]	0.38 [2.09]	0.02	−2.30 [−0.26]	0.22 [1.05]	0.68 [2.47]	0.04
Jordan	1979.02	−0.29 [−0.06]	0.17 [1.67]	0.02	−0.23 [−0.05]	0.08 [0.78]	0.37 [2.38]	0.05
Nigeria	1985.02	−6.97 [−0.49]	0.23 [1.05]	−0.00	−9.98 [−0.64]	0.16 [0.83]	0.36 [1.21]	−0.00
Portugal	1986.03	26.79 [1.44]	1.20 [4.84]	0.15	27.12 [1.41]	1.21 [5.07]	-0.05 [−0.12]	0.14
Turkey	1987.02	36.95 [1.13]	0.10 [0.22]	−0.02	35.02 [1.07]	0.05 [0.10]	0.38 [0.40]	−0.03
Zimbabwe	1976.02	−0.43 [−0.05]	0.21 [1.11]	0.00	−1.13 [−0.13]	0.06 [0.29]	0.65 [2.62]	0.03
Composite	1985.02	8.44 [0.92]	0.50 [2.30]	0.10	15.71 [1.94]	0.66 [3.58]	−0.86 [−3.84]	0.23
Developed markets								
United Kingdom	1976.02	4.26 [1.06]	1.11 [14.78]	0.49	3.97 [1.00]	1.05 [11.89]	0.27 [2.29]	0.50
Japan	1976.02	2.92 [0.73]	1.18 [11.02]	0.53	2.46 [0.64]	1.08 [9.90]	0.43 [3.43]	0.56
United States	1976.02	0.47 [0.20]	0.84 [13.94]	0.63	0.98 [0.48]	0.95 [17.00]	−0.47 [−7.19]	0.71

Table 4
(continued)

B. Multivariate test that intercepts equal zero

Sample	Model	F-statistic {p-value}
8 countries 1976.02–1992.06	1 factor	2.449 {0.015}
8 countries 1976.02–1992.06	2 factor	2.493 {0.014}
18 countries 1986.03–1992.06	1 factor	2.625 {0.001}
18 countries 1986.03–1992.06	2 factor	3.012 {0.001}

The monthly returns for emerging markets are from the International Finance Corporation. The developed market returns are from Morgan Stanley Capital International (MSCI). All returns are calculated in U.S. dollars and are in excess of the 30-day Eurodollar deposit rate. In the one-factor model, the factor is the world market return is the U.S. dollar return on the MSCI value-weighted world market portfolio in excess of the 30-day Eurodollar deposit rate. In the two-factor model, the excess MSCI world return is used along with the U.S. dollar return to holding a trade-weighted portfolio of Eurocurrency deposits in 10 countries (G-10 countries minus United States plus Switzerland) [details of construction are found in Harvey (1993)] in excess of the 30-day Eurodollar deposit rate. Hetroskedasticity consistent t-statistics in brackets. Hetroskedasticity consistent multivariate tests are conducted with eight assets over the full sample (Argentina, Brazil, Chile, Mexico, Korea, India, Thailand, and Greece). In the subsample from 1986:03, 18 countries are used (all emerging markets except Indonesia and Turkey).

Table 4 also presents a two-factor specification, motivated by Adler and Dumas (1983), which augments the world market portfolio with the excess return on a trade-weighted portfolio of 10 currency deposits. Adler and Dumas's model allows for deviations from purchasing power parity. In their Equation 14 with L countries, expected returns in a numeraire currency are generated by the covariance with the world portfolio and by the covariances of the asset returns and inflation rates in all the countries. The weights on these inflation covariances depend on the wealth-weighted risk aversion in each country. The usual way to implement this model is to follow the Solnik (1974) assumption that the asset covariance with the numeraire country's inflation is zero. Expected returns can then be written in terms of their covariance with the world portfolio and their $L-1$ covariances with exchange rate changes.[10]

Econometrically, this model is intractable unless a very small number of countries are examined. One possible simplification pursued in a number of articles[11] is to aggregate the exchange rate factor. Given

[10] See the discussions in Dumas (1993) and Stulz (1993).

[11] See Bodurtha (1990), Jorion (1991), Brown and Otsuki (1993), Bailey and Jagtiani (1994), Ferson and Harvey (1993, 1994a), Harvey, Solnik, and Zhou (1994), and Dumas and Solnik (1995).

that it is impossible to observe the wealth-weighted risk aversions of the $L - 1$ countries, trade weights (exports plus imports) are used as an aggregation method.

The aggregation of the exchange risk factor departs from the asset pricing theory but provides tractability. One may also view this as the prespecification of factors in some general multibeta model. Empirically, Ferson and Harvey (1993, 1994a) and Harvey, Solnik, and Zhou (1994) have found the aggregated exchange risk factor to be significant in both conditional and unconditional asset pricing tests. Indeed, Harvey, Solnik, and Zhou show that the loadings from these first two factors are able to explain 50 percent of the cross section of expected returns in developed markets.

In contrast to previous applications that use exchange rate changes, I calculate the excess return on the trade-weighted currency portfolio. The portfolio return is a trade-weighted sum of investments in 10 currencies (G-10 countries minus the United States and plus Switzerland). The investment includes both the change in the value of the currency *and* the country's 30-day Eurodeposit rate. While the measure does not include emerging markets, the trade weight on these markets would be very small.[12] The foreign currency portfolio return is measured in excess of the 30-day Eurodollar deposit rate. This procedure ensures that the factor return is a traded asset and avoids the two-step estimation problem for factor mimicking portfolios inherent in the Ferson and Harvey (1993) approach.

In contrast to the results of Cumby and Glen (1990) and Harvey (1991) for developed countries, the world market portfolio beta has little influence on the expected returns in emerging countries. Only one country, Portugal, has a beta greater than one.[13] The world market portfolio is significant in only seven countries: Mexico, Korea, Philippines, Malaysia, Thailand, Greece, and Portugal. Of the emerging markets sample, many conjecture that these countries are the most integrated in the world economy.

Looking across all the countries, the restrictions of the world CAPM are rejected. The intercepts in five countries, Argentina, Chile, Colombia, Philippines, and Pakistan, are significant at the 5 percent level, and the correlation among the stock returns in these countries is low.

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[12] Although some emerging markets have had very large exchange rate swings, the factor is intended to measure the return on a currency deposit in each country. Presumably, a large depreciation in currency, say in Brazil, would be offset by a large local deposit interest rate. Additional details of the construction and the data used are provided in Harvey (1993).

[13] I also estimated (not reported) betas following Scholes and Williams (1977) using one lag and one lead of the world market return. In general, there is little difference between the Scholes-Williams betas (and intercepts) and the OLS parameters. However, three countries over the full sample have betas greater than one: Mexico, Philippines, and Portugal.

The multivariate test of the intercept restrictions of Gibbons, Ross, and Shanken (1989) adjusted for conditional heteroskedasticity and tested on the eight countries with data from 1976:02 provides convincing evidence against the null hypothesis that the intercepts are equal to zero.

Not only are the intercepts significantly different from zero, but the significant intercepts are all positive. Even if we use a different level of significance, say the one associated with t-ratios greater than 1.3 (10 percent level, one-sided), all 13 countries have positive intercepts. If the single factor CAPM describes world expected returns, this would imply that these countries' returns greatly exceeded expected levels of performance. Indeed, some of the unexpected returns are massive. For example, Argentina's unexpected return (or pricing error) is 63.4 percent per annum with a t-ratio of 2.4, and Chile has an annualized error of 29.7 percent with a t-ratio of 2.9. Another possible interpretation is that the intercepts are telling us something about survivorship bias. While the IFC started collecting data in 1981, the multivariate intercept tests reach back to 1976. However, an examination of the subperiod that does not include the look-back bias period suggests that survivorship does not completely explain the findings.

I also tested the restrictions (but do not report) over the most recent subperiod, 1986:03 to 1992:06. Five of the seven countries that had significant betas on the world index in the full sample have significant betas in the most recent subperiod. Intercepts are significant at the 5 percent level in 7 of the 20 countries. Eleven of the countries have intercepts with t-ratios greater than 1.3 and all of these intercepts are positive. Similar to the overall period, there are some countries with very large pricing errors. For example, Chile has an error of 43.9 percent per annum with a t-ratio of 3.9. The multivariate test of Gibbons, Ross, and Shanken (1989) provides evidence against the null hypothesis that the intercepts are zero for 18 countries at the 0.1 percent level.

The multivariate tests suggest that the world market portfolio is not the Sharpe-Lintner tangency portfolio. This is in contrast to the findings of Cumby and Glen (1990) and Harvey (1991) who consider only developed market returns. The intercept tests suggest that the shift in the mean-variance frontier documented in Table 3 was large enough to provide a rejection of the null hypothesis.

The two-factor estimates over the full sample are presented in the right-hand columns of Table 4. The world market beta remains significant at the 5 percent level in six countries: Mexico, Korea, Philippines, Malaysia, Thailand, and Portugal. The foreign exchange risk factor has some explanatory power in eight countries. It is especially important in explaining the aggregated index returns, Latin America, Asia, and the emerging markets composite.

The addition of this second factor, however, does not affect the intercepts. Five of the intercepts are significant (and positive) at the 5 percent level. Eleven have t-ratios greater than 1.3 and all of these are positive. The multivariate test provides evidence against the null hypotheses at the 1.4 percent level of significance.

The currency risk factor appears to have more of an influence in the most recent subperiod (not reported). The currency return significantly loads into seven countries' factor models: Chile, Mexico, Taiwan, Malaysia, Pakistan, Thailand, and Zimbabwe. Both factors are important for the aggregated indices with 29 percent of the variance of the composite index explained. However, 7 intercepts are significantly different from zero at the 5 percent level and 12 have t-ratios greater than 1.3. All of these intercepts are positive. The multivariate intercept test provides evidence against the null hypothesis of zero intercepts at the 0.1 percent level of significance.

It is possible that this analysis is sensitive to the assumption of a risk-free asset. Kandel and Stambaugh (1989) present a methodology to test whether the index portfolio or a combination of multiple index portfolios lies on the minimum variance boundary of risky assets. They characterize a critical hyperbola. If the index portfolio or a combination of factor portfolios lies to the right of the critical hyperbola, then we can reject the hypothesis that the portfolio or combination lies on the minimum-variance boundary. Importantly, this approach is different from the Gibbons, Ross, and Shanken (1989) approach which tests whether the index portfolio or combination of multiple index portfolios is the Sharpe-Lintner tangent portfolio. The Kandel and Stambaugh approach is graphical and, as such, one sees how close the given portfolio (portfolios) is to the critical hyperbola.

The Kandel and Stambaugh (1989) critical rejection regions are presented in Figure 2. The solid hyperbola in Figure 2 is the unconditional mean-variance frontier for 36 assets from 1986:03 to 1992:06. The dashed hyperbola in the first panel is the critical rejection region for a 5 percent significance level for the one-factor model. Notice that the world market portfolio is well to the right of the critical rejection region indicating that this benchmark portfolio is significantly off the minimum standard deviation frontier. The second panel of Figure 2 presents the critical rejection region for the two factor model. It is clear that portfolios of the world market return and the exchange rate return do not cross the critical rejection region drawn at the 5 percent significance level.

Two additional world risk factors were considered.[14] In contrast to

[14] These factors were examined after the factor models were estimated in Table 4, in response to a suggestion by a conference discussant, and, as such, should not be considered factor snooping.

A. One factor model

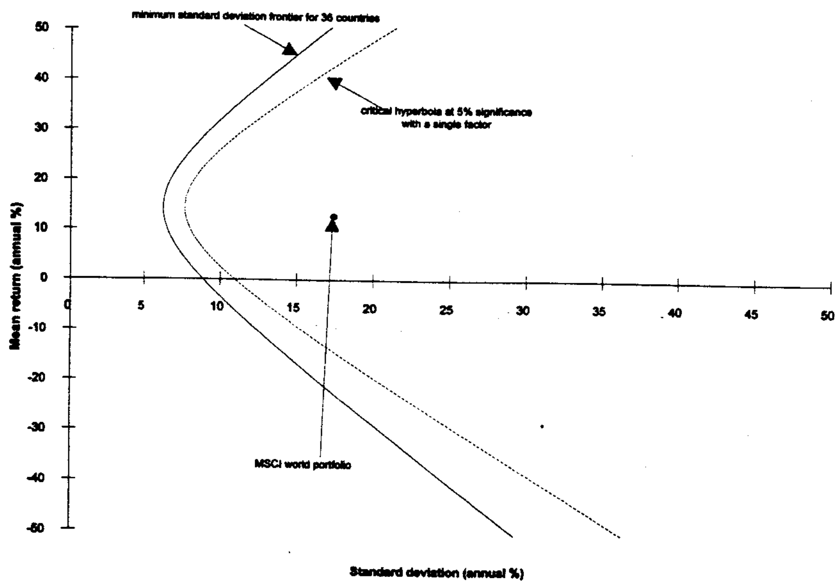

Figure 2
Minimum standard deviation frontier with critical rejection region for the one-factor model
The monthly returns for 18 emerging markets are from the International Finance Corporation. The 18 developed market returns are from Morgan Stanley Capital International (MSCI). The world market return is the MSCI value-weighted world market portfolio. The exchange rate portfolio is is the return to holding a trade-weighted portfolio of Eurocurrency deposits in 10 countries (G-10 countries minus the U.S. plus Switzerland). All returns are computed in U.S. dollars. The sample is from 1986:03 to 1992:06. The critical hyperbola follows Kandel and Stambaugh (1989). Define the efficient set constants $a = \bar{r}'\hat{V}^{-1}\bar{r}$, $b = \bar{r}'\hat{V}^{-1}\iota$, $c = \iota'\hat{V}^{-1}\iota$, and $d = ac - b^2$ where $\bar{r}$ are the expected returns, $\hat{V}$ is the estimated variance matrix and ι is a vector of ones. Let $\hat{\mu}_p$ be a target expected return and $\hat{\sigma}^{2*}(\hat{\mu}_p)$ be the minimum variance for expected return $\hat{\mu}_p$. Hence, $(\hat{\mu}_p, \hat{\sigma}^{2*}(\hat{\mu}_p))$ is a point in the expected return–minimum variance space. Let w^s be a central-F variate at a given significance level. Kandel and Stambaugh prove that $w(p) > w^s$, i.e., portfolio p's efficiency is rejected if and only if

$$\hat{\sigma}_p^2 > \delta_1(w^s) + \delta_2(w^s)\sigma^{2*}(\hat{\mu}_p)$$

where $\hat{\sigma}_p^2$ is the variance of p and

$$\delta_1(w) = \frac{w(w+1)}{cw - d} \qquad \delta_2(w) = \frac{-d(w+1)}{cw - d}$$

Thus, $\hat{\sigma}^2 = \delta_1(w^s) + \delta_2(w^s)\sigma^{2*}(\hat{\mu})$ defines a critical hyperbola in mean standard deviation space. If the given portfolio is to the right of the hyperbola, efficiency can be rejected at the significance level s. In panel A, the given portfolio is the MCSI world market portfolio. In panel B, the given portfolios are represented by the minimum standard deviation frontier formed from the MSCI world market portfolio and the exchange rate portfolio.

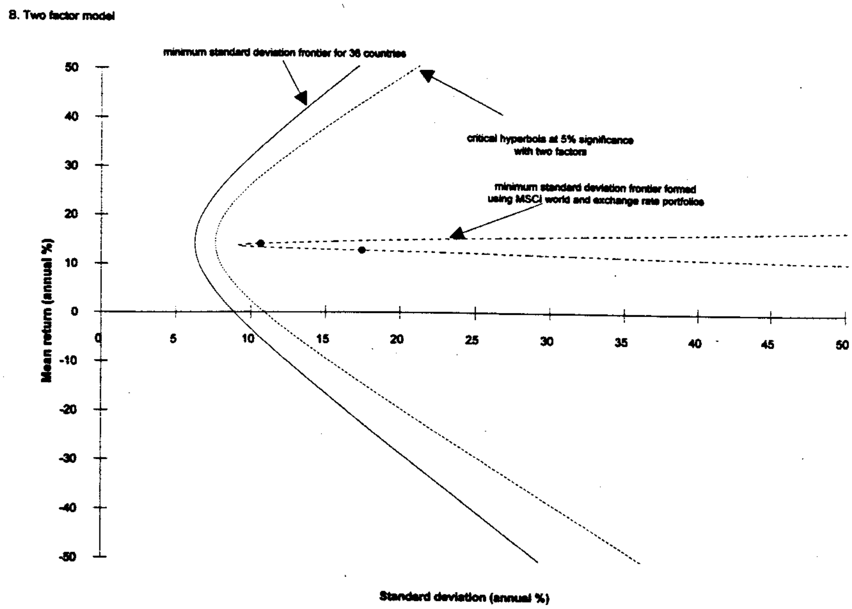

Figure 2
(continued)

developing countries, many of the emerging markets have undiversified industrial sectors. Given that many of these equities are resource based, the emerging market equities may have significant exposure to price fluctuations in an index of natural resources. Bivariate regressions are estimated using the percentage change in the Commodity Research Bureau's (CRB) industrial inputs index in excess of a risk-free rate. There was only one country, Indonesia, that had a significant exposure to this factor.

The emerging economies also have larger proportional agricultural sectors than the developed economies. Factor models were estimated using the percentage change CRB food price index in excess of a risk-free rate. Similar to the industrial input series, no country exhibited a significant sensitivity to this factor.

Although the tests indicate that world market portfolio is inefficient, what is the cross-sectional relation between the expected returns and the risk sensitivities? Roll and Ross (1994) and Kandel and Stambaugh

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Other specifications of global risk factors are investigated by Ferson and Harvey (1994a,b). The general approach follows Chen, Roll, and Ross (1986).

(1994) have emphasized that a small degree of inefficiency could result in no relation between expected returns and risks.[15] The first panel of Figure 3 provides a scatter plot of the average returns and the world market betas over the recent subperiod. The cross-sectional regression line is also plotted and is insignificant. None of the cross-sectional variation is explained. If the loadings from the second risk factor are added to the estimation, the regression is still insignificant at the 5 percent level.

The second panel of Figure 3 presents the same average returns against their standard deviations. The cross-sectional regression line of the average returns on the volatilities is also presented with and without the influential Argentinian observation. The regression using all countries is significant at the 0.5 percent level. The country's variance has more explanatory power than the beta with respect to the world portfolio. These results support the interpretation that many of the emerging markets are not fully integrated into world capital markets.

There are other reasons why the unconditional CAPM could fail aside from the market integration issue. For example, the linear factor specification in Table 4 assumes that the risk exposures are constant over the estimation period. The differences in the magnitude of the some of the risk coefficients in the full and most recent subperiod (1986:03 to 1992:06, not reported) suggest that exposures may be time varying. Indeed, a rejection of the unconditional CAPM does not imply a rejection of the conditional CAPM.

3. Analysis of Conditional Risk

3.1 Predictable returns in emerging markets

Table 5 presents an analysis of the predictable variation in the emerging market returns. Linear regressions of the emerging market returns on three sets of information variables are detailed. The first set consists of common world information variables. The second includes only variables that are specific to the country being examined. The final set combines the local and country-specific information sets.

To provide a direct comparison to research on developed markets, the world information set follows Harvey (1991).[16] The set includes lagged values of the MSCI world return, the return on the U.S. 3-month Treasury bill minus the 1-month return, the yield spread between

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[15] Kandel and Stambaugh (1994) also show that a high degree of inefficiency can accompany a near-perfect relation between expected returns and risk.

[16] Harvey's (1991) selection of variables was motivated by Keim and Stambaugh (1986), Campbell (1987), and Fama and French (1988).

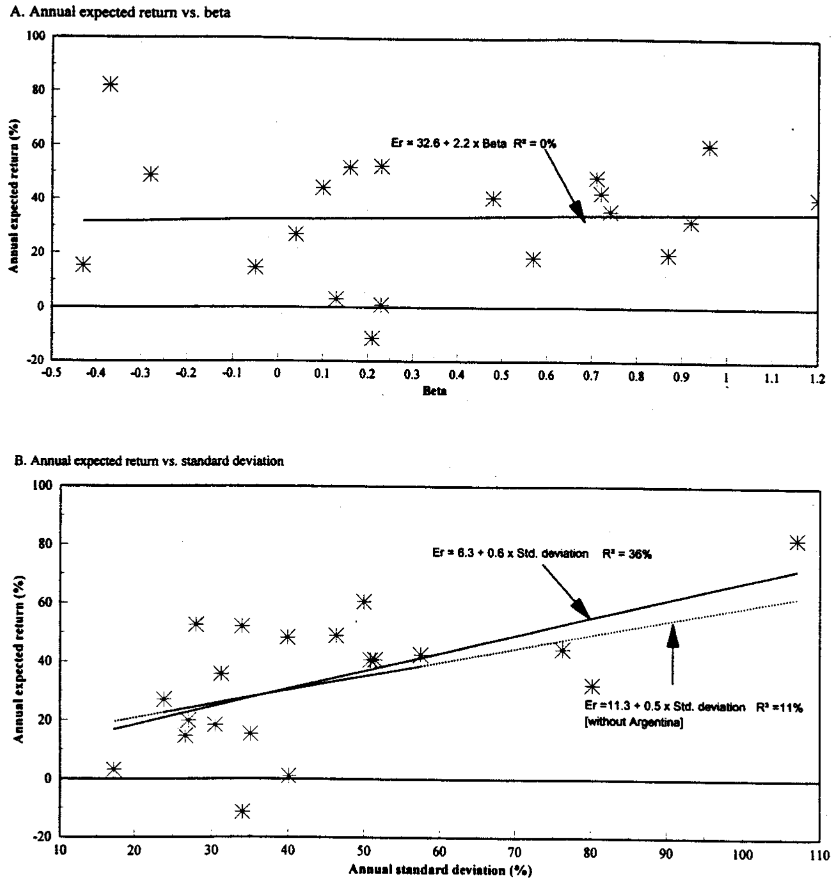

Figure 3
The cross section of expected returns, betas, and standard deviations
The monthly returns for 20 emerging markets are from the International Finance Corporation. The 18 developed market returns are from Morgan Stanley Capital International (MSCI). The world market return is the U.S. dollar return on the MSCI value-weighted world market portfolio. The sample is from 1986:03 to 1992:06 for all countries except Turkey and Indonesia. In panel A, the betas result from the least squares regression of the average returns on the world market return. The fitted line is a regression of the average returns on the estimated betas. In panel B, the solid line is a regression of the average returns on the estimated standard deviations. The dotted line excludes the influential Argentinian observation from the regression.

Moody's Baa and Aaa rated bonds, and the Standard and Poor's 500 dividend yield minus the 1-month U.S. Treasury bill return. The only difference between this information set and Harvey's is the exclusion of the January dummy variable.

The first column of adjusted R^2 results from regressions on the world information variables. Notice that the sample periods are slightly

Table 5
Analysis of predictable returns in emerging markets

A. Single-equation results

Country	First month in sample	$\bar{R}^2$ World information	$\bar{R}^2$ Local information	$\bar{R}^2$ Combined information	χ^2 exclude local	Proportion of variance due to: World information	Local information	Covariance
Latin America								
Argentina	1977.04	0.003 [0.184]	−0.001 [0.638]	−0.000 [0.376]	2.499 [0.645]	0.551	0.456	−0.007
Brazil	1977.04	0.006 [0.196]	0.076 [0.000]	0.078 [0.000]	46.210 [0.000]	0.235	0.830	−0.065
Chile	1977.04	0.098 [0.000]	0.088 [0.000]	0.127 [0.000]	18.054 [0.001]	0.441	0.349	0.211
Colombia	1986.02	0.001 [0.200]	0.213 [0.001]	0.212 [0.001]	13.852 [0.008]	0.214	0.856	−0.070
Mexico	1977.04	0.110 [0.000]	0.072 [0.053]	0.145 [0.000]	12.021 [0.017]	0.652	0.361	−0.014
Venezuela	1985.02	−0.010 [0.422]	0.062 [0.039]	0.033 [0.064]	9.698 [0.046]	0.263	0.883	−0.145
East Asia								
Korea	1977.04	−0.011 [0.711]	0.036 [0.013]	0.021 [0.040]	11.837 [0.019]	0.110	0.856	0.034
Philippines	1985.02	0.150 [0.005]	0.121 [0.000]	0.201 [0.000]	15.016 [0.005]	0.427	0.512	0.061
Taiwan	1985.02	0.018 [0.081]	−0.019 [0.679]	−0.018 [0.242]	1.246 [0.871]	1.251	0.213	−0.464

Table 5
(continued)

Country	First month in sample	$\bar{R}^2$ World information	$\bar{R}^2$ Local information	$\bar{R}^2$ Combined information	χ^2 exclude local	Proportion of variance due to World information	Proportion of variance due to Local information	Proportion of variance due to Covariance
South Asia								
India	1977.04	−0.011 [0.546]	−0.003 [0.740]	−0.003 [0.405]	3.677 [0.451]	0.607	0.794	−0.401
Indonesia	1990.02	0.105 [0.002]	0.010 [0.341]	0.227 [0.000]	7.118 [0.130]	0.948	0.711	−0.659
Malaysia	1985.02	−0.014 [0.240]	0.046 [0.053]	0.045 [0.067]	10.888 [0.028]	0.346	0.889	−0.236
Pakistan	1985.02	0.018 [0.478]	0.134 [0.258]	0.114 [0.369]	5.842 [0.211]	0.144	0.719	0.138
Thailand	1977.04	0.067 [0.000]	0.003 [0.528]	0.055 [0.000]	1.371 [0.849]	0.795	0.117	0.088
Europe/Mideast/Africa								
Greece	1977.04	0.026 [0.004]	−0.002 [0.288]	0.018 [0.006]	3.343 [0.502]	0.754	0.230	0.016
Jordan	1979.02	0.003 [0.336]	−0.024 [0.978]	−0.020 [0.649]	0.868 [0.929]	0.990	0.114	−0.103
Nigeria	1985.02	−0.018 [0.853]	−0.026 [0.804]	−0.056 [0.937]	1.378 [0.848]	0.587	0.391	0.023
Portugal	1986.03	0.125 [0.003]	0.111 [0.005]	0.150 [0.001]	6.919 [0.140]	0.456	0.421	0.124
Turkey	1987.02	0.080 [0.033]	0.101 [0.001]	0.094 [0.000]	10.589 [0.032]	0.278	0.467	0.255
Zimbabwe	1978.01	0.051 [0.016]	0.038 [0.016]	0.159 [0.000]	24.384 [0.000]	0.946	0.803	−0.749
Global variables								
World return	1977.04	0.051 [0.002]	—	—	—	—	—	—
FX return	1977.04	0.063 [0.004]	—	—	—	—	—	—

Table 5
(continued)

B. Multivariate test of predictability

Sample	F-statistic
8 countries world information	2.1523 [0.000]

The monthly returns for emerging markets are from the International Finance Corporation. ' developed market returns are from Morgan Stanley Capital International (MSCI). All returns calculated in U.S. dollars and are in excess of the 30-day Eurodeposit rate. The world informat variables are the MSCI world return, the U.S. 3-month Treasury bill return minus the 1-mo return, the spread between Moody's Baa rated bonds and Aaa bonds, and the Standard . Poor's 500 dividend yield minus the 30-day Treasury bill rate. The local information varial include the local U.S. dollar return, the change in the foreign currency rate versus the U.S. do the local dividend yield, and a local interest rate. Heteroskedasticity consistent p-values ar brackets. The proportion of variance explained by the world information is the variance of fitted values generated from the world information variables in the regression that includes b world and local information divided by the variance of the fitted values using both world ; local information variables. A similar variance ratio is calculated using the local information in numerator. The first two variance ratios do not sum to one because of the covariance betw the local and world information.

The global variables include the U.S. dollar return on the MSCI value-weighted world mar portfolio in excess of the 30-day Eurodollar deposit rate and the U.S. dollar return to holdin trade-weighted portfolio of Eurocurrency deposits in 10 countries (G-10 countries minus Uni States plus Switzerland) [details of construction are found in Harvey (1993)] in excess of the 30- Eurodollar deposit rate.

Multivariate tests are conducted with eight assets over the full sample (Argentina, Brazil, Ch Mexico, Korea, India, Thailand, and Greece). The heteroskedasticity consistent test is based Pillai's trace. The F-statistic has degrees of freedom of 32 and 676.

different than the Table 4 regressions. This is due to the unavailabili of some of the local information variables that will be used in lat analysis. Heteroskedasticity consistent tests of significance (p-value are reported beneath the R^2. The expected returns in 9 of the . countries are significantly (5 percent level) affected by the world i formation variables. A multivariate heteroskedasticity consistent te of predictability [see Kirby (1994)] provides strong evidence agair the hypothesis of constant expected returns.

The second column of adjusted R^2 is obtained from regressions (the local information variables. The local information set includes tl lagged country U.S. dollar returns, the change in the foreign exchan rate versus the U.S. dollar, the dividend yield and a local short-ter interest rate.[17]

[17] I selected interest rates that were the 'most unregulated.' Deposit rates were used for Argenti Chile, Colombia, Venezuela, Thailand, Greece, Jordan, and Nigeria. Call money rates were u in India, Indonesia, and Pakistan. Money market rates were used for Korea, Malaysia, and Turk Treasury bills were used for Mexico, Philippines, Portugal, and Zimbabwe. The bank rate v used for Brazil. The U.S. 3-month Treasury bill yield was used for Taiwan, who is not a memi of the International Monetary Fund.

Local information is important for 11 of the 20 regressions at the 5 percent level of significance. When the local information is combined with the world information, 12 regressions are significant at the 5 percent level and 14 at the 10 percent level. A heteroskedasticity-consistent exclusion test of the local information variables provides evidence against the null hypothesis in 10 countries at the 5 percent level. That is, in the 12 countries with significant regressions, 10 are importantly influenced by local information. The variance ratios in the far right-hand columns suggest that more than half of the predictable variance in these emerging market returns is induced by local information.

From the evidence of serial correlation presented in Table 1, it may seem obvious that lagged country returns should predict future returns. Indeed, it is possible that this type of predictability could be induced by infrequent trading.[18] However, using a monthly frequency should diminish this influence. Interestingly, in the regressions with world and local information (not reported), only three countries—Colombia, Venezuela, and the Philippines—have significant coefficients on the lagged country returns.

These results contrast with the results on developed countries in three respects. First, the degree of explanatory power is greater in emerging markets. Using the combined information set, seven of the regression adjusted R^2 exceed 10 percent and three exceed 20 percent. Over the same period, the predictability of the world market portfolio is limited to 5 percent. Over the 1970.02 to 1989.5 period, Harvey (1991) reports that only 2 of 18 developed countries have adjusted R^2 that exceed 10 percent using world information variables. Using various combinations of world and local information only three countries have R^2 that exceed 10 percent.

The second difference concerns the importance of local information variables. In almost all of the significant regressions, local information played an important role. In contrast, Harvey (1991) found that most of the variation was being driven by global information variables. Using a different sample and different instruments, Ferson and Harvey (1993) report that local information is important in only 6 of 18 developed markets.

Some are skeptical of the predictability in asset returns because of the collective data snooping by many researchers [see, for example, Foster and Smith (1993)]. While most of the snooping is focused on U.S. returns, the use of international returns does not provide 'out-of-sample' evidence of predictability because of the correlation

[18] Serial correlation could be induced by persistence in country risk exposures or world risk premiums. It could also be induced by informational inefficiencies. Unfortunately there is no way to separate these possible causes and hence no attempt has been made to filter the data.

between the international returns and the U.S. return. For example, using the results in Harvey (1991), the rank-order correlation between the predictive R^2 and the squared correlation of the developed country returns with U.S. returns is 57.9 percent, which is significant at the 5 percent level (p-value = 1.8 percent). That is, high correlation with the U.S. usually implies a high degree of predictability.

The final contrast with developed markets is that there is little or no relation between the predictability of emerging market returns and their unconditional correlations with the U.S. or world market return. The rank-order correlation between the predictive R^2 and the squared correlation with the U.S. return is only 29.5 percent (p-value = 22.0 percent). A similar result is obtained when one considers the squared correlation with the world market return. In this case, the rank-order correlation drops to −3.7 percent (p-value = 88.0 percent). While this evidence is informal, it suggests that the predictability may be genuine.

3.2 Conditional asset pricing tests

Following the unconditional analysis in Table 3, I examine the influences of two sources of risk, the world market return and the foreign exchange portfolio return, on conditionally expected returns. In this analysis, expected returns, risk premiums, and betas change through time as a function of the information variables.

Let $\boldsymbol{Z}^{w}$, $\boldsymbol{Z}^{\ell}$, $\boldsymbol{Z}^{w,\ell}$ be the world information, local information, and combined information respectively. The following model is estimated:

$$
\begin{aligned}
u_{1it} &= r_{it} - \boldsymbol{Z}^{w,\ell}_{t-1}\boldsymbol{\delta}_i \\
\boldsymbol{u}_{2t} &= \boldsymbol{f}_t - \boldsymbol{Z}^{w}_{t-1}\boldsymbol{\theta} \\
\boldsymbol{u}_{3it} &= \left[\boldsymbol{u}'_{2t}\boldsymbol{u}_{2t}(\boldsymbol{Z}^{w,\ell}_{t-1}\boldsymbol{\kappa}_i)' - \boldsymbol{f}'_t u_{1it}\right]' \\
u_{4it} &= \mu_i - \boldsymbol{Z}^{w,\ell}_{t-1}\boldsymbol{\delta}_i \\
u_{5it} &= (-\alpha_i + \mu_i) - \boldsymbol{Z}^{w,\ell}_{t-1}\boldsymbol{\kappa}_i(\boldsymbol{Z}^{w}_{t-1}\boldsymbol{\theta})'
\end{aligned}
\tag{3}
$$

where r represents the return on asset i, $\boldsymbol{\delta}$ are coefficients from a linear projection of the asset returns on the information, $\boldsymbol{Z}^{w,\ell}\boldsymbol{\kappa}_i$ are the fitted conditional betas, $\boldsymbol{f}$ are the factor returns, $\boldsymbol{\theta}$ are the coefficients from a linear projection of the factor returns on the information, μ is the mean asset return, and α is the difference between the mean asset return and the model fitted mean asset return (pricing error). Conditioning u_1 and $\boldsymbol{u}_3$ on $\boldsymbol{Z}^{w,\ell}$, $\boldsymbol{u}_2$ on $\boldsymbol{Z}^{w}$, and u_4 and u_5 on ones produces an exactly identified system of equations.[19]

[19] For analysis of related systems, see Ferson (1990), Harvey (1991), Ferson and Korajczyk (1995).

The following is the intuition behind the system. The first two equations are regressions of the asset and factor returns on the information. These are 'statistical' models of expected returns. I let the country returns be influenced by both local and world information variables. However, the world risk premiums are strictly a function of world information variables. Next, the definition of conditional beta is used:

$$\beta_{it} = (E[u_{2t}' u_{2t} \mid Z_{t-1}^{w,\ell}])^{-1} E[f_t' u_{1it} \mid Z_{t-1}^{w,\ell}] \tag{4}$$

The conditional beta in Equation (4) is assumed to be a linear function of the combined world and local information.[20] The last two equations deliver the average pricing error. Parameter μ_i is the average expected return from the statistical model. The parameter α_i is the difference between the average 'statistical' model returns and the asset pricing model's fitted returns. It is analogous to the α_i reported in Table 3. However, in this analysis, both the betas and the premiums are changing through time. Furthermore, the focus is on the predictable portion of the returns.

This complicated system of equations can only be estimated one asset at a time. As such, not all the cross-sectional restrictions of asset pricing theory can be imposed. For example, it will not be possible to report a multivariate test of whether the α_i parameters are equal to zero. However, one important cross-sectional restriction has been imposed. Because the system is exactly identified, the world risk premium function, $Z_{t-1}^{w}\theta$, is identical for every country examined.

The conditional risk function is simply $Z^{w,\ell}\kappa_i$. Wald tests are conducted to test for the significance of the beta and to test whether the beta changes through time.

As this system is exactly identified, there is no general test of the model's restrictions in the form of Hansen's (1982) J-statistic. However, the asset pricing model implies that the coefficient α_i should not be different from zero and this hypothesis can be tested. Another possible test involves analyzing the model disturbance:

$$u_{6it} = r_{it} - Z_{t-1}^{w,\ell}\kappa_i(Z_{t-1}^{w}\theta)' \tag{5}$$

According to the asset pricing model, $E[u_{6it} \mid Z_{t-1}^{w,\ell}]$ should be zero. Diagnostics are reported by regressing u_{6it} on the three sets of infor-

and Ferson and Harvey (1995). Importantly, I ask the model to explain the predictability induced by both local *and* world information, whereas Ferson and Harvey (1993) only challenge the model to explain the predictability induced by the world information.

[20] The linear conditional beta formulation is used in Shanken (1990), Ferson and Harvey (1991, 1993), and Jagannathan and Wang (1994).

mation variables and comparing the predictability of the model errors to the predictability of the asset returns.

Estimates of Equation (3) are provided in Table 6 for the subset of eight countries with data available from 1977:04 (there are 183 observations).[21] Panel A details the results of the one factor model. Consistent with the unconditional results in Table 3, the annualized average pricing errors are more than two standard errors from zero for Chile and India and 1.5 standard errors from zero for Argentina, Mexico, and Thailand. The average pricing errors are of the same magnitudes as the average returns indicating that allowing for time-varying betas and premiums is not enough to get the mean returns right.

The Wald tests show that, in four of the countries, the conditional betas are significantly different from zero. In three of these countries, the betas exhibit significant time variation. However, the time variation in the betas does not help explain the predictability in the asset returns. For the countries that have significant time variation in their expected returns, not only are the pricing errors different from zero on average, they are correlated with the predetermined information. These correlations are sufficient to provide rejection of the asset pricing specification in Equation (3).

The results of the two-factor estimation are presented in panel B of Table 6. In six of the eight countries, the average pricing errors are worse with two factors rather than one. The betas are jointly significant in six of the countries. There is significant time variation in the betas of five of these six countries. The addition of the extra factor reduces the residual R^2 on the combined information in four of the five countries with time-varying betas. However, the correlation between the pricing errors and the combined information is still significant for three of the countries.

It is possible to further characterize these rejections either as a failure to model expected returns and/or as a rejection of the restriction of equal risk premiums. First, consider the restriction of equal world risk premiums. Given that the system in Equation (3) is exactly identified, equal risk premiums are enforced in the asset by asset estimation. It is possible to overidentify the system by adding orthogonality conditions based on the local information variables to the world risk premium disturbance, u_2. One interpretation of the χ^2 test of the overidentifying restriction is a test of the equality of the world risk premiums. That is, the unexpected part of the world risk premium should not

[21] For some of the countries, the interest rate data was not available before 1977:03. Zimbabwe is not included because the interest rate data begins later.

Table 6
An analysis of the conditional risk of emerging market returns

	Average		χ^2			$\bar{R}^2$				Proportion
	Excess	Error		Constant	Equal risk	Returns	Errors			of variance
Country	return	α_i	Betas = 0	betas	premiums[a]	on $Z^{w,\ell}$	on Z^w	on Z^ℓ	on $Z^{w,\ell}$	explained[b]
A: 1-factor model										
Argentina[c]	45.956	41.888	11.678	11.566	2.807	0.005	0.011	0.003	0.014	0.111
		(27.426)	[0.166]	[0.116]	[0.422]					(0.171)
Brazil	13.863	8.755	6.391	6.090	11.793	0.078	−0.000	0.073	0.075	0.033
		(16.020)	[0.700]	[0.637]	[0.019]					(0.040)
Chile	24.436	26.971	10.462	10.357	2.847	0.127	0.096	0.150	0.150	0.082
		(10.724)	[0.314]	[0.241]	[0.584]					(0.086)
Mexico	24.624	23.593	55.854	32.981	4.126	0.145	0.087	0.077	0.137	0.123
		(12.028)	[0.000]	[0.000]	[0.389]					(0.092)
Korea	7.609	9.998	21.509	9.655	3.113	0.021	−0.015	0.024	0.010	0.171
		(8.325)	[0.011]	[0.290]	[0.539]					(0.200)
India	11.513	15.760	19.714	19.380	2.814	−0.003	−0.015	0.002	−0.003	0.195
		(7.324)	[0.020]	[0.013]	[0.589]					(0.237)
Thailand	11.874	12.340	47.419	45.730	1.124	0.055	0.064	0.045	0.053	0.148
		(7.391)	[0.000]	[0.000]	[0.876]					(0.120)
Greece	0.716	−1.599	9.366	3.143	5.883	0.018	0.025	0.002	0.018	0.062
		(9.337)	[0.404]	[0.925]	[0.208]					(0.104)

Table 6
(continued)

	Average		χ^2			$\bar{R}^2$				Proportion
	Excess	Error		Constant	Equal risk	Returns	Errors			of variance
Country	return	α_i	Betas = 0	betas	premiums[a]	on $\mathbf{Z}^{w,\ell}$	on $\mathbf{Z}^{w}$	on $\mathbf{Z}^{\ell}$	on $\mathbf{Z}^{w,\ell}$	explained[b]
B: 2-factor model										
Argentina[c]	45.956	47.300 (27.580)	44.891 [0.000]	44.446 [0.000]	13.487 [0.036]	0.005	0.008	0.003	0.011	0.110 (0.180)
Brazil	13.863	6.072 (16.967)	19.723 [0.349]	16.201 [0.439]	18.298 [0.019]	0.078	0.016	0.078	0.097	0.078 (0.082)
Chile	24.436	31.307 (9.638)	26.842 [0.082]	26.112 [0.052]	5.887 [0.659]	0.127	0.075	0.132	0.123	0.285 (0.231)
Mexico	24.624	27.365 (12.552)	114.147 [0.000]	64.523 [0.000]	5.965 [0.651]	0.145	0.091	0.081	0.131	0.131 (0.178)
Korea	7.609	6.351 (8.433)	74.269 [0.000]	28.267 [0.029]	4.519 [0.807]	0.021	−0.009	0.032	0.023	0.301 (0.268)
India	11.513	16.806 (7.554)	65.568 [0.000]	32.691 [0.008]	10.020 [0.201]	−0.003	−0.015	0.003	−0.003	0.408 (0.446)
Thailand	11.874	12.683 (7.197)	120.290 [0.000]	104.588 [0.000]	3.805 [0.874]	0.055	0.058	0.039	0.042	0.160 (0.144)
Greece	0.716	3.405 (10.030)	32.248 [0.021]	12.953 [0.676]	7.101 [0.526]	0.018	0.016	−0.002	0.007	0.270 (0.320)

The monthly returns for emerging markets are from the International Finance Corporation. All returns are calculated in U.S. dollars and are in excess of the 30-day Eurodeposit rate. The world information variables, $\mathbf{Z}^{w}$, are the MSCI world return, the U.S. 3-month Treasury bill return minus the 1-month return, the spread between Moody's BAA rated bonds and AAA bonds, and the Standard and Poor's 500 dividend yield minus the 30-day Treasury bill rate. The local information variables, $\mathbf{Z}^{\ell}$, include the local U.S. dollar return, the change in the foreign currency rate versus the U.S. dollar, the local dividend yield, and a local interest rate. The first factor is the U.S. dollar return on the MSCI value-weighted world market portfolio in excess of the 30-day Eurodollar deposit rate. The second factor is the U.S. dollar return to holding a trade-weighted portfolio of Eurocurrency deposits in 10 countries (G-10 countries plus Switzerland) [details of construction are found in Harvey (1993)] in excess of the 30-day Eurodollar deposit rate.

Table 6
(continued)

The following system is estimated for each asset i:

Disturbance	Orthogonal to
$u_{1it} = r_{it} - Z^{w,\ell}_{t-1}\delta_i$	$Z^{w,\ell}_{t-1}$
$u_{2t} = f_t - Z^{w}_{t-1}\theta$	Z^{w}_{t-1}
$u_{3it} = [u'_{2t}u_{2t}(Z^{w,\ell}_{t-1}\kappa_i)' - f_t u_{1it}]'$	$Z^{w,\ell}_{t-1}$
$u_{4it} = \mu_i - Z^{w,\ell}_{t-1}\delta_i$	1
$u_{5it} = (-\alpha_i + \mu_i) - Z^{w,\ell}_{t-1}\kappa_i(Z^{w}_{t-1}\theta)'$	1

where r represents the excess return on asset i, Z is the predetermined information, δ are coefficients from a linear projection of the asset returns on the information, $Z\kappa_i$ are the fitted conditional betas, f are the factor excess returns, θ are the coefficients from a linear projection of the factor returns on the information, μ is the mean asset return, and α is the difference between the mean asset return and the model fitted mean asset return (pricing error). The standard error of the pricing error parameter is reported in parentheses. Heteroskedasticity consistent Wald tests (with p-values in brackets) are reported for two hypotheses: the conditional betas equal zero and the conditional beta is constant. The last three columns report model diagnostics in the form of linear regressions of the pricing errors on the three information sets: world, local, and combined world and local. The sample is from 1977:04 to 1992:06 (183 observations).

[a]In the test of equal world risk premiums, the world risk premium disturbance u_2 is made orthogonal to $Z^{w,\ell}$. This provides overidentifying conditions that are tested with the reported statistic.

[b]The variance ratio is estimated by adding to the above system:

Disturbance	Orthogonal to
$u_{6it} = \Gamma_i(Z^{w,\ell} - \mu_i)^2 - (Z^{w,\ell}_{t-1}\kappa_i(Z^{w}_{t-1}\theta)' - (-\alpha_i + \mu_i))^2$	1

where Γ_i measures the proportion of predictable variation that the model explains. As in the original system of equation, this augmented model is exactly identified.

[c]Results are reported for a local information set that excludes the local short-term interest rate.

be related to local market information. The results in Table 6 suggest that the world risk premium restriction is rejected for Brazil in the one-factor model and for both Argentina and Brazil in the two-factor model. However, the results of this test do not help us understand the results in the other six countries.

A more likely explanation is that the model is not generating sufficient variation in the expected returns to match the baseline statistical predictability in the returns. The following condition is added to Equation (3):

$$u_{6it} = \Gamma_i(Z^{w,\ell} - \mu_i)^2 - (Z^{w,\ell}_{t-1}\kappa_i(Z^{w}_{t-1}\theta)' - (-\alpha_i + \mu_i))^2, \qquad (6)$$

where Γ_i measures the proportion of predictable variation that the model explains. As in Equation (3), this augmented model is exactly identified.

The variance ratios are reported with heteroskedasticity-consistent standard errors in Table 6. The one-factor model explains, on average, 12 percent of the variation in the predictability across the eight coun-

Table 7
The relation between emerging market returns and the world market return

Country	Correlation with world	Tests of time-varying: Correlation	Tests of time-varying: Variance ratio
Argentina	−0.013	4.330	15.578
	(0.062)	[0.826]	[0.035]
Brazil	0.094	7.337	12.701
	(0.077)	[0.501]	[0.123]
Chile	0.052	11.741	20.275
	(0.084)	[0.163]	[0.009]
Mexico	0.241	10.072	11.349
	(0.087)	[0.260]	[0.183]
Korea	0.235	11.637	12.494
	(0.064)	[0.168]	[0.130]
India	−0.044	9.080	14.882
	(0.072)	[0.336]	[0.061]
Thailand	0.236	12.134	16.933
	(0.110)	[0.145]	[0.031]
Greece	0.153	7.476	11.833
	(0.081)	[0.486]	[0.159]

The monthly returns for emerging markets are from the International Finance Corporation. All returns are calculated in U.S. dollars and are in excess of the 30-day Eurodeposit rate. The world information variables, $\mathbf{Z}^{w}$, are the MSCI world return, the U.S. 3-month Treasury bill return minus the 1-month return, the spread between Moody's Baa rated bonds and Aaa bonds, and the Standard and Poor's 500 dividend yield minus the 30-day Treasury bill rate. The local information variables, $\mathbf{Z}^{\ell}$, include the local U.S. dollar return, the change in the foreign currency rate versus the U.S. dollar, the local dividend yield and a local interest rate. Correlation is measured against the U.S. dollar return on the MSCI value-weighted world market portfolio in excess of the 30-day Eurodollar deposit rate.

The test for constant correlation is estimated for each asset i:

Disturbance	Orthogonal to
$u_{1it} = r_{it} - \mu_i$	1
$u_{2it} = u_{1it}^2 - \sigma_i^2$	1
$u_{3it} = r_{wt} - \mu_w$	1
$u_{4it} = u_{3it}^2 - \sigma_w^2$	1
$u_{5it} = \rho\sigma_w\sigma_i - u_{1it}u_{3it}$	$\mathbf{Z}_{t-1}^{w,\ell}$

where r_i represents the excess return on asset i, r_w represents the excess return on the world market portfolio, $\mathbf{Z}$ is the predetermined information, μ_i is the mean asset return, σ_i^2 is the variance of the asset return, μ_w is the mean world return, σ_w^2 is the variance of the world return, and ρ is the correlation. The correlation parameter reported in the first column is based on an exactly identified version of the above system of equations where the fifth equation is conditioned only on a vector of ones. The heteroskedasticity consistent standard error of the correlation is in parentheses. The test of the constant correlation, in the second column, is based on the overidentified system. The χ^2 statistic has eight degrees of freedom.

The test for constant ratio of world variance to country i variance is

Disturbance	Orthogonal to
$u_{1it} = r_{it} - \mathbf{Z}_{t-1}^{w,\ell}\delta_i$	$\mathbf{Z}_{t-1}^{w,\ell}$
$u_{2it} = r_{wt} - \mathbf{Z}_{t-1}^{w}\theta$	$\mathbf{Z}_{t-1}^{w}$
$u_{3it} = \phi_i u_{1it}^2 - u_{2it}^2$	$\mathbf{Z}_{t-1}^{w,\ell}$

where ϕ_i is the ratio of the variance of the world to the variance of country i's excess returns. The χ^2 test of whether this ratio is constant has eight degrees of freedom. The sample is from 1977:04 to 1992:06 (183 observations).

tries. None of the individual variance ratios are significantly different from zero. The two-factor model is able to account for 22 percent of the predictable variation. However, consistent with the one-factor results, none of the individual variance ratios are significantly different from zero.

Hence, the explained variation in the expected returns is so small that there is little hope for the conditional model to yield any different conclusions than those of the unconditional model reported in Table 4. The variance ratio tests examine the product of the conditional risk function and the world risk premium. It is also potentially insightful to further decompose the model by examining the conditional risk function.

Figure 4 provides plots of the conditional betas from the one-factor estimation along with 60-month rolling correlations calculated with and without the October 1987 observation. For most of the countries, the general movements in the conditional betas are reflected in the rolling correlation measure (which is smoother due to the overlapping samples). This is especially true in the countries with the most significantly time-varying betas: Argentina, Mexico, India, and Thailand.

The behavior of the correlations and the relation between the correlations and market betas is important because some observers interpret increased correlation as evidence of increased market integration. From Figure 4, the numerical magnitude of the correlation has increased in five countries: Brazil, Chile, Mexico, Korea, and Thailand. However, there is no necessary link between correlation and integration. A country can have zero correlation with the world market and be perfectly integrated into world capital markets. The low correlation could be caused by the weighted average of the firm betas in the country index equaling zero.

Table 7 sheds some light on the relation between correlation and beta. Interestingly, the unconditional correlation is significantly different from zero in only three countries: Mexico, Korea, and Thailand. A test of whether this correlation is time varying produces no evidence against the null hypothesis of constant correlation, however, the lowest p-values are found for Chile, Mexico, Korea, India and Thailand.[22]

The correlation is related to beta by the ratio of the world and country standard deviations. Table 7 tests whether the ratio of variances is

[22] The test measures whether the unconditional correlation is constant. A different and more complex test is whether the conditional correlation is constant. This is more complex because it is necessary to model the dynamics of the conditional variance processes for both the country and the world portfolio.

constant in the following system:

$$\begin{aligned} u_{1it} &= r_{it} - Z_{t-1}^{w,\ell}\delta_i \\ u_{2it} &= r_{wt} - Z_{t-1}^{w}\theta \\ u_{3it} &= \phi_i u_{1it}^2 - u_{2it}^2 \end{aligned} \qquad (7$$

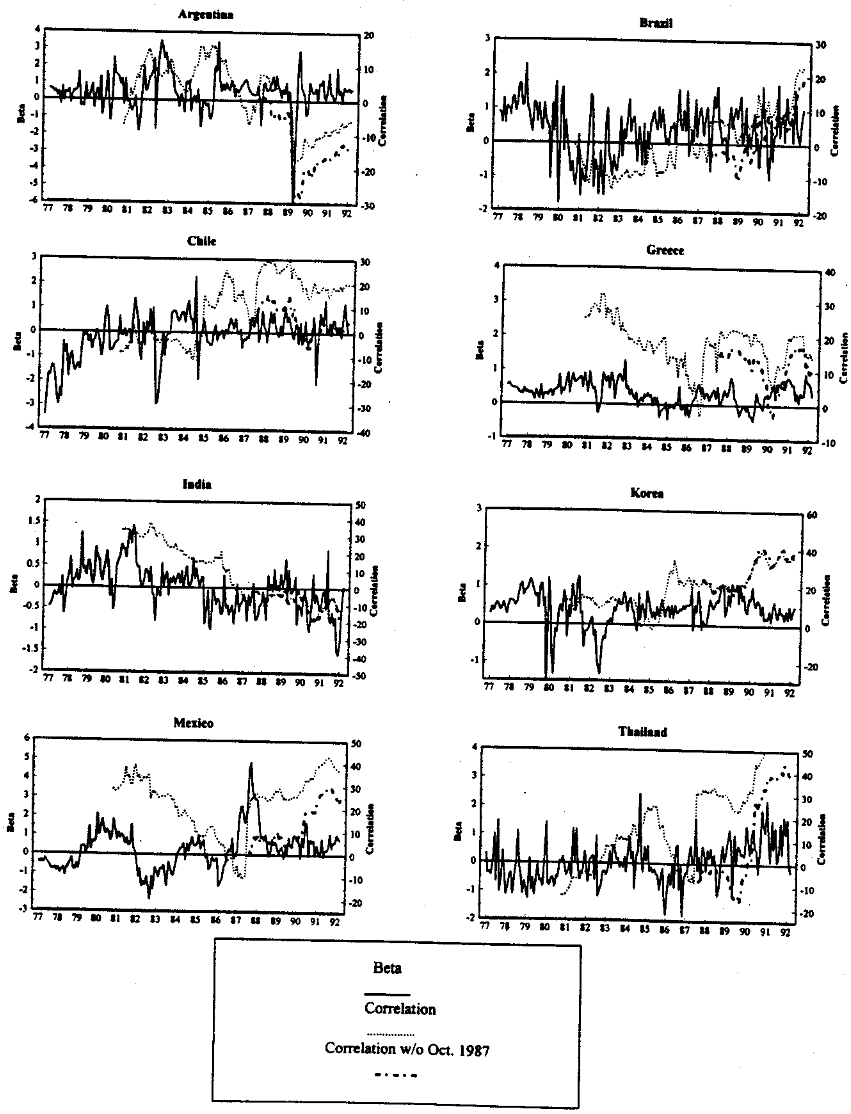

Figure 4
Time-varying conditional betas and correlations with the world market return

where ϕ_i is the ratio of the variance of the world to the variance of country i's excess returns. Conditioning u_1 and u_3 on $Z^{w,\ell}$ and u_2 on Z^w produces a χ^2 test of whether this ratio is constant with 8 degrees of freedom.

This decomposition helps interpret the observation that correlations of the emerging market returns and the world market return are shifting through time. For three of the countries—Argentina, Chile, and Thailand—there is evidence in Table 7 against the null hypothesis that the ratio of variances is constant. For two other countries—Mexico and India—the evidence in Table 6 suggests that the conditional betas are changing through time. Each or both of these two effects could cause time variation in correlations, or they could cancel each other out. But, importantly, the correlation measure, the ratio of volatilities, and the conditional betas are not sufficient to make inference about the degree of integration in these capital markets.

4. Conclusions

This article provides the first comprehensive analysis of 20 new equity markets in emerging economies. These markets have historically been characterized by high average returns and large volatility. However, given the low correlation with developed country returns, the evidence suggests that the emerging market returns are not spanned by the developed market returns. As a result, inclusion of emerging market assets in a mean-variance efficient portfolio will significantly reduce portfolio volatility and increase expected returns.

Figure 4
Facing page: The monthly U.S. dollar returns for eight emerging markets markets are from the International Finance Corpation. The world market return is the U.S. dollar return on the Morgan Stanley Capital International (MSCI) value-weighted world market portfolio. The sample is from 1977:04 to 1992:06. The dotted line denotes rolling unconditional correlations estimated with a 60-month window. The broken line represents rolling unconditional correlations estimated withou the October 1987 observation. The conditional betas result from the estimation of the following system for each asset i:

Disturbance	Orthogonal to
$u_{1it} = r_{it} - Z^{w,\ell}_{t-1}\delta_i$	$Z^{w,\ell}_{t-1}$
$\boldsymbol{u}_{2t} = \boldsymbol{f}_t - Z^{w}_{t-1}\theta$	Z^{w}_{t-1}
$\boldsymbol{u}_{3it} = [\boldsymbol{u}'_{2t}\boldsymbol{u}_{2t}(Z^{w,\ell}_{t-1}\kappa_i)' - \boldsymbol{f}'_t u_{1it}]'$	$Z^{w,\ell}_{t-1}$
$u_{4it} = \mu_i - Z^{w,\ell}_{t-1}\delta_i$	1
$u_{5it} = (-\alpha_i + \mu_i) - Z^{w,\ell}_{t-1}\kappa_i(Z^{w}_{t-1}\theta)'$	1

where r rerpesents the excess return on asset i, Z is the predetermined information, δ are coefficients from a linear projection of the asset returns on the information, $\boldsymbol{f}$ are the factor excess returns, θ are the coefficients from a linear projection of the factor returns on the information, μ is the mean asset return, and α is the difference between the mean asset return and the model fitted mean asset return (pricing error). The conditional betas are assumed to be linear functions of both the world and local information, $Z^{w,\ell}_{t-1}$. The fitted conditional betas are $Z^{w,\ell}_{t-1}\kappa_i$.

Next, the risk of emerging market equities is analyzed. Risk exposure is interlinked with asset pricing theory. That is, exposure is only meaningful if it is rewarded in equilibrium. However, equilibrium models of global asset pricing take, as given, the complete integration of world capital markets. Applying standard one- and two-factor global asset pricing paradigms leads to large pricing errors. The betas are unable to explain any of the cross-sectional variation in expected returns.

Finally, the predictability of the emerging market returns is investigated. Both world and local information variables are used to forecast the returns. There are three important differences between the predictability in emerging and in developed markets. First, in developed markets, the market's correlation with the U.S. return is closely linked to the degree of predictability. In emerging markets, there is no significant association between correlation with the U.S. portfolio and predictability. Second, the amount of predictability found in the emerging markets is greater than that found in developed markets. Third, local information variables play a much more important role in predicting emerging market returns. Indeed, over half of the predictable variance in the emerging market returns can be traced to local information.

Predictability can be induced by time-varying risk premiums, time-varying risk exposures, or a combination of the two. Given the nature of the predictability, in that it is strongly influenced by local information, it is most likely driven by time-varying risk exposures. When a model is estimated that allows for all of the moments to change through time, there is some evidence of time-varying risk exposures. However, the conditional asset pricing models fail to price the emerging market assets correctly on average and are unable to account for the time variation in expected returns.

The fact that much of the predictability is induced by local information is also consistent with the possibility that some of these countries are segmented from world capital markets. Future research will investigate an asset pricing framework that allows for the possibility of incomplete integration and for the degree of integration to change through time.

In contrast to the evidence in developed markets, the global unconditional asset pricing models are unable to explain the cross-section of expected returns in emerging markets. Also different from the evidence in developed markets, the analysis of conditional risk and risk premiums suggests that significant pricing errors persist and the standard asset pricing models do not account for the predictability in the emerging market returns.

While the null hypothesis of complete integration of the world capital markets is difficult to reject for many developed markets, it is likely a factor contributing to the failure of these models for the emerging markets. There are two other approaches. The first is to assume that the emerging markets are completely segmented. The second is to assume that emerging markets are partially integrated. These two approaches are problematic because they assume that the regime is fixed through time. That is, the partial integration models assume that the market can be characterized by the same degree of partial integration over the estimation period. However, intuition would suggest that integration is a dynamic concept. As regulations change and information becomes easier to access, the degree of integration may change through time.

In the context of a one-factor model, a specification that allows for time-varying integration should allow both the covariance with the world market and the variance of the local market return to affect the conditional mean. This research direction is being pursued in Bekaert and Harvey (1995).

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