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Emerging Stock Markets and International Asset Pricing

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This article investigates whether emerging stock markets are now part of the global financial market and characterizes return behavior in these markets. Tests of the conditional International Capital Asset Pricing Model (ICAPM) reveal that eighteen of the twenty largest emerging markets were integrated with the world market between December 1984 and December 1991, but that many of the same markets reject the model when data for 1977–84 are used. These results suggest that large capital inflows from industrial economies, beginning in the late 1980s, caused prices in emerging markets to reflect covariance risk with the world portfolio, thus inducing their consistency with the ICAPM.

The year 1981 saw the formation of the first emerging-market country funds to attract investors to purchase stocks in developing economies; today, big Wall Street brokerages trade issues from developing economies, and the *Financial Times* tracks fourteen emerging markets daily. Stock markets offer a promising channel through which developing economies can attract foreign capital to fund investment and growth. So-called emerging markets are large and expanding rapidly, yet they continue to exhibit very different risk and return characteristics from comparably sized industrial markets. The combination of supranormal yields, highly autocorrelated returns, and volatile prices suggest that these markets may be inefficient, that excess returns may exist, and that emerging markets may not be fully integrated into global capital markets. More important, consistently high rates of return in these economies translate into a high cost of capital, which limits the stock market's role as a source of private financing.

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This article presents strong evidence that emerging markets now adhere to the International Capital Asset Pricing Model (ICAPM) in that expected returns reflect expected covariance with the world portfolio. In tests of the conditional ICAPM using monthly data from December 1984 to December 1991, the model cannot be rejected for eighteen of the twenty emerging markets. Tests on data for 1977–84, however, indicate that few emerging markets were integrated before the late 1980s. These results suggest that large capital inflows from industrial economies, catalyzed by Southeast Asian stock market booms around 1987, induced ICAPM relationships to evolve in many previously segmented markets.

Section I establishes characteristics of emerging markets that may affect whether standard models can accurately price emerging-market stocks. Section II covers the econometric methodology for estimating the ICAPM, and section III documents the data. Section IV presents results of the ICAPM estimates for 1985–91; section V presents estimates using data for 1977–84. Section VI offers conclusions.

I. Characterizing Emerging Markets

Although emerging stock markets have risen swiftly both in value and as a source of financial flows, they remain different in many ways from the mature markets in industrial economies. This section characterizes return patterns and policy attributes that distinguish emerging markets from their industrial counterparts.

Price and return patterns reveal some of the most crucial differences between emerging and mature markets. Many markets in developing economies offer yields far in excess of industrial-market returns and low-to-negative correlation with the world market. Both of these facts suggest that unexploited profit opportunities may exist. High autocorrelation in returns, characteristic of speculative inefficiency, indicates that lagged prices may contain information about future returns; volatile stock prices also suggest inefficiency. In addition, rapidly rising price-earnings ratios (see table 1) signal ongoing transition in emerging markets. From 1988 to 1991, price-earnings ratios more than doubled in seven of twenty emerging markets tracked by the International Finance Corporation's Emerging Markets Data Base (IFC EMDB), and more than tripled in four (Argentina, Chile, Pakistan, and Turkey). During the same period, the price-earnings ratio of the *Morgan Stanley Capital International Perspective* (MSCI) world index rose only 22 percent (Capital International Perspective, S.A. and Morgan Stanley & Co., various issues).

High price volatility in emerging markets may stem from small-market effects and informational imperfections. With few trades occurring, information about stock value—and therefore stock prices—tends to be noisy. Moreover, limited reporting requirements in many markets mean that investors typically have less information about firms and receive less-frequent updates than do investors in

Table 1. *Price-Earnings Ratios in Selected Markets, 1986–91*

Market	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*	*1991/1986*
Emerging markets							
Argentina	16.0	3.8	11.3	22.1	3.1	38.9	2.4
Brazil	4.2	15.4	8.0	8.3	5.3	7.7	1.8
Chile	5.3	5.0	4.4	5.8	8.9	17.4	3.3
Colombia	8.3	11.6	8.8	7.0	10.7	26.1	3.2
Greece	—	30.5	10.6	24.3	26.2	10.4	0.3[a]
India	18.0	22.1	21.5	18.3	20.6	13.9	0.8
Indonesia	—	—	—	—	30.8	26.7	—
Jordan	12.9	12.8	17.3	14.9	8.2	10.6	0.8
Korea, Rep. of	25.7	21.7	39.5	38.6	21.5	17.6	0.7
Malaysia	32.7	30.7	24.1	30.8	23.0	14.6	0.4
Mexico	10.5	6.2	5.0	10.7	13.2	24.4	2.3
Nigeria	5.8	4.9	6.1	7.0	7.0	9.7	1.7
Pakistan	8.2	6.9	9.4	8.4	8.5	23.9	2.9
Philippines	4.4	8.9	9.9	18.5	24.5	16.2	3.7
Portugal	24.8	27.2	26.5	21.4	15.5	18.9	0.8
Taiwan (China)	12.0	13.0	40.2	51.2	44.4	14.5	1.2
Thailand	12.5	10.5	12.6	23.1	10.9	17.2	1.4
Turkey	—	19.8	2.6	17.6	22.5	21.6	1.1[a]
Venezuela	9.4	16.9	11.5	6.4	29.3	30.5	3.2
Zimbabwe	4.2	7.0	4.2	7.0	12.0	8.4	2.0
Industrial markets							
New York	16.8	15.4	12.2	14.7	15.2	21.9	1.3
Tokyo	47.3	58.3	58.4	70.6	39.8	37.8	0.8

— Not available.
Note: The price-earnings ratio is the ratio of end-of-month price to trailing twelve-month earnings.
a. 1991/1987.
Source: Author's calculations based on data from the IFC EMDB.

industrial markets. Uncertainty about the financial condition of firms may introduce high variance in expected returns. In a small securities-market, trades that are small by New York standards may adversely affect prices; limitations on the size of transactions may prevent investors from fully exploiting all available information and may explain why emerging-market returns contain a large forecastable component.

Many developing economies impose capital controls that insulate the local stock exchange from global markets. Markets in which neither foreign nor local capital can freely cross borders lack the capital flows necessary to induce an ICAPM relationship (assuming that capital controls prove effective in preventing financial flows). All but five of the twenty markets considered here bar nationals from holding foreign securities; as a result, emerging markets are populated by investors who cannot diversify internationally. All but two of the markets banned or severely restricted foreign investment during part of the 1985–91 sample period. Because barriers to foreign investment limit the number of market participants, they also restrict the capital supply and thus the market's capital formation potential capital. A look at actual openings to foreign investment shows that market capitalization rose permanently within a few years of many of the earlier openings, as happened in Chile, Mexico, the Philippines, Turkey, and Venezuela (table 2).

Table 2. *Year-End Price-Earnings Ratios and Turnover Ratios for the Year before and the Year of Selected Market Openings*

		Price-earnings ratio		*Market capitalization*		*Turnover ratio*		
Market	*Opening date*	*Before opening*	*After opening*	*Before opening*	*After opening*	*Before opening*	*After opening*	*Nature of opening*
Argentina	October 1991	3.11	38.89	3.27	18.5	33.6	45.3	Full opening
Brazil	September 1987	4.24	15.38	42.1	42.7	74.4	41.5	Country fund admitted
	May 1991	5.34	7.65	16.3	42.7	23.6	22.0	Full opening
Chile	October 1989	4.4	5.82	6.8	28.0	6.3	8.8	Country fund admitted
Colombia	October 1991	10.66	26.08	1.4	4.0	5.6	7.1	Full opening
Indonesia	March 1989	—	—	0.2	6.8	2.5	38.6	Minor restrictions on entry and exit; previously, wholly closed
Mexico	May 1989	5.04	10.66	13.8	101.2	51.7	33.3	Restrictions reduced
Pakistan	June 1991	8.53	23.87	2.9	7.3	8.7	12.6	Full opening
Philippines	October 1989	9.92	18.5	4.3	10.2	24.4	29.1	Country fund admitted
Portugal	January 1986	—	—	0.2	9.6	4.0	7.1	Full opening
Turkey	December 1989	2.62	17.64	1.1	15.7	5.5	19.0	Country fund admitted
Venezuela	December 1988	16.91	11.45	2.3	11.2	8.1	10.9	Minor restrictions on entry and repatriation; previously, special share classes only

— Not available.

Source: Author's calculations based on data from the IFC EMDB and IMF (various years).

Because many of the openings occurred in 1991, it is too early to judge whether market capitalization will sustain a rise. After some lag, the number of listings may also expand as more firms go public, able to meet the now-reduced costs of raising capital in the stock markets. Turkey's market had 50 listings in the three years up to and including its 1989 opening; by 1992, 145 firms were traded. Indonesia had 24 listings one year prior to its 1989 opening, 57 by the end of 1989, and 155 by the end of 1992. Turnover ratios also rose after 9 of 12 openings, with the exceptions of Mexico's marginal 1989 opening and Brazil's 1987 and 1991 openings (see table 2).

Those markets that have liberalized restrictions on foreign investment have consistently experienced huge price increases. In 1991 four countries eliminated closed-market regimes in favor of policies of free entry and exit. In the period from December before the opening to December after the opening each country witnessed increases in the price-earnings ratio of between 40 and 1,000 percent; Argentina witnessed an increase of 1,150 percent; Brazil, 43 percent; Colombia, 145 percent; and Pakistan, 180 percent (see table 2). Argentina previously admitted foreign investors but prohibited repatriation of capital before three years had passed from the date of initial investment. Brazil admitted investment only into special share classes or through a country fund and also restricted repatriation.

Because broader economic reforms typically accompany financial openings, price-earnings ratios may in some cases rise in the short run in expectation of future gains in earnings and then return to their previous levels once earnings increase. However, in a number of cases price-earnings ratios have risen continuously for several years after the opening. The continuous rise suggests that the markets were historically undervalued and that their opening reduced the cost of capital permanently; the 1989 openings in Chile, Mexico, and the Philippines all provide examples. Although a trade opening should reduce rents in monopolized local industries, earnings may actually rise in competitive industries. The entry of foreign firms increases competition in the local market, forcing domestic firms to become more productive, efficient, and competitive to survive. As a result, the government can no longer appropriate rents from local producers as high as those before the opening, whether through taxation, fees, or kickbacks. The average return retained by local firms may therefore actually rise, and earnings may also rise as the firms become more streamlined and efficient.

Returns in emerging markets may also be affected by the fact that the policy environment tends to be less stable in developing than in industrial economies. Uncertainty about policies governing future earnings may introduce "peso problems" if investors fear some low-probability policy shift that will dramatically reduce returns: a devaluation, closing of the stock market, expropriation, or imposition of capital controls that bar repatriation of capital or profits. The potential for any of these events to occur reduces the expected liquidity of holding emerging-market stocks and may cause what appear to be excess returns in a period in which the bad state fails to materialize.

II. SPECIFICATION OF THE CONDITIONAL ICAPM

The International Capital Asset Pricing Model (ICAPM) states that if emerging markets are part of a global market, then each market's expected returns should be proportional to that market's covariance with a capitalization-weighted world portfolio. If emerging markets are not integrated into the world market—that is, if returns do not reflect covariance with the world portfolio—then by adding issues from emerging markets to their portfolios, investors can both reduce overall risk and increase expected returns. As investors in industrial economies increasingly participate in emerging markets (and investors in developing economies increasingly participate in industrial markets), the investors should exploit and subsequently eliminate any excess returns relative to the ICAPM.

This article takes as given the ICAPM's validity as a description of mature markets because of its success at describing return behavior on the exchanges of industrial economies (see Harvey 1991 and Dumas and Solnik 1992). Treating each economy's market index as a portfolio, the article tests whether market returns in developing economies are consistent with the model's predictions. The study examines data for twenty markets during 1985–91 and also for a smaller, longer sample during 1977–91 to investigate whether emerging markets became more integrated after inflows of equity capital from industrial economies took off in the late 1980s. The article's objective is to determine to what extent emerging markets behave like industrial markets in relation to the world portfolio and to examine how the relation between emerging markets and the world portfolio has changed over time.

Numerous studies have used international data to test the Sharpe-Lintner asset-pricing model (Sharpe 1964 and Lintner 1965). The model assumes that investors divide their wealth between a riskless asset and risky assets or stocks in proportions that depend on each investor's risk aversion. Extending the model internationally allows investors to choose among stocks from many countries rather than from a single stock market; the market portfolio now includes all the assets in the world. In choosing a portfolio of risky assets, investors seek a high expected-return–to–variance ratio.

The ICAPM states that the expected return on any given risky asset in excess of the safe rate is proportional to the expected return on the market in excess of the safe rate:

$$\begin{aligned} E(R_{jt}) - R_{ft} &= \beta_j\,[E(R_{wt}) - R_{ft}] \\ &= \frac{\operatorname{cov}(R_{wt}, R_{jt})}{\operatorname{var}(R_{wt})}\,[E(R_{wt}) - R_{ft}] \end{aligned} \tag{1}$$

where R_{jt} is the total return on some asset j, R_{ft} is the rate of return on the risk-free asset, β_j is the proportionality factor $[\beta_j = \operatorname{cov}(R_{wt}, R_{jt})/\operatorname{var}(R_{wt})]$, and R_{wt} is the total return on the world, or market, portfolio. Under the model, optimizing behavior leads investors to care only about covariance risk with the market portfolio and about no other sources of risk; the ICAPM relation should evolve out of investors' efforts to diversify risk. A stock or portfolio is integrated with the defined market in an ICAPM sense if its returns are consistent with the model. Many empirical studies reduce the model's complexity by creating portfolios of stocks and allowing the investors to divide their assets between the riskless asset and the risky portfolios. This study takes that approach, using a representative portfolio for each emerging market.

A weakness of the ICAPM is that the model assumes independent and identically distributed returns and ignores the presence of serial correlation. Given serially correlated returns, most investors would likely prefer a more complicated, intertemporal strategy to the ICAPM. In fact, the presence of serial correlation in industrial markets has been established by Cutler, Poterba, and Summers (1991) and emerging-market returns display strong serial correlation at short intervals. Because the objective here is to evaluate whether emerging markets behave like industrial markets in terms of the fit of the ICAPM, the estimates will remain faithful to the standard formulation of the model and will not correct for serial correlation.

Several recent studies test asset-pricing models on data from emerging markets. De Santis (1993) finds that adding assets from emerging markets to a benchmark portfolio of U.S. assets induces a statistically significant change in the volatility bounds. This result suggests that standard asset-pricing models that perform well on data on assets from industrial economies may fail to price assets traded on exchanges in emerging markets. Claessens, Dasgupta, and Glen (1993) compare the fit of a single-factor ICAPM and a multifactor model for eighteen markets during 1988–92. They conclude that the additional factors generate a better fit; the improvement is not, however, shown to be statistically significant. Moreover, even the multifactor model is rejected for every economy except Brazil. The poor fit of either model may be caused by the short sample period. Errunza, Losq, and Padmanabhan (1992) attempt to classify eight emerging markets during 1976–87 as integrated, mildly segmented, or segmented and find that the hypothesis of mild segmentation is rejected least frequently. However, the fact that India rejects all three models raises questions about Errunza, Losq, and Padmanabhan's classification scheme; and their use of the U.S. market to represent the world portfolio, during a period when the U.S. market represented two-fifths of world capitalization, may have affected their results.

Following recent work by Harvey (1989, 1991) and Dumas and Solnik (1992), this study uses conditional or expectational asset pricing to test the Sharpe-Lintner model. "Conditional" refers to the use of conditioning information—some information set Z_{t-1}—to calculate expected moments and to test properly the ICAPM as a relation between expected returns and ex ante risk. Earlier tests of the ICAPM used realized or ex post return and covariance data and thereby failed to capture the ex ante relationship described by the theoretical model.

The conditional formulation restricts the conditionally expected return on an asset (based Z_{t-1}) to be proportional to the asset's covariance with the market portfolio, yet allows expected returns to vary over time:[1]

$$E[r_{jt}|Z_{t-1}] = \beta E[r_{wt}|Z_{t-1}] \tag{2}$$

$$\text{where } \beta_{jt-1} \equiv \frac{\operatorname{cov}(r_{jt}, r_{wt}|Z_{t-1})}{\operatorname{var}(r_{wt}|Z_{t-1})},$$

where r_{jt} and r_{wt} represent the excess returns on an asset j and the world portfolio, respectively. The proportionality factor β_j, which is also calculated using conditional moments, represents the price of covariance risk or the expected return compensation investors demand for taking on a unit of covariance risk. The modeling and specification borrow from Harvey (1991).

The conditional ICAPM successfully explains both time-series variation and cross-sectional differences in Organization for Economic Cooperation and Development (OECD) market returns.[2] Harvey (1991) finds returns consistent with the ICAPM in fourteen of seventeen industrial country markets—an 82 percent success rate—during 1970–89; only Austria, Denmark, and Japan reject the model. Moreover, the betas he obtains for each market correspond in ranking to the ranking of mean returns across these markets, with the exception of underestimating the Japanese return. The fact that the model fails for Austria and Denmark, the two smallest OECD markets, suggests that illiquidity or other small-market effects may impede the evolution of ICAPM relationships. Harvey also runs a multimarket test over all Group of Seven nations and is unable to reject the model. Using a slightly different formulation, Dumas and Solnik (1992) analyze U.S., German, and Japanese returns simultaneously and are unable to reject the model as a description of return patterns in all three markets.

The estimates in this article impose the restriction that β is constant over time and test whether expected returns in the local market are proportional to the expected return on a benchmark portfolio, in this case the world portfolio. Hansen's (1982) generalized method of moments (GMM) is used to estimate a constant proportionality factor β,

$$\epsilon_{jt} = r_{jt} - r_{wt}\beta_j , \tag{3}$$

which is equivalent to equation 2. In the orthogonality condition

$$f(r_{jt}, \beta_j) = \epsilon_{jt}' Z_{t-1}, \tag{4}$$

r_{jt} and r_{wt} denote the local and world excess returns in U.S. dollars, and ϵ_{jt} is the vector of errors from estimating equation 3. Z_{t-1} contains l information variables (instruments) and is a subset of the $t - 1$ information set. The rise of international capital flows to these markets suggests that β may have changed

1. Conditional variances and covariances may also be allowed to vary over time, with sufficient data. The short sample of emerging-markets data does not permit estimation of time-varying variances or covariances. See Harvey (1991) for an example.

2. The unconditional formulation of the model has done poorly.

over time. However, the brevity of the data series currently available prohibits estimation of time-varying betas (because of inadequate degrees of freedom). Estimation of time-varying betas will be possible and advisable in future work, when longer time series become available.

Single-market tests determine whether the time-series behavior of local returns accords with equation 4 and identify which emerging markets do not reflect covariance with the world market. However, the single-market tests do not impose one of the ICAPM's restrictions: that the price of covariance risk must be the same for each market. The price of covariance risk is the conditionally expected world-market return divided by the conditional variance of the world market return:

$$\frac{E[r_{wt} | Z_{t-1}]}{\text{var}[r_{wt} | Z_{t-1}]} = \kappa \quad \text{and} \tag{5}$$

$$\beta_j = \text{cov}[r_{jt}, r_{wt} | Z_{t-1}] * \kappa \quad \text{for all } j.$$

A stricter test of the model, including the cross-asset restriction, is obtained by estimating equation 3 on multiple markets in a system.

For details of GMM estimation see the attached technical appendix or Ogaki (1992).

III. Data and Summary Statistics

The data for stock exchanges in developing economies come from the Emerging Markets Data Base (EMDB) compiled by the International Finance Corporation (IFC, various years). The IFC has constructed its own indexes for every market. The indexes typically include 10 to 20 percent of listed stocks, selected on the basis of high trading volume or large capitalization or to give the index an industry composition representative of the market overall. Like many industrial-market indexes, the IFC indexes are biased toward local blue-chip stocks, and this somewhat diminishes their representativeness. All empirical work in this article uses the IFC's representative indexes and treats each as a stock portfolio. I choose to work with the IFC indexes instead of the locally calculated market indexes because the former offer greater comparability across markets and are, I believe, more carefully calculated. Monthly index (and stock) data are available for seventeen markets from December 1984 to December 1991; data for Portugal, Turkey, and Indonesia start in December of 1986, 1987, and 1988, respectively. The data base includes series dating back to December 1976 for ten markets; prior to 1985, however, fewer stocks were sampled to create the market indexes. The ten markets with longer data series are those of Argentina, Brazil, Chile, Greece, India, Jordan (beginning in 1978), the Republic of Korea, Mexico, Thailand, and Zimbabwe.

Market data for industrial nations come from MSCI. MSCI's indexes represent European, Japanese, U.S., and world market portfolios. The MSCI's capitalization-weighted thirteen-market index for Europe includes Austria, Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom. Ideally, the world index would include all the emerging-market stocks used in this analysis as well as stocks from the industrial markets, but neither the MSCI index nor any other standard world index does so.

Like the EMDB indexes, MSCI indexes contain only selected stocks and are weighted toward large capitalization issues; studies have found, however, that MSCI indexes are highly correlated with commonly quoted national indexes such as the New York Stock Exchange index (99.1 percent correlation) or the Nikkei 255 (93.8 percent; Harvey 1991). The MSCI indexes differ from EMDB indexes in that investment companies and foreign-domiciled companies are excluded to avoid double counting. However, other forms of double counting still pose problems. According to McDonald (1989) and French and Poterba (1989), MSCI's world index weights Japanese stocks too heavily because it fails to correct for the extensive corporate cross-ownership. Unfortunately, no world index corrected for cross-holding exists (see Harvey 1991).

All returns in industrial and emerging markets are calculated as the excess return in dollars over the holding yield on the U.S. Treasury bill closest to thirty days to maturity on the last trading day of the month. Government bond data come from the Center for Research on Securities Prices (CRSP) Government Bond File. The U.S. inflation component in dollar stock returns cancels out against the inflation component in the Treasury bill return.

Ideally, the set of instrumental variables should replicate the information investors use to predict prices. For each period, actual rates of return set during the previous period serve as conditioning information. This choice allows expected returns to vary over time. The common-instrument set, identical for all emerging markets, contains information about industrial-market returns only; local-instrument sets also include the lagged rate of return in the local market that investors would likely consider in their investment decision. Preliminary tests also considered the lagged local-dividend yield and the lagged return on the dollar–local currency exchange rate as instruments. In regressions of returns on lagged instruments (not reported), the addition of the lagged local return substantially improves return prediction.

The selection of common instrumental variables draws on studies of U.S. stock returns and returns in other industrial economies. Following Harvey (1991), the information set includes the lagged world excess stock return, a dummy variable for the month of January, the dividend yield on the MSCI world index, a U.S. term structure premium, and the U.S. default risk–yield spread. The lagged return on the world market portfolio is included; Fama (1970) and many studies since have found autocorrelation in returns. The January dummy is included because Keim (1983) and Gultekin and Gultekin (1983) find systematically higher January returns in the United States and other industrial economies; Claessens, Dasgupta, and Glen (1993) find statistically significant January effects in seven of eighteen emerging markets. The U.S. term structure premium is calculated as the one-month return to holding a three-month Treasury bill less the return on a bill thirty days to maturity. Campbell and Hamao (1989) show that measures of the term structure statistically explain returns in Japan and the United States. The default risk spread, measured here as the difference between the yield on a Moody's Baa bond and a Moody's Aaa bond, is included because of the findings of Keim and Stambaugh (1986) and Fama and French (1989) that the junk bond spread helps in predicting stock market returns. The final instrumental variable is the dividend yield on the world portfolio. Fama and French (1988, 1989) show the importance of this term in predicting U.S. returns; Cutler, Poterba, and Summers (1989) find that lagged dividend yields also influence international returns. Again, all returns are calculated in excess of the return on a Treasury bill thirty days to maturity.

Table 3 presents summary statistics on the twenty emerging markets in the EMDB and the MSCI European, Japanese, U.S., and world indexes, calculated from January 1985 to December 1991. All calculations use monthly total (not excess) returns. Fourteen emerging markets have mean returns exceeding those of all the industrial-market indexes, whereas five have mean returns below the industrial-market range. However, only five emerging markets (Chile, Colombia, Pakistan, the Philippines, and Zimbabwe) have higher reward-to-risk ratios (mean/standard deviation) than the industrial markets, and all five of these opened during the sample period. Figure 1 plots mean returns against return variance for all twenty-four markets. All four industrial-market indexes are closely clustered, offering very low variances but also lower-than-average returns. Three emerging markets (India, Korea, and Pakistan) also join this tight cluster, and another four (Chile, the Philippines, Thailand, and Zimbabwe) offer higher means for only a small increase in variance. Note that Argentina, Brazil, and Turkey have very large return variances.

More striking is the high return autocorrelation in many emerging markets, shown in table 3. Among industrial markets, the world index exhibits the highest one-month autocorrelation at 0.0713, and only Japan exhibits positive autocorrelation at two months. In contrast, fifteen emerging markets exhibit one-month autocorrelation exceeding 0.1000, and the predictable component rises as high as 0.5509 for Indonesia and 0.4999 for Colombia; for Chile, Colombia, Indonesia, and the Philippines the autocorrelations are significant at 95 percent confidence. Six markets also demonstrate autocorrelation over 0.1000 at two-month intervals, although most emerging markets exhibit mean reversion after two to three months. The high predictable component in returns in emerging markets far exceeds the autocorrelation in industrial markets. High serial correlation suggests that returns contain a predictable component and, according to efficient-markets models that assume risk-neutral investors, that the market is inefficient (see LeRoy 1989 for a survey of the efficient-markets literature).

The correlation matrices of total equity returns in table 4 show that emerging markets are generally less correlated with the world portfolio and with industrial markets than industrial markets are with each other. During 1985–91, the U.S.,

Table 3. *Summary Statistics on Monthly Total Equity Returns, Including Reinvested Dividends, January 1985 to December 1991*

Market	*Mean*	*Standard deviation*	*Reward/ risk ratio*	*Autocorrelation* ρ_1	ρ_2	ρ_3	ρ_4	ρ_5
Europe	0.0178	0.0574	0.3103	−0.0176	−0.0646	0.0141	0.0566	−0.1214
Japan	0.0164	0.0786	0.2080	0.0192	0.0012	0.0025	0.0388	0.1383
United States	0.0138	0.0513	0.2682	0.0545	−0.0903	−0.0921	−0.1850	−0.0481
World	0.0146	0.0488	0.2991	0.0713	−0.0458	−0.0329	−0.1073	0.0274
Argentina	0.0358	0.2797	0.1279	−0.1045	−0.1087	0.0949	−0.2005	−0.1158
Brazil	0.0069	0.2239	0.0308	−0.0483	0.0768	−0.0717	−0.0921	−0.0234
Chile	0.0402	0.0779	0.5159	0.3147**	−0.0404	−0.2566	−0.1809	0.1005
Colombia	0.0334	0.0779	0.4287	0.4999**	0.1961	0.0374	0.0271	0.0378
Greece	0.0244	0.1292	0.1891	0.1282	0.1591	−0.0060	−0.1650	−0.1327
India	0.0146	0.0852	0.1712	0.0500	−0.0291	0.0538	0.0249	−0.1425
Indonesia[a]	−0.0215	0.1006	−0.2138	0.5509**	0.2867	0.1835	0.2753	0.6103
Jordan	0.0038	0.0531	0.0707	0.0751	0.0526	0.2962**	0.0243	0.2791
Korea, Rep. of	0.0194	0.0833	0.2323	−0.0268	0.2075*	−0.0186	0.2030	0.1256
Malaysia	0.0079	0.0812	0.0974	0.1109	0.0808	−0.0438	0.0423	−0.0893
Mexico	0.0361	0.1593	0.2268	0.3494	−0.1669	−0.2875	−0.0560	−0.0889
Nigeria	−0.0001	0.1179	−0.0007	0.1241	−0.0488	−0.1300	0.1124	−0.0006
Pakistan	0.0206	0.0547	0.3759	0.3789*	0.0365	0.0647	0.1375	0.0264
Philippines	0.0348	0.1101	0.3162	0.3652**	0.0261	0.0520	0.1669	0.0864
Portugal	0.0303	0.1390	0.2177	0.2846	−0.0098	0.0271	0.2686	0.0646
Taiwan (China)	0.0234	0.1591	0.1468	0.0391	0.0730	−0.0411	0.0410	0.1679
Thailand	0.0261	0.0906	0.2883	0.1034	0.0360	−0.0534	−0.2401	−0.1184
Turkey	0.0579	0.2294	0.2524	0.1804	0.0298	0.2486	0.2723	−0.0977
Venezuela	0.0267	0.1393	0.1913	0.2124	0.2012**	0.0558	−0.0167	−0.1320
Zimbabwe	0.0270	0.0833	0.3234	0.2749*	0.2544	0.2134	0.1678	−0.2273

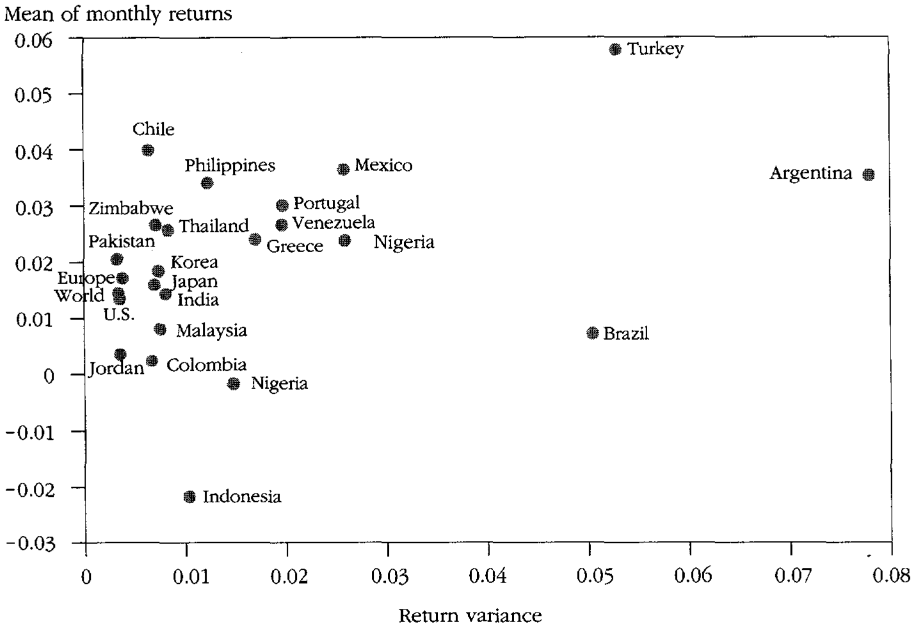
* Significant at 90 percent.

** Significant at 95 percent.

a. The calculations are based on only twenty-four observations because the EMDB began tracking the Jakarta market only in December 1989.

Source: Author's calculations based on data from the IFC EMDB.

Figure 1. *Mean Returns and Return Variances in Selected Emerging and Industrial Markets, 1985–91*



Source: Author's calculations based on the Emerging Markets Data Base (EMDB).

Japanese, and European portfolios all exhibit correlations of 0.75 or above with the world market. However, correlations with the world portfolio that exceed 0.25 are exhibited in only seven emerging markets: Malaysia (with the highest correlation, at 0.51), Thailand, Portugal, Korea, the Philippines, Mexico, and Taiwan (China). Meanwhile, Argentina, Indonesia, India, Turkey, Venezuela, and Zimbabwe all offer consistent hedges against the world markets. From December 1976 to December 1984, emerging markets exhibited on average even less correlation with the industrial markets. Two facts—that the markets best known to foreign investors are those most correlated with the industrial markets and that correlations between industrial and emerging markets have risen over time—suggest that once foreign investors "discover" an emerging market, it quickly becomes part of the global market. Bekaert (1993) further discusses the link between market correlation and market integration.

IV. Tests of a Conditional ICAPM with Time-varying Expected Returns, 1985–91

Tests of the conditional ICAPM on two different time periods reveal that many emerging markets were integrated into the global capital market during

Table 4. *Total Return Correlations including Reinvested Gross Dividends, in Selected Markets, 1985–91 and 1976–84*

A. 1985–91

Market	*Brazil*	*Chile*	*Colombia*	*Greece*	*Indonesia*	*India*	*Jordan*	*Korea, Rep. of*	*Mexico*	*Malaysia*	*Nigeria*
Argentina	−0.06	−0.02	−0.07	0.04	−0.23	0.22	−0.13	−0.14	0.11	−0.04	0.11
Brazil		0.13	0.03	−0.01	−0.12	−0.03	−0.04	0.01	−0.01	0.12	0.00
Chile			0.10	0.17	0.03	−0.06	−0.06	0.12	0.33	0.27	0.04
Colombia				0.22	0.16	−0.08	0.05	−0.09	0.07	0.03	0.03
Greece					0.34	0.04	0.07	−0.14	0.15	0.08	0.05
Indonesia						−0.03	0.21	−0.11	0.23	0.43	−0.26
India							0.14	−0.03	−0.00	−0.05	0.07
Jordan								−0.17	−0.04	0.06	−0.01
Korea, Rep. of									0.15	0.10	0.01
Mexico										0.44	−0.09
Malaysia											−0.22
Nigeria											
Taiwan (China)											
Pakistan											
Philippines											
Portugal											
Thailand											
Turkey											
Venezuela											
Zimbabwe											
United States											
Japan											
Europe											

B. 1976–84

Market	*Brazil*	*Chile*	*Greece*	*India*	*Jordan*	*Korea, Rep. of*
Argentina	−0.07	0.08	0.05	0.09	−0.03	−0.06
Brazil		−0.10	−0.17	−0.22	−0.01	−0.02
Chile			0.23	0.11	0.17	0.01
Greece				0.25	0.32	−0.04
India					0.35	−0.02
Jordan						−0.16
Korea, Rep. of						
Mexico						
Thailand						
Zimbabwe						
United States						
Japan						
Europe						

Source: Author's calculations.

Taiwan (China)	Pakistan	Philip- pines	Portu- gal	Thai- land	Turkey	Vene- zuela	Zim- babwe	United States	Japan	Eu- rope	World
−0.02	−0.03	−0.11	−0.03	0.10	0.10	0.08	−0.26	0.04	−0.13	−0.08	−0.09
0.10	0.01	0.13	0.11	0.07	0.13	−0.18	−0.02	0.12	0.16	0.14	0.17
0.35	−0.05	0.23	0.24	0.27	0.01	−0.20	−0.02	0.33	0.07	0.19	0.22
0.07	0.51	0.08	0.17	0.11	0.06	0.02	−0.19	0.14	0.00	0.08	0.09
0.05	−0.10	0.12	0.42	0.32	0.20	−0.08	0.01	0.15	0.06	0.18	0.16
0.18	0.20	0.48	0.09	0.48	0.17	0.04	0.28	0.20	−0.20	0.18	−0.01
−0.12	0.08	−0.09	−0.06	0.01	0.23	0.05	0.07	−0.05	−0.12	0.08	−0.06
0.12	0.08	0.11	−0.02	0.15	−0.16	0.01	0.06	0.02	0.10	0.23	0.13
0.05	−0.02	0.20	0.10	−0.02	−0.09	−0.23	−0.12	0.26	0.35	0.23	0.36
0.34	0.03	0.10	0.43	0.39	0.12	−0.05	−0.09	0.45	0.09	0.23	0.30
0.30	−0.03	0.34	0.28	0.57	0.20	0.01	0.01	0.57	0.24	0.43	0.51
−0.18	0.01	−0.00	−0.22	−0.12	0.08	0.03	−0.06	0.02	0.08	0.06	0.05
	−0.02	0.12	0.35	0.43	0.12	−0.25	−0.08	0.20	0.21	0.17	0.26
		−0.01	0.00	0.12	−0.00	0.05	−0.14	−0.01	−0.05	0.08	0.00
			0.07	0.27	−0.01	−0.19	0.01	0.30	0.29	0.29	0.36
				0.39	0.22	−0.06	0.12	0.23	0.40	0.34	0.42
					0.19	−0.09	−0.04	0.42	0.26	0.42	0.46
						−0.16	0.05	−0.05	−0.00	0.05	−0.00
							0.07	−0.09	−0.16	−0.13	−0.16
								−0.09	0.01	−0.06	−0.05
									0.25	0.64	0.75
										0.52	0.79
											0.84

Mexico	Thailand	Zim- babwe	United States	Japan	Europe	World
0.16	−0.16	0.17	0.07	0.08	0.09	0.11
−0.13	−0.17	−0.10	−0.06	−0.13	−0.02	−0.07
0.04	−0.03	0.23	−0.15	0.08	0.04	−0.06
−0.20	0.13	0.31	0.03	0.19	0.25	0.15
−0.00	0.14	0.27	−0.01	0.28	0.28	0.17
−0.04	−0.04	−0.01	0.15	0.10	0.24	0.20
0.05	0.07	−0.09	0.04	0.15	0.12	0.09
	0.06	0.15	0.12	0.03	0.13	0.15
		−0.06	−0.13	0.05	0.13	−0.04
			0.05	0.06	0.15	0.11
				0.22	0.46	0.86
					0.53	0.59
						0.79

1985–91 but that many of the same markets reject the model when data for 1977–84 are used. Indeed, the late 1980s marked a change in the relation between emerging markets and world financial markets as the emerging markets began receiving large capital inflows from industrial economies. The greater success of integration tests in the more recent sample indicates that many emerging markets were segmented from international capital markets until the late 1980s and suggests that rising cross-border capital flows served as the means of integration.

Table 5 presents tests of a conditional ICAPM with heteroskedasticity-corrected errors on individual markets from January 1985 to December 1991. As modeled in section II, the original Sharpe-Lintner formulation assumes that asset returns are proportional to the return on the world market portfolio, with coefficient of proportionality β. The third and fourth columns of table 5 provide chi-squared statistics for each test; high chi-squared statistics indicate poor fit. The p-value (in parentheses in the third and fourth columns) indicates the probability that if the model's errors were indeed distributed chi-squared with the given degrees of freedom, a value exceeding the calculated chi-squared value would be obtained. The discussion will focus on whether or not the model is rejected with 90 percent or more confidence (denoted by a p-value smaller than 0.10).

For eighteen of twenty markets, the ICAPM cannot be rejected using either instrument set; only Mexico and Zimbabwe reject the model, both with over 95 percent confidence and using both the local- and common-instrument sets.[3] That the ICAPM can be rejected in only two markets gives strong evidence that emerging markets were integrated in the late 1980s. That the model rejects for Zimbabwe is unsurprising because Zimbabwe is the smallest market in the sample (with a capitalization of \$1.3 billion in December 1991) and likely the least liquid; this last feature would affect pricing patterns. Although Mexico's market was large by 1991, with a capitalization of \$100 billion, it stood at a mere \$2.2 billion in 1985 and the model's rejection may relate to changes in return patterns during its dramatic growth.

The estimated betas are statistically distinct from zero in ten of twenty markets, of which six are more than two standard deviations from zero and four are at least one standard deviation from zero; in the remaining ten markets the standard error exceeds the estimated coefficient. In contrast, Harvey's study of industrial markets yields betas that are two or more standard errors from zero for every market except Austria, for which he rejects the model.

The failure to obtain insignificant betas for emerging markets is unsurprising for two reasons. One reason is that because of high idiosyncratic risk, the markets are very noisy and volatile, leading to large standard errors and making

3. Without the heteroskedasticity correction, the ICAPM can also be rejected with at least 90 percent confidence for Colombia, Pakistan, Portugal (with local instruments only), and Turkey (with common instruments only). In each of these cases, the chi-squared statistics are much higher in the tests with uncorrected errors than in the heteroskedasticity-corrected tests. The betas differ between the corrected and uncorrected tests, but not in any consistent manner.

Table 5. *Heteroskedasticity-consistent Estimates of a Conditional ICAPM with Time-varying Expected Returns and Constant Conditional Proportionality Factors ($\epsilon_{jt} = r_{jt} - r_{wt}\beta$), 1985–91*

Market	*Coefficient of proportionality, β*	*Mean excess return*	*Local instruments, χ^2_6*	*Common instruments, χ^2_5*
Argentina	1.204	0.030	5.48	2.71
	(1.413)		(0.484)	(0.745)
Brazil	1.173	0.002	2.66	2.11
	(1.346)		(0.851)	(0.834)
Chile	2.127	0.035	8.99	7.11
	(0.685)		(0.174)	(0.213)
Colombia	0.919	0.028	6.98	4.92
	(0.420)		(0.323)	(0.425)
Greece	0.081	0.019	7.79	6.93
	(0.731)		(0.254)	(0.226)
India	0.052	0.009	1.90	1.90
	(0.574)		(0.928)	(0.863)
Indonesia	0.276	−0.027	7.81	3.60
	(0.583)		(0.252)	(0.609)
Jordan	0.280	−0.002	1.57	1.57
	(0.367)		(0.955)	(0.905)
Korea, Rep. of	1.293	0.014	5.93	1.06
	(0.516)		(0.431)	(0.958)
Malaysia	0.405	0.003	3.08	1.97
	(0.463)		(0.799)	(0.853)
Mexico	1.397	0.031	13.63*	13.82*
	(0.797)		(0.034)	(0.017)
Nigeria	−1.368	−0.005	3.37	3.40
	(0.843)		(0.760)	(0.639)
Pakistan	0.395	0.015	6.06	5.98
	(0.233)		(0.416)	(0.308)
Philippines	2.812	0.029	2.15	2.14
	(0.814)		(0.906)	(0.830)
Portugal	2.271	0.025	7.58	4.89
	(0.638)		(0.270)	(0.429)
Taiwan (China)	1.720	0.018	2.93	2.53
	(0.642)		(0.818)	(0.771)
Thailand	0.624	0.021	7.14	7.05
	(0.468)		(0.308)	(0.217)
Turkey	−1.859	0.053	8.07	6.19
	(2.574)		(0.232)	(0.288)
Venezuela	1.156	0.021	6.98	4.14
	(0.703)		(0.323)	(0.528)
Zimbabwe	−0.375	0.022	15.52*	15.46*
	(0.450)		(0.017)	(0.009)

* Null hypothesis of the ICAPM can be rejected with 95 percent confidence.

Note: All estimates use Hansen's (1982) generalized method of moments (GMM) for the model $\epsilon_{jt} = r_{jt} - r_{wt}\beta$. The GMM procedure iterates three to five times over the weighting matrix because Monte Carlo simulations have found that repeated iteration improves the small-sample properties of the estimates. Common instruments include a constant, the lagged return on the world index less the return on a thirty-day Treasury bill, a dummy for the month of January, the lagged differential between the return to holding a ninety-day Treasury bill for one month and the return on a Treasury bill thirty days to maturity, the lagged differential between the yield on a Moody's Baa bond and the yield on a Moody's Aaa bond, and the lagged dividend yield on the world portfolio less the return on a thirty-day Treasury bill. The local instrument set includes all common instruments plus the lagged return on the local index less the return on a thirty-day Treasury bill. Values in parentheses in column 1 are standard errors; in columns 3 and 4 they are p-values.

Source: Author's calculations.

the beta unstable. Allowing conditional moments to vary across time might alleviate this problem; unfortunately, however, adequate data are not yet available to estimate the additional parameters. Even with a strong covariance, a high variance could lead to an insignificant coefficient. As shown in section III, the correlation between returns on the world portfolio and returns in a number of emerging markets is still negligible.

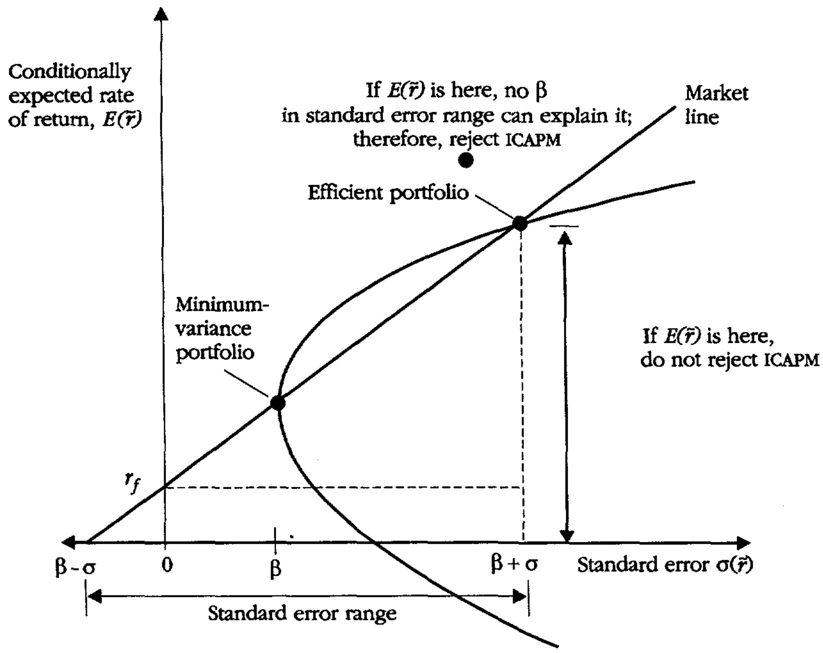
A second reason is that although correlations have risen on average since the late 1970s, covariance risk may remain too small or too idiosyncratic for local returns to reflect covariance with the world market. In that case, obtaining significant betas is unlikely. Indeed, the strongest βs are obtained in the markets most correlated with the world portfolio (as shown in table 4): Chile, Korea, Mexico, the Philippines, Portugal, Taiwan (China), and Thailand. Only Malaysia has a similarly high correlation with the world market yet fails to yield a strong beta. Bekaert (1993) also finds larger betas (in relation to the U.S. market) for larger emerging markets and associates high betas with a higher degree of market integration. These markets are also among the most developed in the sample and the most popular with foreign investors.

The lack of significant betas in no way invalidates the ICAPM tests. The ultimate test of the model's fit lies in the chi-squared statistic, not the estimated beta. Strong rejections of the model for Mexico and Zimbabwe (with 97 percent to over 99 percent confidence) confirm that the test indeed has the power necessary to discriminate between markets that do and do not reject the model. Small betas may be consistent with either the null hypothesis of ICAPM integration or the alternative hypothesis of nonintegration. The model should not be rejected as long as the conditionally expected rate of return $E(\tilde{r})$ falls within the range predicted by the model—that is, between the minimum and maximum vertical intercepts of the security-market line between $(\beta - \sigma)$ and $(\beta + \sigma)$ as shown in figure 2. If $E(\tilde{r})$ is not predicted by any beta in the standard error range of the estimate, then the model should be rejected.

The model's success at describing emerging markets in the late 1980s slightly exceeds that of similar studies of industrial markets. This can likely be explained by the fact that ICAPM studies on industrial markets (such as Harvey 1991) typically use time series that include data from the 1970s, when international capital flows were more restricted, even among industrial markets, than in the late 1980s. Moreover, the results in this article may make emerging markets look more efficient and integrated than they in fact are because the IFC indexes include only each market's largest and most heavily traded stocks and are calculated with capitalization-based weights.

Emerging markets are very concentrated by international standards; for example, the Buenos Aires stock market lists 175 companies, but the 10 largest companies accounted for more than 68 percent of both market capitalization and value traded at the end of 1992. A valuable extension would be to examine the correlation of capitalization-based portfolios with the world market and perform ICAPM tests to determine whether increased integration applies only to

Figure 2. *The Securities-Market Line and Model Rejection and Nonrejection Ranges*



the largest stocks or is reflected throughout markets. Claessens, Dasgupta, and Glen (1993) examine the behavior of capitalization-based portfolios in eighteen emerging markets during 1988–92.

A stricter test of the ICAPM is achieved by imposing the cross-asset restriction that a common price of covariance risk holds across markets, in addition to requiring that the time-series behavior in each market accords with the model. Estimating all seventeen markets with complete time series (Indonesian, Portuguese, and Turkish data start after December 1984) as a system provides a stricter test of the model on the most complete sample of markets possible. This test is expected to reject the model, because the ICAPM cannot explain the time-series behavior of returns for two of the markets in the system. The instrument set is reduced to include only the lagged returns on the world- and local-market portfolios so that the number of unique elements of the weighting matrix will be smaller than the number of data points (including market data and instruments). The results are presented for completeness but should be interpreted cautiously because their numerical properties are very weak. As table 6 shows, the ICAPM is not rejected. The nonrejection of the model despite the presence of two markets whose time-series behavior the model cannot explain suggests that the test may have inadequate power. Harvey (1991) also found multimarket tests unable to reject the ICAPM even when component markets rejected the model in time-series tests.

Table 6. *Multimarket Estimates of a Conditional ICAPM*

Time period and sample	*Estimate*
17-market sample,[a] 1985–91	24.43
	(0.108)
9-market sample,[b] 1977–84	3.07
	(0.962)

Note: The estimates are from a conditional ICAPM with time-varying expected returns and constant conditional proportionality factors, β, and are heteroskedasticity-consistent. The lagged return on the world market portfolio, r_{mt-1}, and the lagged return on the local portfolio, r_{jt-1}, are used as instruments in the model $\epsilon_{jt} = r_{jt} - r_{wt}\beta$. The seventeen-market test has seventeen degrees of freedom—the number of orthogonality conditions (17 times 2), less the number of parameters (17); the nine-market test has nine degrees of freedom. p-values are in parentheses.

a. Argentina, Brazil, Chile, Colombia, Greece, India, Jordan, Korea, Malaysia, Mexico, Nigeria, Pakistan, the Philippines, Taiwan (China), Thailand, Venezuela, and Zimbabwe.

b. Argentina, Brazil, Chile, Greece, India, Korea, Mexico, Thailand, and Zimbabwe.

Source: Author's calculations.

V. Tests of the Conditional ICAPM for 1977–84

To investigate whether emerging markets have become more integrated over time, this section presents ICAPM tests on a ten-market sample from January 1977 to December 1984. The earlier data cover a period when emerging markets were effectively isolated from world capital markets and were much smaller in relation to industrial markets than they are today. Emerging markets probably became more integrated beginning in the late 1980s, when investors from industrial economies became active participants in emerging stock markets and many markets lifted restrictions on foreign investment. The critical year may have been 1987 or 1988, when booming Southeast Asian markets first attracted capital from industrial economies to emerging markets.

Table 7 shows ICAPM estimates with heteroskedasticity-corrected errors for ten markets. For 1977–84, five markets reject the ICAPM under both the local- and common-instrument sets. These are Greece, India, Korea, Mexico, and Zimbabwe. Chile rejects the model in the common-instrument test and comes close to the 90 percent rejection level in the local-instrument test. All rejections with the local-instrument set are in the 95 percent confidence range except Korea, which rejects with 90 percent confidence; all rejections with the common-instrument tests are in the 90 percent confidence range except Mexico, which rejects with 95 percent confidence.[4] The fact that the ICAPM successfully describes 1985–91 return behavior (that is, that the model is not rejected) in four of these markets—Chile, Greece, India, and Korea—indicates that they became integrated sometime in the mid-1980s. Six of the estimated betas are one or more standard deviations from zero; the betas for Brazil, Greece, Mexico, and Thailand are all two or more standard deviations from zero. The betas do not,

4. In tests without the errors correction for heteroskedasticity, the only major difference is that the ICAPM is not rejected for Korea.

Table 7. *Heteroskedasticity-consistent Estimates of a Conditional ICAPM with Time-varying Expected Returns and Constant Conditional Betas ($\epsilon_{jt} = r_{jt} - r_{wt}\beta$), 1977–84*

Market	*Local proportionality factor, β_{local}*	*Local instruments, χ^2_6*	*Common instruments, χ^2_5*
Argentina	−0.654	7.96	7.93
	(1.222)	(0.241)	(0.160)
Brazil	−1.645	2.56	2.24
	(0.683)	(0.861)	(0.816)
Chile	−1.607	10.62	10.70*
	(0.969)	(0.101)	(0.058)
Greece	1.167	13.43**	10.83*
	(0.556)	(0.037)	(0.056)
India	0.113	14.91**	10.76*
	(0.374)	(0.021)	(0.056)
Jordan	−0.256	3.023	3.234
	(0.341)	(0.806)	(0.664)
Korea, Rep. of	0.839	11.00*	10.72*
	(0.647)	(0.088)	(0.057)
Mexico	2.057	15.11**	15.07**
	(0.889)	(0.019)	(0.010)
Thailand	1.229	2.08	1.06
	(0.569)	(0.912)	(0.957)
Zimbabwe	0.218	13.63**	10.83*
	(0.821)	(0.034)	(0.055)

* Null hypothesis of the ICAPM is rejected with 90 percent confidence.

** Rejection with 95 percent confidence.

Note: All estimates use Hansen's (1982) generalized method of moments (GMM) on the model $\epsilon_{jt} = r_{jt} - r_{wt}\beta$. The GMM procedure iterates three to five times over the weighting matrix, as Monte Carlo simulations have found that repeated iteration improves the small-sample properties of the estimates. The common-instrument set includes a constant, the lagged return on the world index less the return on a thirty-day Treasury bill, a dummy for the month of January, the lagged differential between the return to holding a ninety-day Treasury bill for one month and the return on a Treasury bill thirty days to maturity, the lagged differential between the yield on a Moody's Baa bond and the yield on a Moody's Aaa bond, and the lagged dividend yield on the world portfolio less the return on a thirty-day Treasury bill. The local-instrument set includes all common instruments plus the lagged return on the local index less the return on a thirty-day Treasury bill. Standard errors are in parentheses.

Source: Author's calculations.

however, rank closely with the markets' correlation with the world portfolio (as shown in table 4).

For completeness, cross-country tests on nine markets (Jordanian data start later) appear in table 6. Although six markets reject the model in time-series tests, the system estimates fail to reject the model. These results should be viewed as evidence of power problems, not evidence of integration. As in the tests of the seventeen-market system, only the lagged world- and local-market returns are used as instruments, and the numerical properties of the estimates are weak.

VI. Conclusions

This article finds that emerging markets became increasingly integrated into global financial markets in the late 1980s, with rising capital flows from industrial economies evidently the mechanism of integration. For 1977–84, six of ten markets reject the ICAPM in tests of the conditional formulation of the Sharpe-Lintner ICAPM. However, evidence of integration is strong for 1985–91: eighteen of twenty markets do not reject the model in heteroskedasticity-consistent estimates, although high rate-of-return variance impedes estimation of market betas. Stylized evidence from recent market openings suggests that opening expands markets in terms of participants, firms listed, and value, and promotes the capital flows necessary for integration.

Technical Appendix: The Generalized Method of Moments

The article uses the generalized method of moments (GMM) to obtain a consistent and efficient estimate of beta. The weighting matrix W_T is chosen optimally as in Hansen (1982).[5] The orthogonality condition of equation 4 implies that the moment restrictions

$$E(\epsilon_t) = E[f(r_{jt}, \beta)] = 0 \tag{A-1}$$

hold, where r_{jt} denotes excess returns in U.S. dollars, β is the proportionality factor for expected returns in the local market, and $f(r_{jt}, \beta)$ is referred to as the wing. GMM estimation mimics this moment restriction by minimizing a quadratic form of the sample means,

$$J_T(\beta) = \left[\frac{1}{T}\sum_{t=1}^{T} f(r_{jt}, \beta)'\right] W_T \left[\frac{1}{T}\sum_{t=1}^{T} f(r_{jt}, \beta)\right] \tag{A-2}$$

with respect to β. W_T, the variance-covariance matrix of wing $f(r_{jt}, \beta)$, is a positive definite matrix satisfying

$$\lim_{t\to\infty} W_T = W_0 \tag{A-3}$$

with probability approaching one for positive definite matrix W_T; both W_T and W_0 are referred to as the weighting matrix. Hansen (1982) shows that the optimal weighting matrix, that is, the one that minimizes the variance-covariance matrix of $\tilde{\beta}$, is the inverse variance-covariance matrix of the wing.

Generally, two iterations over W_T should yield an asymptotically consistent estimate for β, β_T. However, Monte Carlo simulations have shown that repeated iteration over the weighting matrix improves the small-sample properties of the estimates (Tauchen 1986). All single-market estimates in this article are obtained after three to five iterations over W_T, with the procedure ceasing before five iterations if W_T has converged; multimarket estimates use as many as sixteen iterations to obtain convergence.

The minimized value of the quadratic form in equation A-2 is distributed χ^2 under the null hypothesis, with degrees of freedom equal to the number of

5. To perform my GMM estimation, I use the Gauss procedures described in "GMM Programs for Gauss" by Lars Peter Hansen, John Heaton, and Masao Ogaki (1992). This work was sponsored by the National Science Foundation and is available from Lars Peter Hansen, Department of Economics, University of Chicago, Chicago, Ill.

orthogonality conditions less the number of parameters, or equal to the number of instruments less the number of parameters. The χ^2 statistic measures how close the errors are to zero (H_0) after repeated iteration, and can be interpreted as an indicator of the model's goodness of fit as it measures whether the quadratic maximand evaluated at the optimal parameter estimates is statistically different from zero. A high value of the χ^2 statistic signals that the disturbances are correlated with the instrumental variables and that the model may be misspecified.

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