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The Risk Exposure of Emerging Equity Markets

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The low correlation between returns in emerging equity markets and industrial equity markets implies that the global investor would benefit from diversification in emerging markets. This article explores the sensitivity of the emerging-market returns to measures of global economic risk. When these traditional measures of risk are used, the emerging markets have little or no sensitivity. This finding is consistent with these markets' being segmented from world capital markets. However, the correlation between the emerging-market returns and the risk factors appears to be changing over time.

New interest in international investing has been partly caused by the emerging equity markets, which are attractive because of their high average returns and low correlations with industrial markets. Little is known, however, about how to measure the risk of investment in emerging markets. The goal of this article is to advance the understanding of the investment risk in emerging markets by measuring each market's exposure to a number of global economic forces.

To measure risk in a meaningful way, an asset-pricing model is needed. In the international version of the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965) investors are presumed to hold a diversified portfolio of equities from all national markets, that is, a world market portfolio. In this type of model, the portfolio risk is the variance of this well-diversified portfolio. The risk of an individual security is measured by its contribution to (or covariance with) the world market portfolio. Usually, the covariances are scaled by the variance of the world market portfolio and are called betas. The CAPM predicts that equities with higher covariances (higher risk) will command higher expected returns in equilibrium.

Roll (1977) emphasizes that testing the CAPM is equivalent to testing the mean-variance efficiency of the market portfolio. That is, any test that tries to

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investigate whether higher-risk securities receive higher expected returns is contingent on the market portfolio's being the portfolio with the highest possible expected return for any given level of variance (efficiency). Encouragingly, a number of tests fail to reject the null hypothesis of mean-variance efficiency of the world market portfolio (see, for example, Harvey 1991). However, an important caveat is that these tests consider equities only in industrial markets. The focus of this article is on emerging-market equities.

The efficiency issue is important in the following sense. Suppose that a world CAPM is a reasonable approximation of equilibrium. Suppose, however, that a world portfolio is an inefficient benchmark; that is, there exists another portfolio with a higher expected return and the same variance. Roll and Ross (1994) point out that there may be little or no relation between risk and expected return in this case. As a result, although estimating risk exposure (or covariance) is possible, this risk exposure may not be that meaningful in distinguishing between high and low expected returns.

An alternative approximation of equilibrium is a multifactor world CAPM. In this case, the risk of an equity investment is measured by its contribution to the variance of a portfolio of the factors (assuming the factors are traded-asset returns). These factors are often specified to represent broad economic forces such as average world interest rates, world inflation growth, and world business cycle movements. The risk of each asset or domestic market can be characterized by a number of betas that represent the sensitivity to changes in these factors.

Both the single-factor CAPM and the multiple-factor CAPM present measures of risk. These measures are contingent on the asset-pricing model's being well specified. There are many possible sources of statistical rejection of these models. First, the fundamental assumptions that provide the building blocks for these models, such as utility specification, information environment, or distributional assumptions, could be violated. Second, as mentioned earlier, the benchmark portfolio that is used to measure risk could be improperly specified. Third, there could be problems with the returns data caused by infrequent trading of the component stocks. Fourth, capital markets may not be integrated.

In examining emerging markets, this last factor may be crucial. If domestic investors encounter barriers in accessing foreign markets and foreign investors in accessing the domestic market, then risk is even more problematic to define. Indeed, Bekaert (1995) describes numerous barriers to investing in emerging markets. The notion that risk can be defined as the sensitivity to the changes in world factor returns is contingent on the assumption of complete market integration. As the amount of segmentation increases, risk takes on a new definition as a security's sensitivity to local-market factors. The intuition is as follows. In integrated world capital markets, the sensitivity to many local events can be hedged by a diversified portfolio. That is, a negative event in one country may be offset by positive news in another country. However, if capital

markets are segmented, the sensitivity to local events can have dramatic effects on the required returns for the securities that trade in the local market.

The issue of integration and segmentation is a complicated one. The idea here is to start with the world asset-pricing paradigm and to explore the emerging markets' sensitivities to world factors. This is a logical place to start, and the exercise yields important insights that can be used for future studies of market integration.

Another important issue concerns how information is incorporated into the analysis. Indeed, the traditional analyses of returns employ static models. For example, risk exposures and hence expected returns are often assumed to be constant. In the context of mature, industrial economies, this might be an innocuous assumption. In the arena of emerging economies, it is unlikely that risk exposure remains fixed over time. Emerging economies are often characterized by a shifting industrial structure that will induce changes in risk sensitivities. My research provides a first-step examination of time-varying correlations between the emerging-market returns and a number of world factors that are designed to capture common sources of risk in the world. These factors include risks related to equity and leverage, foreign exchange, commodity prices, world business cycles, and inflation.

The article is organized as follows. Section I describes the data sources and summary statistics. Section II analyzes the risk exposure to a single factor. Section III discusses exchange risk. Section IV broadens the focus to a multifactor asset-pricing model. Section V offers conclusions.

I. Data Sources and Summary Statistics

Data on twenty-one industrial markets are from Capital International Perspective, S.A. and Morgan Stanley & Co. (various issues), from now on referred to as MSCI, and data on twenty emerging markets are from the International Finance Corporation (IFC). Each market's return is based on a value-weighted portfolio of securities that trade in that market. The number of stocks included in the market indexes ranges from 17 to 300 (see Harvey 1991 for the MSCI markets and Harvey 1994c and Claessens, Dasgupta, and Glen 1995 for the emerging markets). Stocks are selected for inclusion on the basis of liquidity (how often they trade and the volume of trading) and size (market value). The industrial composition of the index is also important. That is, if two securities have approximately the same size and liquidity, the security that enables the index to better reflect the industrial composition of the local market may be chosen. All of the indexes reflect total returns, that is, dividends and capital gains. Details of the MSCI indexes are presented in Harvey (1991). The IFC indexes are described in Harvey (1994c).

MSCI has also introduced a set of emerging-market indexes. These indexes suffer from a relatively short sample period (the earliest data begin in 1987), whereas IFC indexes for nine markets are available back to December 1975.

The early IFC data are problematic, however. When the IFC began publishing its indexes in 1981, the portfolio of stocks the IFC formed for each market was "backtracked" to December 1975, and this induced a "look-back" bias. Had the IFC selected the portfolio of stocks in December 1975, the portfolio might have been different from the one selected in January 1981 and backtracked to December 1975. Indeed, if the stocks had been selected in December 1975, some might not have made it through the next five years because of bankruptcy. But the stocks selected in 1981, by construction, survived. The look-back bias is an example of survivorship bias. Given the look-back bias, the average returns should have been higher. To deal with the look-back bias problem, I calculated results based on the full sample (beginning in December 1975) and on a more recent subsample that bypasses the survivorship problem.[1]

Some summary statistics are presented in table 1 for the full sample period, 1976–92. Only U.S. dollar returns are displayed. The statistics include the average (annualized) arithmetic and geometric returns, the standard deviation, and autocorrelations for lag 1, 2, and 12 periods. The industrial-market summary statistics are presented over different samples by other authors and are included in table 1 for comparison with the emerging-market returns.

Arithmetic and geometric average returns have an important difference. The arithmetic average is the return to a strategy that requires equal investment in each period. That is, the gains are not reinvested in the market. The geometric average has a more appealing portfolio interpretation. The geometric average represents the average return to a buy-and-hold strategy. In this strategy, a fixed amount is invested in the first period, and the portfolio is held until the end of the sample.

The mean U.S. dollar returns in the emerging markets range from 72 percent (in Argentina) to −6 percent (in Indonesia, the sample for which begins only in January 1990). This range sharply contrasts with the range of average returns in the industrial markets. In the MSCI sample, no market has an average arithmetic return that exceeds 25 percent. In the IFC sample, nine markets (Argentina, Chile, Colombia, Mexico, the Philippines, Portugal, Taiwan (China), Turkey, and Venezuela) have returns that average above 25 percent.

The emerging-market returns are characterized by high volatility, which induces large differences between the arithmetic and geometric mean returns. These differences are especially evident in the sample of emerging markets. The most dramatic example is in Argentina, where the arithmetic average return is 72 percent, and the geometric average return is 27 percent.

Volatility (the standard deviation) ranges from 18 percent (in Jordan) to 105 percent (in Argentina). In contrast, volatilities in the MSCI markets range between 15 and 33 percent. Thirteen emerging markets have a volatility higher than 33 percent (Argentina, Brazil, Chile, Greece, Indonesia, Mexico, Nigeria,

1. The full-sample (1976–92) results are reported in the article; the subsample (1985–92) results, which are not reported, are available from the author.

Table 1. *Means, Standard Deviations, and Autocorrelations of International Equity Returns, 1976–92*
(percent)

Market	*Starting year and month*	*Arithmetic mean*	*Geometric mean*	*Standard deviation*	*Autocorrelation* ρ_1	ρ_2	ρ_{12}
Industrial markets							
Australia	1976.01	15.95	12.17	26.34	0.02	−0.13	−0.10
Austria	1976.01	15.20	12.31	24.21	0.14	0.02	0.01
Belgium	1976.01	18.03	15.80	20.97	0.07	0.07	−0.01
Canada	1976.01	12.44	10.39	19.93	−0.02	−0.07	−0.11
Denmark	1976.01	14.98	13.13	19.08	−0.07	0.06	−0.18
Finland	1988.01	−9.66	−12.17	22.15	0.09	−0.33	0.03
France	1976.01	17.78	14.51	25.26	0.02	−0.02	−0.10
Germany	1976.01	15.17	12.73	21.81	−0.04	−0.01	−0.08
Hong Kong	1976.01	25.45	19.25	33.88	0.02	−0.05	−0.06
Ireland	1988.01	12.61	9.72	24.28	−0.19	−0.11	−0.25
Italy	1976.01	14.68	11.11	26.84	0.18	−0.03	0.07
Japan	1976.01	17.97	15.20	23.38	0.01	−0.03	0.12
Netherlands	1976.01	18.95	17.30	17.53	−0.06	−0.09	0.01
New Zealand	1988.01	−1.98	−5.18	26.12	−0.04	−0.09	−0.10
Norway	1976.01	16.60	12.49	28.41	0.12	−0.04	−0.02
Singapore and Malaysia	1976.01	16.72	13.05	26.21	0.03	0.02	−0.05
Spain	1976.01	10.32	7.32	24.47	0.11	0.00	−0.03
Sweden	1976.01	18.65	15.87	23.24	0.08	0.00	0.01
Switzerland	1976.01	14.18	12.37	18.74	0.05	0.00	−0.03
United Kingdom	1976.01	19.20	16.50	22.90	−0.01	−0.09	−0.14
United States	1976.01	14.27	13.00	15.46	−0.01	−0.06	−0.02
Emerging markets							
Argentina	1976.01	71.66	27.02	105.06	0.05	0.06	−0.10
Brazil	1976.01	22.69	4.71	60.83	0.03	−0.04	0.03
Chile	1976.01	38.65	30.90	39.84	0.17	0.26	0.09
Colombia	1985.01	45.60	40.27	32.57	0.49	0.16	0.03
Greece	1976.01	9.75	3.82	36.27	0.12	0.18	−0.05
India	1976.01	21.45	17.88	26.87	0.09	−0.10	−0.09
Indonesia	1990.01	−6.29	−12.35	34.95	0.30	0.24	0.19
Jordan	1979.01	10.14	8.53	18.04	0.00	0.02	−0.02
Korea, Rep. of	1976.01	20.02	15.15	31.97	0.01	0.07	0.12
Malaysia	1985.01	13.56	9.81	26.90	0.05	0.08	−0.10
Mexico	1976.01	30.44	19.02	45.00	0.25	−0.08	−0.01
Nigeria	1985.01	2.18	−6.36	37.20	0.09	−0.13	−0.08
Pakistan	1985.01	25.65	23.21	22.38	0.27	−0.24	0.13
Philippines	1985.01	51.16	43.23	38.79	0.33	0.02	0.06
Portugal	1986.02	40.85	29.00	51.43	0.27	0.03	0.03
Taiwan (China)	1985.01	39.93	25.37	54.06	0.06	0.04	0.13
Thailand	1976.01	21.55	18.11	25.69	0.12	0.16	0.05
Turkey	1987.01	47.89	22.04	76.71	0.24	0.10	−0.16
Venezuela	1985.01	37.92	26.23	47.52	0.27	0.18	−0.06
Zimbabwe	1976.01	10.16	4.33	34.30	0.13	0.15	−0.04

Note: Values are based on U.S. dollar returns from monthly data from January 1976 to June 1992. ρ_j denotes the jth-order autocorrelation coefficient.

Source: The monthly returns for emerging markets are from the International Finance Corporation (IFC) Emerging Markets Data Base (EMDB). The industrial-market returns are from Capital International Perspective, S.A. and Morgan Stanley & Co. (various issues), thereafter referred to as MSCI.

the Philippines, Portugal, Taiwan (China), Turkey, Venezuela, and Zimbabwe).

The autocorrelations in table 1 measure the persistence (or predictability) of the market returns on the basis of past market returns. This persistence could be driven by market imperfections, such as infrequent trading of the component securities, or by some fundamental forces, such as predictable changes in sensitivities to world risk factors. Among the MSCI markets, only five have first-order autocorrelations that exceed 10 percent. Among the emerging markets, twelve have autocorrelations greater than 10 percent. Indeed, eight have first-order autocorrelations above 20 percent (Colombia, Indonesia, Mexico, Pakistan, the Philippines, Portugal, Turkey, and Venezuela). Although the sample period is shorter for some of these markets, and the standard errors of the autocorrelations are higher, the evidence suggests that returns in many of the emerging markets can be predicted on the basis of past information.

There is evidence that many of the emerging-market returns depart from normality. Harvey (1994c) presents a test of normality based on Hansen's (1982) generalized method of moments and rejects normality in fourteen of twenty emerging markets. Claessens, Dasgupta, and Glen (1995) use an alternative test and find results that are consistent with Harvey's. Although normality is not required for any of the measurements presented here, it may be that the distributional characteristics of the emerging-market returns induce a nonlinear relation between returns and global risk factors. This is a subject for further research.

In my examination of the most recent subperiod, 1985–92 (not reported), similar patterns to those in the summary statistics have emerged. For example, the extraordinary arithmetic average return of 72 percent for Argentina is not a function of look-back bias; in the most recent subperiod the average return in Argentina is 88 percent. Indeed, in the most recent subperiod, ten emerging markets have returns exceeding 33 percent. Predictability is also retained, with ten markets exhibiting serial correlation above 20 percent.

I also calculated the summary statistics for returns measured in local currency terms, although they are not reported in the tables. The wild inflation in Argentina and Brazil is evident in the 228 and 156 percent average returns over the full sample. Other economies that have experienced severe inflation, such as Colombia, Chile, and Venezuela, also have much higher local returns. Calculating the returns in U.S. dollars eliminates the local inflation but retains the U.S. inflation.

The correlations within emerging markets and the correlations between emerging markets and the MSCI markets are presented in table 2. Panel A shows the U.S. dollar return correlations within the emerging markets. These correlations are remarkably small. For example, the correlation between Argentina and Brazil is only −3 percent. The correlation between Pakistan and India is −5 percent. The correlation between Colombia and Chile is 0 percent. The correlations in the most recent subperiod (not reported) show the same

characteristics. The correlation between Argentina and Brazil is still −4 percent, which is somewhat surprising, given that Argentina and Brazil have recently become important trading partners.

The correlations between the emerging and industrial markets are presented in panel B. The average correlations are very small. Over the full sample period, Malaysia has the highest correlation with industrial markets and Mexico has the second highest. For the other markets, the correlations are often less than 10 percent. For example, Argentina has correlations of less than 10 percent with eighteen of the twenty-one industrial markets. The Republic of Korea has correlations of less than 10 percent with eight of the twenty-one industrial markets. The same holds true in the most recent subperiod (not reported). The correlations for Argentina and Venezuela with each of the twenty-one MSCI markets are less than 10 percent, and many emerging markets have negative correlations with several industrial markets.

Mullin (1993) argues that the low average monthly correlations between emerging markets and MSCI markets as well as the cross-correlations within the emerging markets could be caused by market imperfections such as infrequent trading. Mullin shows that the annual correlations are higher than the monthly correlations. However, it is not clear that the annual correlations are statistically higher. In my sample (excluding Indonesia), there are 171 cross-correlation coefficients for emerging-market returns. When monthly data are used, twenty-six correlations are significantly different from zero; when annual data are used, only five are significantly different from zero. This evidence supports the view that the low correlations are real rather than an artifact of infrequent trading. In addition, when monthly data are used, five emerging markets have significant correlation with the U.S. return; whereas when annual data are used, only one market has significant correlation (at the 5 percent level of significance).

The low correlations imply that significant benefits are possible in diversifying into the emerging markets. Even though the volatility of the individual emerging markets is high, the low correlations should reduce portfolio volatility. This reduction in volatility is evident in the work of Divecha, Drach, and Stefek (1992), Harvey (1994a, 1994c), Stone (1990), and Wilcox (1992).

These analyses measure the effect of adding emerging markets to portfolios of industrial-market securities. As mentioned above, the studies show that including emerging markets in a well-diversified portfolio reduces overall volatility even though the emerging-market equities, held alone, are much more volatile than the industrial-market equities. However, investors usually require information in addition to the mean and variance of the portfolio before making their portfolio decisions.

An important control in real-world portfolio management is the level of risk exposure that the portfolio bears. That is, a quadratic program can select the portfolio with the highest expected return for a given level of variance. However, this portfolio might have an unacceptable exposure to, for example,

Table 2. *Correlation of International Equity Returns, 1976–92*

A. Correlation of Emerging-Market Returns

Market	*Argentina*	*Brazil*	*Chile*	*Colombia*	*Greece*	*India*	*Indonesia*	*Jordan*	*Korea, Rep. of*
Argentina	1.00								
Brazil	−0.03	1.00							
Chile	0.08	0.00	1.00						
Colombia	−0.10	0.06	0.00	1.00					
Greece	0.06	−0.03	0.14	0.23	1.00				
India	0.12	−0.01	0.06	−0.11	0.07	1.00			
Indonesia	−0.29	0.06	0.09	0.25	0.36	0.07	1.00		
Jordan	−0.02	0.00	0.01	0.03	0.10	0.16	0.20	1.00	
Korea, Rep. of	−0.11	0.02	0.03	−0.01	−0.05	0.00	0.00	−0.18	1.00
Malaysia	−0.08	0.12	0.24	0.02	0.06	−0.01	0.46	0.07	0.07
Mexico	0.14	−0.02	0.13	0.02	0.05	0.03	0.04	−0.07	0.10
Nigeria	0.11	0.01	−0.03	0.14	0.11	−0.13	−0.10	0.00	0.04
Pakistan	−0.03	−0.03	−0.10	0.43	−0.09	−0.10	0.05	0.11	−0.01
Philippines	−0.10	0.12	0.20	0.13	0.12	−0.11	0.50	0.09	0.18
Portugal	−0.02	0.10	0.21	0.14	0.41	−0.11	0.24	−0.03	0.10
Taiwan (China)	−0.04	0.07	0.31	0.11	0.09	−0.11	0.30	0.10	0.04
Thailand	−0.04	−0.01	0.10	0.14	0.26	0.10	0.42	0.06	0.01
Turkey	0.15	0.07	0.02	0.13	0.28	0.09	0.28	−0.12	0.02
Venezuela	0.04	−0.15	−0.23	0.09	−0.04	0.00	0.01	−0.01	−0.15
Zimbabwe	−0.08	−0.04	0.13	−0.18	0.12	0.06	0.04	0.01	−0.08

B. Correlation of Emerging-Market Returns with Industrial-Market Returns

Market	*Australia*	*Austria*	*Belgium*	*Canada*	*Denmark*	*Finland*	*France*	*Germany*	*Hong Kong*	*Ireland*
Argentina	0.14	0.01	−0.09	0.10	0.00	−0.15	0.03	−0.01	−0.08	−0.20
Brazil	0.06	0.04	0.04	0.00	0.02	0.38	0.04	0.07	0.13	0.27
Chile	0.13	0.15	0.13	0.07	0.03	0.03	0.04	0.08	0.12	0.02
Colombia	−0.03	0.03	0.05	0.08	0.01	0.08	0.00	0.02	0.09	0.07
Greece	0.08	0.27	0.18	0.10	0.06	0.05	0.17	0.14	0.07	0.12
India	0.13	0.19	0.07	0.05	0.13	0.02	0.13	0.10	0.04	−0.03
Indonesia	−0.05	0.58	0.32	0.20	0.29	0.45	0.17	0.41	0.40	0.27
Jordan	0.15	0.18	0.18	0.15	0.17	0.16	0.19	0.18	0.08	0.33
Korea, Rep. of	0.03	0.02	0.12	0.17	0.07	0.33	0.04	0.09	0.09	0.53
Malaysia	0.40	0.18	0.25	0.50	0.21	0.48	0.15	0.22	0.59	0.55
Mexico	0.19	0.03	0.22	0.19	−0.02	0.23	0.13	0.11	0.15	0.14
Nigeria	−0.12	0.12	0.07	0.11	0.21	0.04	0.08	0.13	−0.09	0.09
Pakistan	0.01	0.08	0.11	−0.05	0.10	−0.05	0.04	0.06	0.10	0.13
Philippines	0.11	0.14	0.33	0.31	0.17	0.43	0.20	0.20	0.30	0.31
Portugal	0.26	0.14	0.20	0.21	0.12	0.14	0.18	0.13	0.29	0.54
Taiwan (China)	0.21	0.19	0.18	0.10	−0.02	0.29	0.11	0.12	0.15	0.17
Thailand	0.24	0.21	0.28	0.10	0.11	0.24	0.14	0.23	0.17	0.38
Turkey	0.11	0.31	0.12	0.02	0.13	−0.01	−0.04	0.09	0.05	0.21
Venezuela	−0.02	−0.17	−0.03	0.04	−0.11	−0.20	−0.13	−0.25	−0.04	−0.27
Zimbabwe	−0.02	0.17	−0.01	0.11	0.11	0.12	0.00	0.04	0.00	0.00

Note: Correlations are based on monthly data in U.S. dollars from January 1976 to June 1992.

Malaysia	*Mexico*	*Nigeria*	*Pakistan*	*Philippines*	*Portugal*	*Taiwan (China)*	*Thailand*	*Turkey*	*Venezuela*	*Zimbabwe*
1.00										
0.40	1.00									
−0.17	−0.10	1.00								
−0.07	−0.4	0.02	1.00							
0.31	0.06	0.08	0.00	1.00						
0.23	0.35	−0.20	0.03	0.03	1.00					
0.23	0.35	−0.14	−0.06	0.06	0.39	1.00				
0.51	0.24	−0.11	0.03	0.25	0.35	0.40	1.00			
0.26	0.17	0.08	0.04	0.12	0.27	0.17	0.29	1.00		
−0.02	−0.05	0.12	0.03	−0.17	−0.07	−0.22	−0.11	−0.10	1.00	
0.01	0.03	0.04	−0.07	0.02	0.12	−0.04	−0.05	0.01	0.10	1.00

Italy	*Japan*	*Netherlands*	*New Zealand*	*Norway*	*Singapore and Malaysia*	*Spain*	*Sweden*	*Switzerland*	*United Kingdom*	*United States*
0.07	−0.04	−0.03	0.03	0.00	−0.01	0.01	0.01	0.04	−0.08	0.01
0.11	0.06	0.04	0.24	0.15	0.07	0.11	0.13	0.09	0.09	0.07
0.05	0.05	0.05	−0.25	0.05	0.08	0.10	0.06	0.02	0.03	0.02
0.07	0.00	0.07	0.01	−0.07	0.08	0.13	0.02	0.07	0.06	0.10
0.15	0.09	0.12	0.06	0.11	0.08	0.17	0.06	0.20	0.13	0.10
0.02	−0.07	0.04	0.07	0.06	0.09	0.08	0.09	0.10	0.05	−0.01
0.51	−0.10	0.32	0.14	0.38	0.43	0.05	0.22	0.28	0.12	0.16
0.03	0.07	0.14	−0.06	0.09	0.10	0.02	0.09	0.26	0.24	0.07
0.08	0.25	0.14	0.16	0.09	0.16	0.10	0.20	0.17	0.19	0.18
0.13	0.20	0.37	0.29	0.52	0.92	0.21	0.38	0.27	0.44	0.53
0.08	0.10	0.17	−0.10	0.23	0.28	0.15	0.21	0.16	0.20	0.28
0.04	0.10	0.19	0.03	−0.04	−0.17	0.25	−0.16	0.15	0.08	0.08
0.03	−0.03	0.13	0.05	0.00	0.01	0.00	0.00	0.06	0.13	0.02
0.30	0.25	0.33	0.24	0.12	0.34	0.36	0.26	0.20	0.18	0.28
0.21	0.39	0.25	0.38	0.35	0.25	0.32	0.31	0.26	0.34	0.22
0.08	0.20	0.01	−0.12	0.19	0.30	0.13	0.14	0.02	0.09	0.14
0.13	0.14	0.18	0.17	0.09	0.38	0.12	0.20	0.25	0.20	0.15
0.05	0.04	0.09	0.03	0.16	0.29	0.22	0.13	0.09	0.01	0.01
−0.22	−0.12	−0.08	−0.07	−0.08	0.02	−0.13	−0.20	−0.21	0.06	−0.07
0.02	0.08	−0.01	−0.01	0.14	0.04	0.11	−0.04	0.03	0.10	0.03

Source: Author's calculations.

shocks in the price of oil. As a result, it is important to try to measure the risk exposure of the emerging-market equity returns.

II. Single-Factor Models

Implicit in the mean-variance analysis are the assumptions that investors prefer higher expected returns and that a portfolio's risk (which investors dislike) is captured by the overall portfolio variance. It is useful to characterize the risk of the individual markets. As mentioned earlier, in implementing portfolio optimization, constraints are often added to limit exposure to certain types of risk. The problem, in particular, is how to characterize the risk of the emerging markets.

If an efficient benchmark portfolio exists, then the risk of the individual market can be measured by the covariance with the efficient benchmark. The expected return on that market will be exactly linear in the efficient benchmark (Roll 1977; Ross 1977). If the benchmark is not efficient (and even if it is very close to being efficient), there may be no relation between the covariance and the expected returns.

One potential benchmark is the MSCI world market portfolio in excess of the thirty-day Eurodollar deposit rate. Cumby and Glen (1990), Ferson and Harvey (1994), Harvey (1991), and Harvey and Zhou (1993) fail to reject the mean-variance efficiency of this portfolio within the set of MSCI industrial-market portfolios. Although this is the most widely used world benchmark, one problem with the portfolio is its lack of investment in emerging markets. Currently, emerging markets represent less than 2 percent of the investments of the MSCI world portfolio, whereas emerging markets represent about 7 percent of world equity capitalization (see IFC 1993).

Table 3 provides estimates of the one-factor model for both industrial and emerging markets. The loading on the MSCI world market portfolio is significantly different from zero in each of the industrial markets.[2] However, among the emerging markets, only seven (Greece, Korea, Malaysia, Mexico, the Philippines, Portugal, and Thailand) have significant betas. In addition, only one of the markets has a beta greater than unity (Portugal, with a beta of 1.168); therefore, a strong relation between expected returns and this risk exposure is unlikely.

A possible explanation of the low betas is that the stocks in the local index trade infrequently. That is, suppose the world market goes up one month and down the next, but that the stocks in the local portfolio do not trade in the first month. Even though the value of the local stocks might rise with the world market in terms of their unobserved market value, the covariance of the returns of the local and world markets over the two months may be close to zero.

2. Note that the table presents regressions of returns, not excess returns, on the MSCI world market portfolio. As a result, many of the intercepts are significantly different from zero.

One solution to the problem of infrequent trading was suggested by Scholes and Williams (1977). In this correction the local-market return is regressed on the lagged world return, the contemporaneous world return, and the lead of the world-market return. Then the three betas are averaged and divided by one plus twice the first-order autocorrelation in the world-market return. These calculations provide an adjustment for possible infrequent trading.

Although not reported in table 3, the Scholes-Williams (1977) betas are broadly similar to the usual betas, with two exceptions. The beta for Mexico for 1976–92 increases from 0.76 to 1.59. The beta for the Philippines for the same period increases from 0.77 to 1.49. For the other markets, there is little change. For example, the beta for Portugal increases from 1.17 to 1.24.

In the more recent subperiod (1985–92), the results (not reported) are similar. Only six emerging markets have betas that are significantly different from zero. Only a single market has a beta greater than one, and two markets have negative betas. The R^2s of these regressions range from 0 percent (in thirteen markets) to 20 percent (in Malaysia). The use of the Scholes-Williams (1977) beta has little effect in the most recent subperiod, with the exception of Mexico. For this market, the beta increases from 0.81 to 1.91 using the Scholes-Williams methodology.

The inability of the single-factor model to characterize the emerging-market returns is a result of the MSCI portfolio's being inefficient in relation to the set of assets examined. Indeed, the low or negative betas are expected from the low and negative correlations that many of the emerging markets have with the industrial market. The MSCI world market portfolio is really an industrial world market portfolio.

The betas estimated in table 3 assume that the risk is constant throughout the period examined. Annex figure A-1 shows five-year rolling correlation measures of the local-market returns and the MSCI excess returns. The graphs depict some interesting changes in the correlations. In Brazil, correlations increase from 0 percent in the early 1980s to 25 percent by 1992. There is no significant pattern in any of the other South American markets. However, the Mexican correlations increase from 0 percent in 1986 to 30 percent by 1991. In the East Asian markets, the correlations increase progressively reaching 40 percent in Korea, 60 percent in Malaysia, 40 percent in the Philippines, 15 percent in Taiwan (China), and 40 percent in Thailand. In India the correlation uniformly decreases over time. In Greece and Portugal the correlations are 25 percent and 50 percent, respectively, by 1992.

The time variation in the correlations suggests that the sensitivity of many emerging markets to the MSCI world portfolios is increasing. Although the betas have only limited ability to explain the expected-return variation across different markets (the cross-sectional adjusted R^2 is only 4 percent in the overall period), it appears as if the cross-sectional R^2 may increase from the beginning of the sample to the end.[3]

3. In contrast, for the twenty-one industrial markets, the adjusted R^2 of the regression of the betas on twenty-one industrial-market average returns is 30 percent.

Table 3. *One-Factor Model Loadings for Forty-One Equity Markets, 1976–92*

Market	*Starting year and month*	*Intercept*	*World return[a] beta*	$\bar{R}^2$
Industrial markets				
Australia	1976.01	0.009	0.889	0.239
		(1.912)	(4.796)	
Austria	1976.01	0.011	0.488	0.082
		(2.171)	(3.726)	
Belgium	1976.01	0.011	0.886	0.377
		(3.334)	(9.502)	
Canada	1976.01	0.006	0.932	0.464
		(2.093)	(10.328)	
Denmark	1976.01	0.010	0.675	0.263
		(2.869)	(8.295)	
Finland	1988.01	−0.008	0.667	0.219
		(−1.109)	(3.912)	
France	1976.01	0.010	1.081	0.387
		(2.475)	(11.681)	
Germany	1976.01	0.009	0.812	0.292
		(2.442)	(7.629)	
Hong Kong	1976.01	0.017	0.998	0.181
		(2.627)	(5.015)	
Ireland	1988.01	0.010	1.047	0.470
		(1.465)	(6.546)	
Italy	1976.01	0.008	0.857	0.213
		(1.758)	(7.689)	
Japan	1976.01	0.010	1.159	0.521
		(2.954)	(11.045)	
Netherlands	1976.01	0.012	0.874	0.527
		(4.877)	(13.545)	
New Zealand	1988.01	−0.002	0.452	0.059
		(−0.192)	(2.247)	
Norway	1976.01	0.009	1.029	0.276
		(1.859)	(7.511)	
Singapore and Malaysia	1976.01	0.010	0.941	0.271
		(2.073)	(5.475)	
Spain	1976.01	0.005	0.821	0.236
		(1.162)	(7.220)	
Sweden	1976.01	0.012	0.858	0.286
		(2.981)	(8.061)	
Switzerland	1976.01	0.008	0.874	0.460
		(2.867)	(12.096)	
United Kingdom	1976.01	0.011	1.099	0.488
		(3.362)	(15.002)	
United States	1976.01	0.008	0.840	0.626
		(4.176)	(13.898)	
Emerging markets				
Argentina	1976.01	0.061	−0.180	−0.004
		(2.752)	(−0.430)	
Brazil	1976.01	0.017	0.407	0.005
		(1.397)	(1.287)	
Chile	1976.01	0.032	0.120	−0.003
		(3.776)	(0.571)	
Colombia	1985.01	0.037	0.145	−0.006
		(3.599)	(0.763)	
Greece	1976.01	0.006	0.381	0.019
		(0.883)	(2.117)	
India	1976.01	0.018	−0.024	−0.005
		(3.242)	(−0.175)	

Market	*Starting year and month*	*Intercept*	*World return[a] beta*	$\bar{R}^2$
Indonesia	1990.01	−0.004	0.126	−0.031
		(−0.249)	(0.311)	
Jordan	1979.01	0.008	0.159	0.012
		(1.902)	(1.548)	
Korea, Rep. of	1976.01	0.014	0.549	0.058
		(2.286)	(3.686)	
Malaysia	1985.01	0.005	0.738	0.199
		(0.700)	(3.542)	
Mexico	1976.01	0.022	0.764	0.057
		(2.416)	(3.107)	
Nigeria	1985.01	0.000	0.222	−0.001
		(0.004)	(1.031)	
Pakistan	1985.01	0.021	0.052	−0.010
		(3.022)	(0.355)	
Philippines	1985.01	0.036	0.770	0.099
		(3.188)	(2.827)	
Portugal	1986.02	0.027	1.168	0.148
		(1.780)	(4.807)	
Taiwan (China)	1985.01	0.028	0.687	0.034
		(1.644)	(1.629)	
Thailand	1976.01	0.016	0.379	0.041
		(2.989)	(1.940)	
Turkey	1987.01	0.039	0.216	−0.013
		(1.459)	(0.524)	
Venezuela	1985.01	0.035	−0.382	0.007
		(2.271)	(−1.119)	
Zimbabwe	1976.01	0.008	0.214	0.003
		(1.053)	(1.151)	

Note: All returns are calculated in U.S. dollars and are in excess of the thirty-day Eurodeposit rate. Results are reported for a linear regression of the excess market return on the world return. The intercept and slope (beta) are reported with heteroskedasticity-consistent *t*-ratios (in parentheses).

a. The MSCI value-weighted world-market portfolio in excess of the thirty-day Eurodollar deposit rate.

Source: The monthly returns for emerging markets are from IFC EMDB. The industrial-market returns are from MSCI.

It is clear that a single-factor model is not enough to provide a meaningful definition of risk. Harvey (1994c) provides statistical tests of the single-factor model (testing eight markets during the period from February 1976 to June 1992 and eighteen markets from March 1986 to June 1992) and finds strong rejections of the model's implications.

Of course, these rejections could be caused by the assumption that the betas and expected returns are constant over time. However, Harvey (1994c) also allows for both the beta and the expected returns to change over time. He finds that this more general model is also rejected. In a way, his evidence contrasts with that of Buckberg (1995), who uses a world CAPM and fails to reject the model for fourteen emerging markets. The difference between these two sets of results can be reconciled. Buckberg estimates her model under the null hypothesis that the excess local-market returns are proportional to the excess world-market return. For many markets, her tests cannot reject the null hypothesis.

Harvey (1994c) estimates the model under the alternative hypothesis that excess returns are linear in the excess world-market return. The intercept, under the null (to make linearity equal to proportionality), should be equal to zero. Harvey finds sharp evidence against the null with this formulation. It is reasonable to conclude that Buckberg's test lacks power. It is unlikely that the single-factor model is sufficient to characterize expected returns in emerging markets.

III. Foreign Exchange Exposure

The international asset-pricing models of Adler and Dumas (1983), Sercu (1980), Solnik (1974), and Stulz (1981) all provide a role for exchange risk. In the Adler and Dumas model (their equation 14), with N 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 Solnik's (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 $N - 1$ covariances with exchange rate changes (see the discussion in Dumas 1994).

Unfortunately, the Adler and Dumas (1983) model is intractable unless a very small number of countries are examined. For example, Dumas and Solnik (1994) are able to estimate the model for only four countries. One possible simplification pursued in a number of papers is to aggregate the exchange rate factor (see Bailey and Jagtiani 1994; Bodurtha 1990; Brown and Otsuki 1993; Ferson and Harvey 1993, 1994; Harvey, Solnik, and Zhou 1994, and Jorion 1991). Given that it is impossible to observe the wealth-weighted risk aversions of the $N - 1$ markets, 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 multifactor model of asset pricing, following Merton (1973), Ross (1976), and Sharpe (1984). Empirically, Ferson and Harvey (1993, 1994) and Harvey, Solnik, and Zhou (1994) have found the aggregated exchange risk factor to be significant in both conditional and unconditional asset-pricing tests. Harvey, Solnik, and Zhou show that the loadings from these first two factors are able to explain 35 percent of the cross-section of expected bond and stock returns in industrial markets.

Both the Organization for Economic Cooperation and Development (OECD) and the Federal Reserve Bank publish indexes of the value of the U.S. dollar. The percentage change in these indexes represents the changes in the exchange rate. The index changes are not "true" returns, however, because investors are usually assumed not to hold cash: an investor purchasing deutsche mark would immediately deposit the deutsche mark in a Euromark account. Hence, to con-

struct a currency return index, local interest rates need to be included in the calculation.

Harvey (1994b) describes the construction of a trade-weighted index of currency returns. Because I use this index to measure the global currency–risk exposure of the emerging markets, a brief review of the construction of the index is in order.

The index of currency returns is similar to the Federal Reserve index in that it uses trade weights to aggregate each market component. A trade weight is the value of exports plus the value of imports divided by the sum of both for ten markets (Group of Ten plus Switzerland minus the United States). The two indexes are dissimilar, however, in that the Federal Reserve index uses the trade weights that existed during 1972–76 and keeps these weights fixed, whereas the index of currency returns allows the trade weights to change over time. The fixed trade weights for the ten markets in the Federal Reserve index are as follows: Germany, 20.8 percent; Japan, 13.6 percent; France, 13.1 percent; the United Kingdom, 11.9 percent; Canada, 9.1 percent; Italy, 9.0 percent; the Netherlands, 8.3 percent; Belgium, 6.4 percent; Sweden, 4.2 percent; and Switzerland, 3.6 percent. The current value of the Federal Reserve index is calculated by dividing the U.S. dollar per local currency rate in the base period of March 1973 by the U.S. dollar per local currency rate in the current period. Hence, as the U.S. dollar depreciates, the index decreases because the denominator gets larger.

Harvey (1994b) allows the trade weights to change through time. Using the same general approach as the Federal Reserve, he lets the weights reflect a five-year moving average of trade. Shifts in trade weights are important. Belgium's trade sector dropped from 7.2 percent in December 1969 to 6.7 percent in November 1992. The drop for Canada is one of the largest, from 10.3 percent to 7.5 percent. France's trade gained from 11.8 percent to 12.7 percent. Germany's grew from 19.9 percent to 21.7 percent. Italy's showed an increase from 8.8 percent to 9.9 percent. The most dramatic increase was Japan's, which jumped from 10.7 percent to 15.6 percent. The Netherlands' trade sector lost a small amount of ground, dropping from 7.7 percent to 7.3 percent. Sweden's fell from 4.5 percent to 3.1 percent. Switzerland's was stable at 3.7 percent. Finally, the United Kingdom's trade share plummeted from 15.4 percent to 11.5 percent. To allow for reasonable publication delays, the trade weights are lagged by one year when the index returns are calculated. That is, the average trade weights for the period January 1975 to December 1979 are applied to the currency return for January 1981.

Harvey then calculates the exchange rate–investment return for each market by converting 100 U.S. dollars into local currency on the last day of the month and investing in a thirty-day Eurodeposit. One month later the deposit comes due and is converted back to dollars. Notice how this approach is different from that of the Federal Reserve index. As the U.S. dollar depreciates, the investor holding a foreign currency will gain.

In summary, Harvey's (1994b) global exchange rate index has two features that distinguish it from the traditional exchange rate indexes: currency returns rather than rate changes are used, and trade weights are allowed to change over time. Although this index does not include emerging markets, including emerging markets would probably not affect the index very much, because the trade weight on these markets would be very small. Even though the trade weight is small, swings in the exchange rate are large; however, the index is calculated with returns, not rate changes. Presumably, a large depreciation in currency, for example in Brazil, would be offset by a high interest rate on local deposits.

For industrial-market returns, the betas on the exchange rate–investment index presented in table 4 are significantly different from zero for twelve of twenty-one markets within the overall period. The betas range from -0.50 for the U.S. portfolio to 0.94 for Austria. In general, the non-Scandinavian markets in Europe exhibit significant positive betas. The risk for Canada and the United States is negative. The exchange rate factor has marginal explanatory power in eight of the twenty emerging markets: Greece, India, Jordan, Malaysia, Mexico, Pakistan, Taiwan (China), and Zimbabwe. However, in eight other markets the R^2 of the two-factor regressions is zero.

In the most recent subperiod (not reported), the marginal explanatory power of the foreign exchange risk factor is not substantially altered. Eight emerging markets have t-statistics greater than 1.5 on the exchange portfolio. This portfolio has some ability to explain returns in Argentina, Chile, and Thailand.

Plots of the five-year rolling correlations between the emerging-market returns and the foreign exchange portfolio are presented in figure A-2. These correlation measures are not the same as betas because there is no control for the correlation with the world market portfolio. However, the plots reveal interesting similarities to the ones presented in figure A-1. There is a tendency for the correlations to increase in absolute magnitude during the last seven years of the sample in some of the markets. This is the case in the South American markets and Mexico. The correlations are 0 percent in the East Asian markets, with the exception of Thailand. The correlation of the foreign exchange index and the Greek equity market is about 30 percent in 1992 and rises to more than 50 percent for Portugal.

Again, although foreign exchange exposure does not explain the average returns (measured over the entire sample, the cross-sectional R^2 is 7 percent), the graphs indicate that the cross-sectional relation may be strengthening over time.[4]

IV. Multifactor Model

International asset-pricing models that include multiple factors are described in Bansal, Hsieh, and Viswanathan (1993); Ferson and Harvey (1993, 1994);

4. For the twenty-one industrial markets, the cross-sectional adjusted R^2 is 37 percent.

Hodrick (1981); Ross and Walsh (1983); Solnik (1983); and Stulz (1981, 1993) find that a number of global risk factors are important in capturing the variation in both the cross-section of expected returns and the time series of expected returns. The three additional factors examined here are similar to theirs.

The factors are designed to capture three broad economic forces: commodity prices, inflation, and the world business cycle. A number of researchers have found that shocks in crude oil prices have important effects on stock returns in industrial markets. I specify the factor as the change in the U.S. dollar price per barrel of crude oil at the wellhead less the Eurodollar deposit rate. The world business cycle is proxied by the growth rate in OECD industrial production. Finally, world inflation is proxied by the OECD inflation rate. The risk exposures for the five-factor model are presented in table 5.

In the overall sample of twenty-one industrial markets, eight have significant exposure to oil, two have exposure to industrial production growth, and five have significant exposure to inflation. The adjusted R^2s of these regressions range from 3 percent to 71 percent.

The inclusion of these additional factors does not help to explain the emerging-market returns. Of the twenty emerging markets, five have significant oil exposure. In four of these markets (Colombia, Jordan, the Philippines, and Taiwan, China), the exposure is negative, which indicates decreasing returns when oil prices rise. In Venezuela, the exposure is positive, as it is (albeit insignificantly) in Mexico and Nigeria. Only three of the emerging markets have significant exposure to world industrial production, and only four markets have significant loadings on world inflation. The adjusted R^2s of the five-factor regressions range from 0 percent (in six markets) to 25 percent in Malaysia.

Plots of the five-year rolling correlations with the final three factors were calculated but are not presented. In most industrial markets, the oil exposure is negative. This means that an increase in the price of oil is viewed as bad news, on average, by market participants. Even producers such as the United Kingdom and Canada have 0 percent or negative exposure. In the emerging markets, there are a number of different patterns. For example, the Mexican exposure, although positive in the early 1980s, is now negative. It appears that the Mexican economy's dependence on the strength of the U.S. economy is more important than Mexico's oil holdings. India's market has an unexpected positive correlation with oil, increasing from 0 percent in 1987 to about 35 percent by 1992. Thailand's correlation shows a dramatic change, from 35 percent in the early 1980s to −35 percent by 1992.

The graphical analysis also suggests time-varying exposures to growth both in industrial production and in the inflation rate. In seven of the emerging markets, the correlation with OECD industrial production shows an increase over time. In the other thirteen emerging markets, there are no detectable patterns over time. There are no obvious trends in the correlation with OECD inflation across all the emerging markets.

Table 4. *Two-Factor Model Loadings for Forty-One Equity Markets, 1976–92*

Market	*Starting year and month*	*Intercept*	*World return[a] beta*	*Exchange rate investment index[b] beta*	$\bar{R}^2$
Industrial markets					
Australia	1976.01	0.010	0.918	−0.128	0.237
		(1.970)	(4.279)	(−0.523)	
Austria	1976.01	0.010	0.271	0.941	0.213
		(2.162)	(1.684)	(5.156)	
Belgium	1976.01	0.011	0.740	0.635	0.457
		(3.393)	(6.890)	(5.075)	
Canada	1976.01	0.007	1.001	−0.299	0.481
		(2.195)	(11.537)	(−2.737)	
Denmark	1976.01	0.009	0.551	0.540	0.331
		(2.880)	(6.893)	(4.552)	
Finland	1988.01	−0.008	0.710	−0.195	0.212
		(−1.057)	(4.161)	(−0.649)	
France	1976.01	0.010	0.920	0.697	0.452
		(2.461)	(9.536)	(4.940)	
Germany	1976.01	0.008	0.628	0.800	0.410
		(2.476)	(4.723)	(5.479)	
Hong Kong	1976.01	0.017	1.013	−0.064	0.177
		(2.634)	(4.352)	(−0.212)	
Ireland	1988.01	0.010	1.036	0.052	0.460
		(1.445)	(5.776)	(0.235)	
Italy	1976.01	0.008	0.799	0.253	0.217
		(1.718)	(7.122)	(1.374)	
Japan	1976.01	0.010	1.063	0.418	0.548
		(2.962)	(9.987)	(3.316)	
Netherlands	1976.01	0.012	0.805	0.300	0.551
		(4.914)	(11.123)	(3.413)	
New Zealand	1988.01	−0.002	0.478	−0.120	0.043
		(−0.163)	(2.578)	(−0.343)	
Norway	1976.01	0.009	0.999	0.129	0.274
		(1.841)	(6.722)	(0.667)	
Singapore and Malaysia	1976.01	0.010	1.011	−0.303	0.279
		(2.167)	(5.187)	(−1.232)	
Spain	1976.01	0.005	0.741	0.350	0.251
		(1.110)	(5.472)	(2.074)	
Sweden	1976.01	0.012	0.848	0.043	0.283
		(2.972)	(7.510)	(0.329)	
Switzerland	1976.01	0.008	0.729	0.629	0.559
		(2.971)	(8.170)	(5.967)	
United Kingdom	1976.01	0.011	1.042	0.249	0.496
		(3.342)	(12.187)	(2.108)	
United States	1976.01	0.009	0.955	−0.499	0.718
		(5.157)	(17.179)	(−7.692)	
Emerging markets					
Argentina	1976.01	0.061	−0.036	−0.621	−0.006
		(2.783)	(−0.089)	(−0.995)	
Brazil	1976.01	0.018	0.561	−0.667	0.010
		(1.451)	(1.711)	(−1.501)	
Chile	1976.01	0.031	0.065	0.240	−0.005
		(3.752)	(0.265)	(0.782)	
Colombia	1985.01	0.035	0.103	0.238	−0.011
		(3.432)	(0.562)	(0.754)	
Greece	1976.01	0.006	0.230	0.655	0.043
		(0.824)	(1.107)	(2.391)	

Market	*Starting year and month*	*Intercept*	*World return[a] beta*	*Exchange rate investment index[b] beta*	$\bar{R}^2$
India	1976.01	0.018	−0.136	0.489	0.020
		(3.230)	(−0.956)	(2.444)	
Indonesia	1990.01	−0.002	0.180	−0.351	−0.059
		(−0.089)	(0.434)	(−0.483)	
Jordan	1979.01	0.008	0.075	0.356	0.044
		(1.972)	(0.702)	(2.296)	
Korea, Rep. of	1976.01	0.015	0.627	−0.339	0.063
		(2.326)	(3.995)	(−1.407)	
Malaysia	1985.01	0.010	0.865	−0.726	0.272
		(1.510)	(4.643)	(−3.012)	
Mexico	1976.01	0.023	1.003	−1.036	0.100
		(2.603)	(3.862)	(−2.692)	
Nigeria	1985.01	−0.002	0.159	0.360	−0.002
		(−0.187)	(0.808)	(1.239)	
Pakistan	1985.01	0.017	−0.040	0.524	0.041
		(2.728)	(−0.276)	(2.295)	
Philippines	1985.01	0.038	0.819	−0.282	0.094
		(3.398)	(2.934)	(−0.916)	
Portugal	1986.02	0.028	1.185	−0.108	0.137
		(1.754)	(5.071)	(−0.252)	
Taiwan (China)	1985.01	0.037	0.937	−1.426	0.102
		(2.298)	(2.426)	(−3.344)	
Thailand	1976.01	0.016	0.409	−0.132	0.039
		(3.060)	(1.753)	(−0.501)	
Turkey	1987.01	0.037	0.155	0.445	−0.026
		(1.387)	(0.345)	(0.475)	
Venezuela	1985.01	0.032	−0.461	0.451	0.005
		(2.115)	(−1.303)	(1.301)	
Zimbabwe	1976.01	0.007	0.072	0.619	0.028
		(1.002)	(0.368)	(2.508)	

Note: All returns are calculated in U.S. dollars and are in excess of the thirty-day Eurodeposit rate. Results are reported for a linear regression of the excess market return on the world return and the exchange-investment index. The intercept and slopes (betas) are reported with heteroskedasticity-consistent *t*-ratios (in parentheses).

a. The MSCI value-weighted world-market portfolio in excess of the thirty-day Eurodollar deposit rate.

b. The U.S. dollar return to holding a trade-weighted portfolio of Eurocurrency deposits in ten countries (Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, Switzerland, and the United Kingdom) in excess of the thirty-day Eurodollar deposit rate (see Harvey 1994b for details of the construction of the index).

Source: The monthly returns for emerging markets are from the IFC EMDB. The industrial-market returns are from MSCI.

Although the addition of the three factors increases the ability to explain the cross-section of expected returns (adjusted R^2 rises to 10 percent), much is left unexplained.[5] There are two ways to interpret these results. In one sense, the combination of the five prespecified factors can be considered a portfolio. The inability of the factor loadings as a group to explain the cross-section of average returns suggests that this portfolio is inefficient.

5. For the twenty-one industrial markets, the adjusted R^2 is 29 percent.

Table 5. *Five-Factor-Model Loadings for Forty-One Equity Markets, 1976–92*

Market	*Starting year and month*	*Intercept*	*World return[a] beta*	*Exchange rate investment index[b] beta*	*Commodity prices[c] beta*	*World business cycle[d] beta*	*Inflation[e] beta*	$\bar{R}^2$
Industrial markets								
Australia	1976.01	0.002	0.960	−0.140	0.072	0.269	1.225	0.241
		(0.188)	(4.504)	(−0.594)	(1.851)	(0.389)	(0.739)	
Austria	1976.01	0.019	0.255	0.914	−0.047	0.998	−2.009	0.226
		(2.099)	(1.680)	(5.015)	(−0.912)	(1.694)	(−1.740)	
Belgium	1976.01	0.020	0.719	0.620	−0.021	0.112	−1.781	0.459
		(3.068)	(6.665)	(4.755)	(−0.894)	(0.222)	(−1.812)	
Canada	1976.01	0.003	1.030	−0.313	0.053	0.275	0.516	0.487
		(0.454)	(12.167)	(−2.947)	(1.975)	(0.645)	(0.423)	
Denmark	1976.01	0.010	0.545	0.544	−0.001	−0.277	−0.089	0.322
		(1.390)	(6.655)	(4.526)	(−0.021)	(−0.541)	(−0.086)	
Finland	1988.01	0.000	0.777	−0.258	0.062	−0.118	−2.073	0.184
		(0.025)	(4.715)	(−0.882)	(1.183)	(−0.082)	(−0.494)	
France	1976.01	0.003	0.925	0.710	−0.043	0.605	1.034	0.454
		(0.336)	(9.267)	(5.109)	(−1.731)	(1.196)	(0.792)	
Germany	1976.01	0.015	0.609	0.793	−0.024	0.012	−1.213	0.406
		(1.965)	(4.630)	(5.387)	(−0.532)	(0.020)	(−1.159)	
Hong Kong	1976.01	0.010	1.018	−0.043	−0.012	−0.147	1.395	0.166
		(0.738)	(4.439)	(−0.142)	(−0.335)	(−0.137)	(0.709)	
Ireland	1988.01	−0.005	1.061	0.039	−0.013	−0.361	3.630	0.438
		(−0.301)	(6.190)	(0.173)	(−0.223)	(−0.304)	(1.029)	
Italy	1976.01	0.018	0.754	0.258	−0.088	0.093	−1.703	0.230
		(1.851)	(6.982)	(1.438)	(−1.881)	(0.124)	(−1.093)	
Japan	1976.01	0.005	1.046	0.452	−0.047	−0.495	1.025	0.551
		(0.687)	(9.949)	(3.724)	(−1.947)	(−1.028)	(0.929)	
Netherlands	1976.01	0.015	0.820	0.277	0.057	0.018	−0.633	0.563
		(3.269)	(11.368)	(3.107)	(3.577)	(0.050)	(−0.869)	
New Zealand	1988.01	0.001	0.541	−0.176	0.059	2.501	−1.462	0.035
		(0.047)	(2.751)	(−0.550)	(1.103)	(2.288)	(−0.240)	
Norway	1976.01	−0.010	1.103	0.097	0.150	1.261	2.971	0.332
		(−1.021)	(7.765)	(0.529)	(4.229)	(1.715)	(1.688)	
Singapore and Malaysia	1976.01	−0.006	1.038	−0.270	0.004	−0.039	2.968	0.282
		(−0.598)	(5.563)	(−1.134)	(0.110)	(−0.051)	(1.955)	

Spain	1976.01	0.011	0.695	0.367	−0.100	−0.026	−1.071	0.271
		(1.117)	(5.162)	(2.222)	(−2.222)	(−0.039)	(−0.754)	
Sweden	1976.01	0.014	0.829	0.044	−0.082	0.900	−0.642	0.304
		(1.910)	(7.860)	(0.332)	(−2.835)	(1.472)	(−0.574)	
Switzerland	1976.01	0.017	0.712	0.613	0.011	−0.316	−1.642	0.563
		(3.094)	(7.811)	(5.691)	(0.454)	(−0.695)	(−1.893)	
United Kingdom	1976.01	0.002	1.060	0.262	0.005	0.111	1.569	0.494
		(0.328)	(12.329)	(2.235)	(0.223)	(0.206)	(1.496)	
United States	1976.01	0.011	0.953	−0.505	0.016	−0.188	−0.411	0.717
		(2.896)	(17.393)	(−7.812)	(1.006)	(−0.631)	(−0.757)	
Emerging markets								
Argentina	1976.01	0.076	0.010	−0.714	0.175	0.553	−2.997	−0.017
		(1.541)	(0.024)	(−1.152)	(1.234)	(0.155)	(−0.424)	
Brazil	1976.01	0.023	0.489	−0.613	−0.116	−1.428	−0.429	0.003
		(0.836)	(1.577)	(−1.347)	(−1.123)	(−0.748)	(−0.112)	
Chile	1976.01	0.028	0.028	0.297	−0.053	−1.578	1.238	−0.009
		(1.804)	(0.115)	(0.978)	(−1.045)	(−1.276)	(0.476)	
Colombia	1985.01	0.074	−0.117	0.378	−0.097	−3.129	−8.701	0.049
		(3.812)	(−0.681)	(1.097)	(−2.109)	(−1.892)	(−2.390)	
Greece	1976.01	0.022	0.161	0.680	−0.024	−2.327	−2.047	0.053
		(1.539)	(0.773)	(2.469)	(−0.411)	(−2.069)	(−1.130)	
India	1976.01	0.007	−0.085	0.474	0.058	0.862	1.572	0.021
		(0.543)	(−0.606)	(2.465)	(1.049)	(1.177)	(0.978)	
Indonesia	1990.01	0.053	−0.205	−0.107	−0.099	1.541	−13.933	−0.064
		(1.511)	(−0.429)	(−0.150)	(−1.051)	(0.466)	(−1.834)	
Jordan	1979.01	−0.009	0.090	0.412	−0.063	0.267	3.215	0.081
		(−1.088)	(0.934)	(2.627)	(−2.012)	(0.421)	(2.107)	
Korea, Rep. of	1976.01	0.032	0.600	−0.379	−0.022	0.553	−3.285	0.064
		(2.507)	(3.739)	(−1.574)	(−0.410)	(0.579)	(−1.394)	
Malaysia	1985.01	0.006	0.900	−0.759	0.010	0.793	0.845	0.251
		(0.336)	(4.882)	(−3.138)	(0.254)	(0.681)	(0.240)	
Mexico	1976.01	0.039	1.031	−1.136	0.043	2.556	−3.845	0.111
		(1.860)	(3.805)	(−2.863)	(0.752)	(1.874)	(−1.356)	
Nigeria	1985.01	−0.005	0.167	0.373	0.023	−0.484	0.820	−0.035
		(−0.173)	(0.707)	(1.233)	(0.599)	(−0.274)	(0.155)	
Pakistan	1985.01	0.033	−0.106	0.558	−0.010	−0.936	−3.717	0.027

(Table continues on the following page.)

Table 5. *(Continued)*

Market	*Starting year and month*	*Intercept*	*World return[a] beta*	*Exchange rate investment index[b] beta*	*Commodity prices[c] beta*	*World business cycle[d] beta*	*Inflation[e] beta*	$\bar{R}^2$
Philippines	1985.01	(2.292) 0.089	(−0.670) 0.607	(2.107) −0.248	(−0.237) −0.148	(−0.642) −0.176	(−1.473) −13.076	0.173
Portugal	1986.02	(3.663) −0.000	(2.572) 1.301	(−0.860) −0.146	(−2.972) 0.030	(−0.119) 0.808	(−2.173) 7.162	0.113
Taiwan (China)	1985.01	(−0.009) 0.018	(4.959) 0.859	(−0.326) −1.300	(0.622) −0.151	(0.475) −1.765	(1.051) 5.977	0.098
Thailand	1976.01	(0.609) 0.031	(2.231) 0.369	(−2.934) −0.151	(−1.718) −0.061	(−0.715) 0.322	(0.776) −2.749	0.049
Turkey	1987.01	(2.769) 0.025	(1.582) 0.185	(−0.574) 0.416	(−1.222) 0.040	(0.450) −1.476	(−1.671) 3.675	−0.073
Venezuela	1985.01	(0.367) 0.021	(0.377) −0.270	(0.443) 0.281	(0.263) 0.169	(−0.349) 3.018	(0.252) 1.399	0.020
Zimbabwe	1976.01	(0.646) −0.007 (−0.499)	(−0.869) 0.139 (0.714)	(0.825) 0.590 (2.341)	(1.689) 0.041 (0.976)	(1.166) 2.065 (1.876)	(0.162) 1.677 (0.788)	0.035

Note: All returns are calculated in U.S. dollars and are in excess of the thirty-day Eurodeposit rate. Results are reported for a linear regression of the excess market return on the world return, the exchange-investment index, and proxies for commodity prices, the world business cycle, and inflation. The intercept and slopes (betas) are reported with heteroskedasticity-consistent *t*-ratios (in parentheses).

a. The MSCI value-weighted world-market portfolio in excess of the thirty-day Eurodollar deposit rate.

b. The U.S. dollar return to holding a trade-weighted portfolio of Eurocurrency deposits in ten countries (Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, Switzerland, and the United Kingdom) in excess of the thirty-day Eurodollar deposit rate (see Harvery 1994b for details of the construction of the index).

c. The change in the U.S. dollar price of crude oil at the wellhead in excess of the thirty-day Eurodollar deposit rate.

d. The growth in OECD industrial production.

e. The growth in OECD inflation.

Source: The monthly returns for emerging markets are from the IFC EMDB. The industrial-market returns are from MSCI.

In another sense, in the context of an integrated global market, identical exposure to a source of risk in two different markets commands the same reward. The lack of a cross-sectional relation between the risk loadings and return performance could be symptomatic of market segmentation. As markets become more integrated, the cross-sectional correlation of risk exposures and expected returns should be higher.

Lack of integration opens up the possibility that equities are inefficiently priced in some emerging markets. Interestingly, the global investment manager may not care. The manager may prefer to have the opportunity to purchase securities at a price lower than the implied value in an integrated world economy.

The notions of underpricing and overpricing are vague without explicit reference to an asset-pricing model. In a globally integrated economy, covariance—not variance—is priced. That is, in integrated capital markets, investors can diversify away much of the idiosyncratic or local market variance by holding stocks from many markets. As a result, increases in the country variance (which could be driven by local events) do not necessarily command increases in expected returns. But in many of the emerging markets, there is a clear relation between average returns and volatility. Indeed, Harvey (1994c) shows that variance in emerging markets explains more of the cross-section of expected returns than covariance. This suggests that many of the markets are not integrated.

Global investors may not care if the market is integrated or segmented as long as they can access the market for investment. Indeed, global investors can enhance their portfolio performance by holding emerging-market assets with high variance and high expected returns. The enhancement results from the extremely high contribution to portfolio expected return per unit of covariance (not variance). Presumably, these opportunities would diminish as emerging markets become more integrated into the world economy. Although the expected return–covariance ratio may drop as a result of integration and the cross-border equity arbitrage may also decrease, integration may also imply that the cost of capital decreases. That is, in a segmented capital market, the cost of capital is high because investors demand a premium for bearing the local, or idiosyncratic, risk. In integrated capital markets, the cost of capital may decrease because compensation for idiosyncratic risk is not required. A lower cost of capital usually leads to additional foreign direct investment.

V. Conclusions

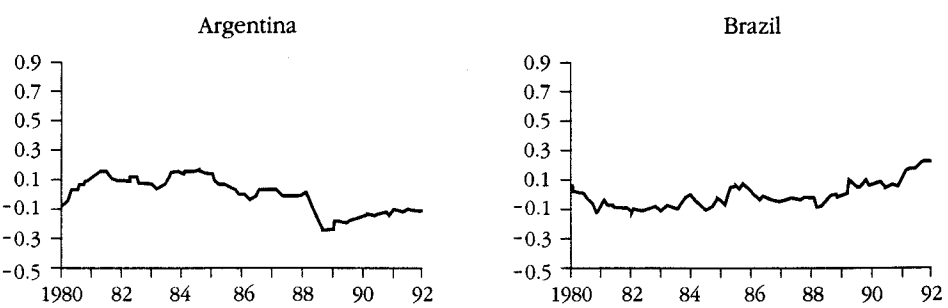
Recently a number of researchers have documented the low correlations between emerging-equity-market returns and industrial-market returns. However, little is known about the risk exposure of equity investments in emerging markets.

Indeed, in real world portfolio selection, investment portfolio weights are chosen subject to a number of constraints. These constraints usually involve the prohibition of short-selling any market, maximum position limits for each market or groups of markets, and limits on the portfolio exposures to certain sources of risk. For the last constraint, estimates of each market's risk exposures are needed. These risk constraints eliminate the possibility of choosing a global portfolio with a higher expected return than, for example, the Standard and Poor's 500 and with the same volatility—but with an oil beta of −3.00 (compared with the Standard and Poor's 500 oil beta of −0.30). In other words, on average, a 3 percent loss on the Standard and Poor's 500 portfolio would result if oil prices increased by 10 percent. In a portfolio with an oil beta of −3.00, the same increase in the price of oil would lead to, on average, a 30 percent loss in portfolio value. To many investors, this type of exposure is unacceptable. Hence, it is important not only to measure the global risk exposures of international markets, but also to use the estimated risk exposures in portfolio formation.

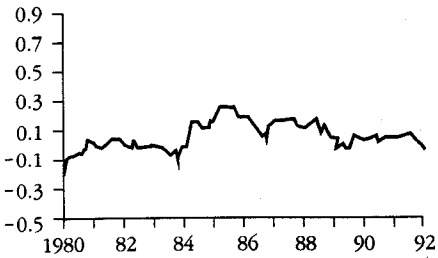
This article has examined five global risk factors: the world-market equity return, the return on a foreign currency index, a change in the price of oil, growth in world industrial production, and the world inflation rate. Only a handful of emerging markets have been found to have significant exposures to these factors. For example, only one of twenty emerging markets was found to have a beta against the world market portfolio that exceeded unity.

One implication of the risk analysis is that many of the emerging markets are not well integrated into the global economy. However, the time-series evidence suggests that a number of markets may be becoming increasingly integrated. Models that allow for time-varying integration of world capital markets are explored in Bekaert and Harvey (1994).

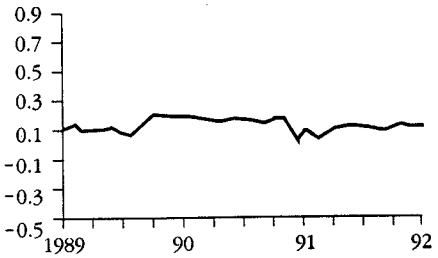
Figure A-1. *Correlation of Emerging-Market Returns with Returns from the MSCI World Market Portfolio*



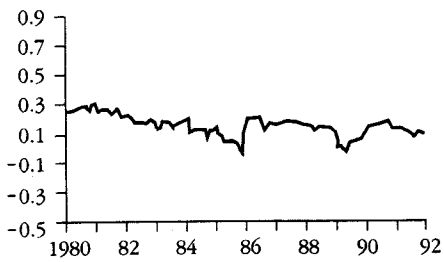
Chile



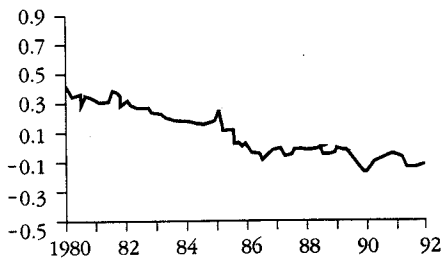
Colombia



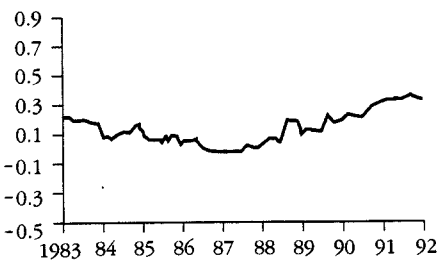
Greece



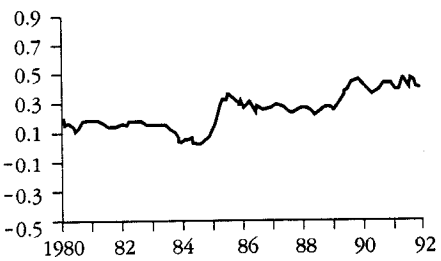
India



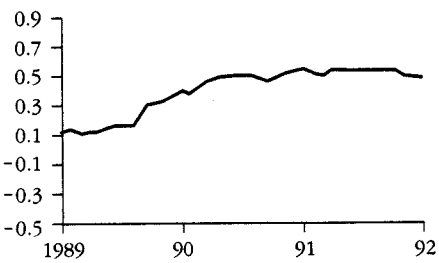
Jordan



Republic of Korea



Malaysia



Mexico

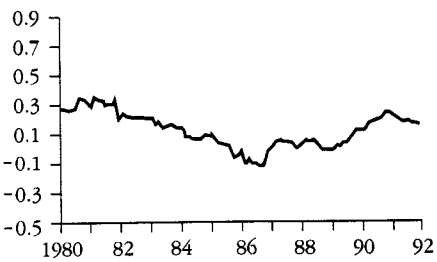


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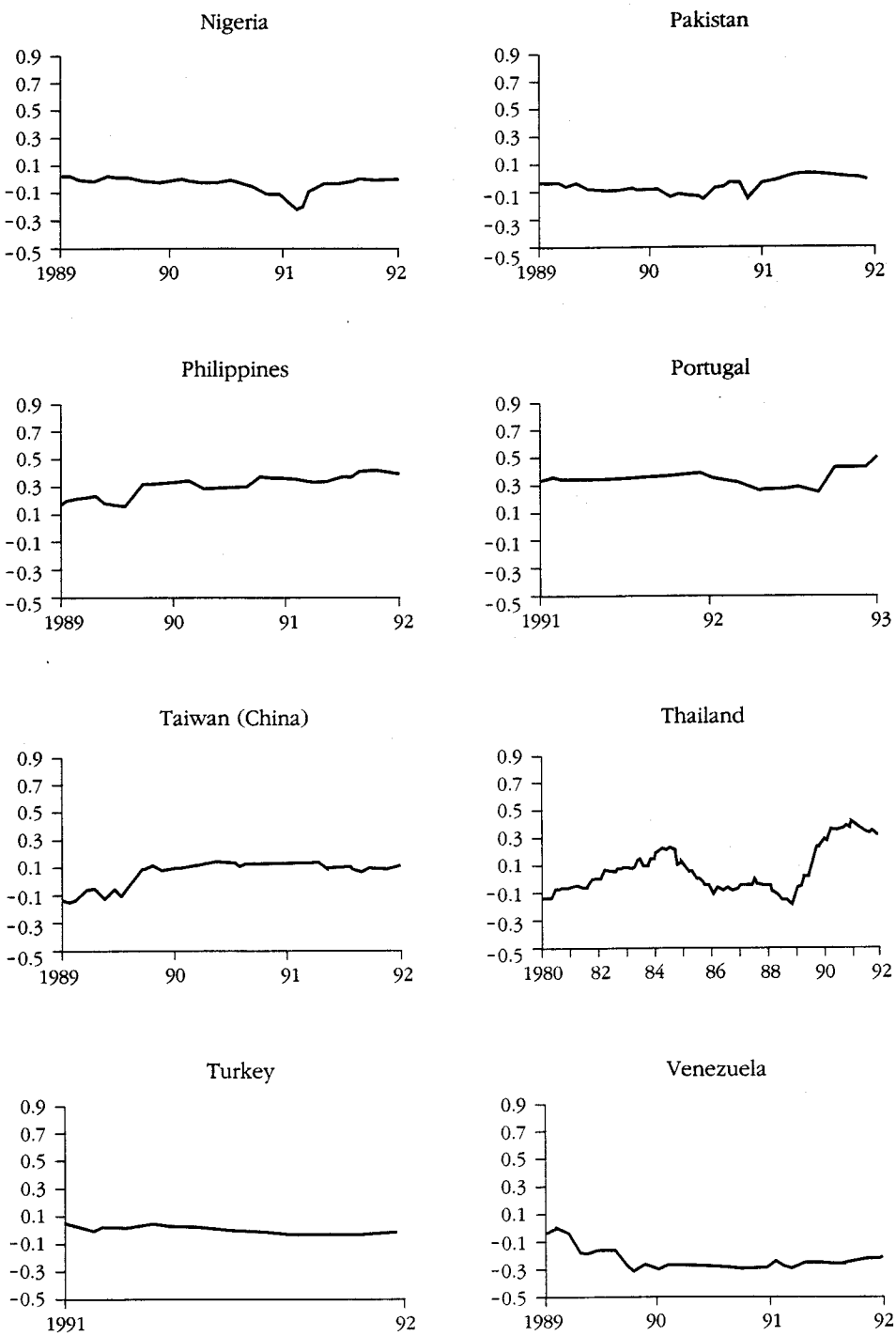
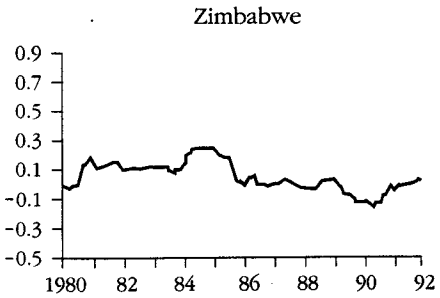
Figure A-1 *(continued)*





Note: Values are five-year moving correlations with the MSCI value-weighted world market portfolio in excess of the thirty-day Eurodollar deposit rate. The correlations are based on monthly returns calculated in U.S. dollars.
Source: Author's calculations.

Figure A-2. *Correlation of Emerging-Market Returns with Currency Returns from Ten Industrial Markets*

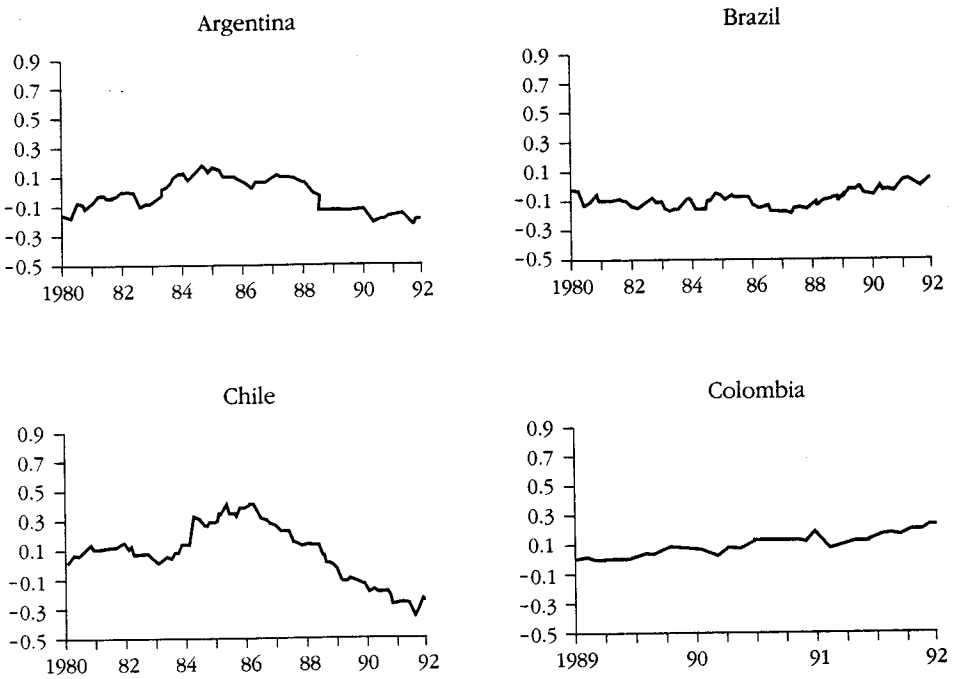


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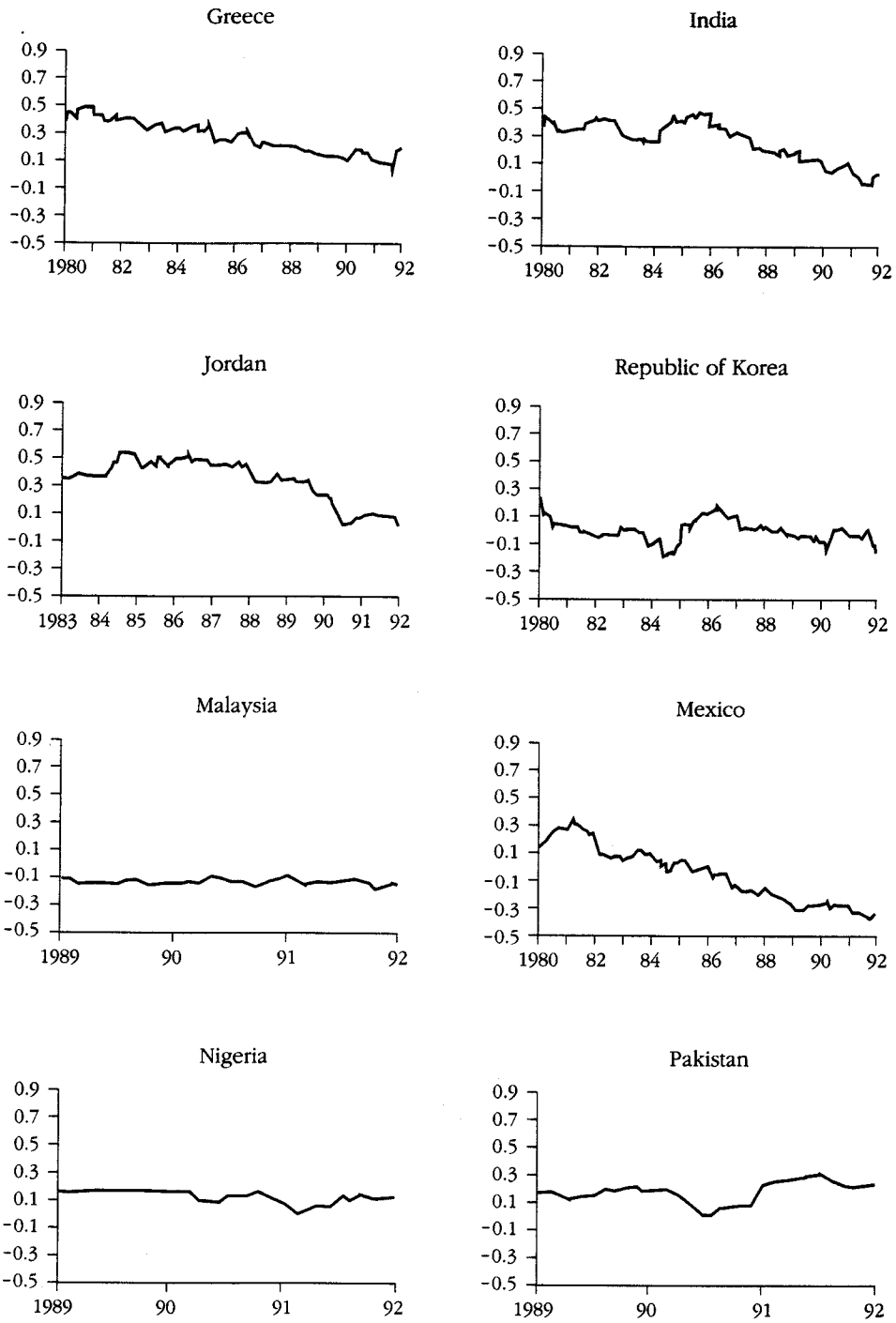
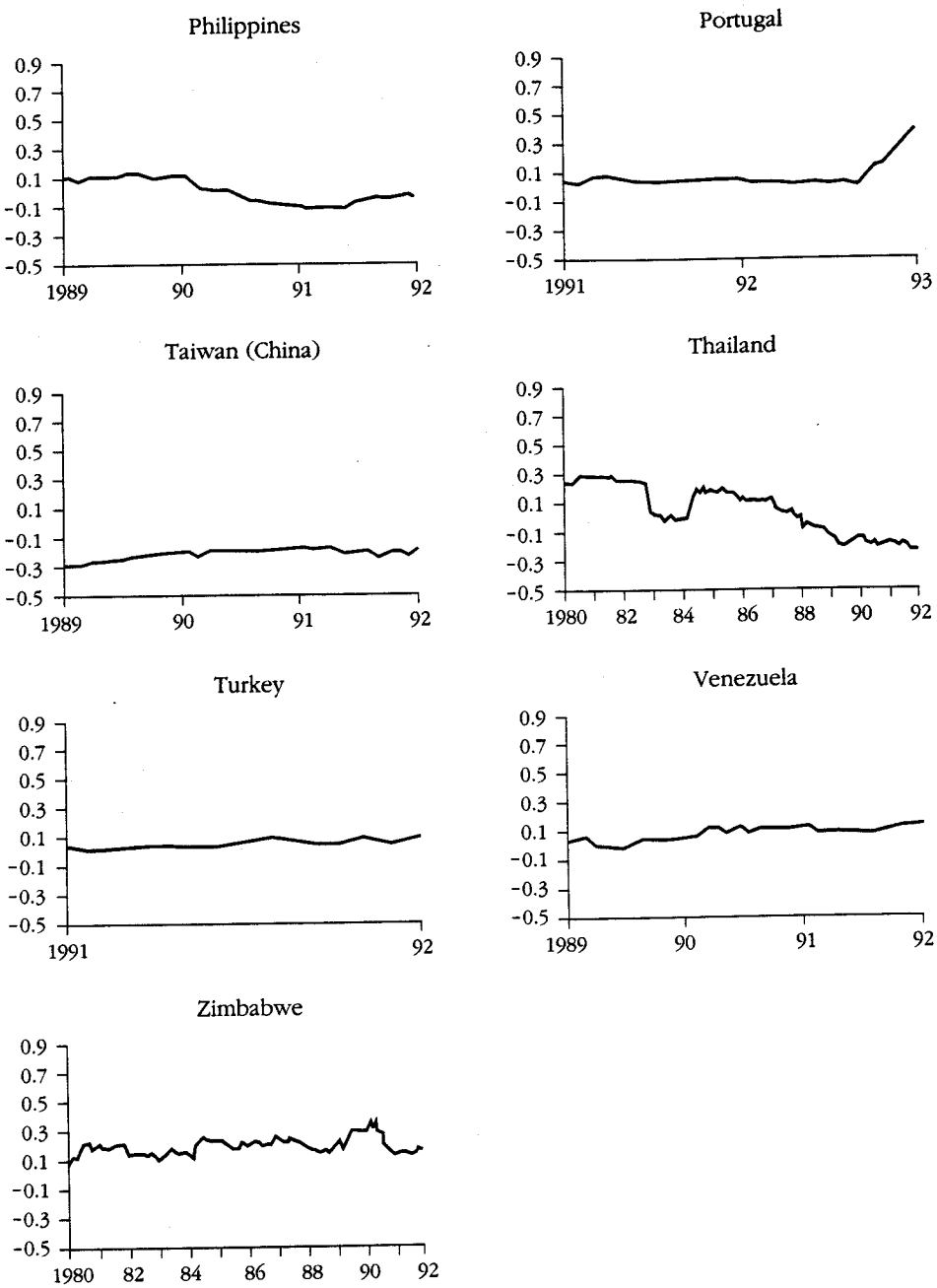
Figure A-2 (*continued*)





Note: Values are five-year moving correlations with the U.S. dollar return to holding a trade-weighted portfolio of Eurocurrency deposits in ten markets (Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, Switzerland, and the United Kingdom) in excess of the thirty-day Eurodollar deposit rate: see Harvey (1994b) for details of the construction of the index. The correlations are based on monthly returns calculated in U.S. dollars.

Source: Author's calculations.

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