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Volatility and Predictability in National Stock Markets: How Do Emerging and Mature Markets Differ?

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Abstract

This paper examines the evidence for the common assertion that the volatility of emerging stock markets has increased as a result of the liberalization of markets. A range of measures suggests that there has been no generalized increase in volatility in recent years; indeed, it appears that volatility may have tended to fall rather than rise on average. The paper also tests for the predictability of long-horizon returns in emerging markets. While there is evidence for positive autocorrelation in returns at horizons of one or two quarters, the autocorrelations appear to turn negative at horizons of a year or more. However, the magnitude of the apparent return reversals is not that much larger than reversals in some mature markets. One interpretation of the results would be that emerging markets have not consistently been subject to fads or bubbles, or at least no more so than in some industrial countries. In general, the liberalization and broadening of emerging markets should lead to a reduction in return volatility as risk is spread among a larger number of investors.

JEL CLASSIFICATION NUMBERS: G12; G15

1/ I am grateful to the International Finance Corporation and Morgan Stanley and Co. for providing data. Thanks to Julian Berengaut, Mohamed El-Erian, Ross Levine, Henri Lorie, Carmen Reinhart and Heidi Willmann Richards for comments and to Linda Galantin for preparing the charts. The views expressed in this paper are those of the author, and do not necessarily reflect those of the International Monetary Fund.

Table of Contents

Summary

A widely held perception about emerging equity markets is that price or return indices in these markets are frequently subject to extended deviations from fundamental values with subsequent reversals, as seen recently in Mexico and other related markets. In addition, there is a perception that these deviations from fundamental values may be due in large part to the growing influence of highly mobile foreign capital, which may have increased volatility in these markets. This paper examines the evidence for these propositions.

The paper constructs various estimates of the volatility of emerging market returns. Although the volatility of emerging markets is, on average, higher than the volatility of mature markets, it may have actually fallen in recent years. Misperceptions about volatility may therefore be more a function of increased attention to emerging markets: price changes that may previously have gone unnoticed now attract significant attention in the international financial press.

To investigate the possibility of extended deviations from fundamental values in asset prices, various tests for long-horizon return predictability are conducted. There is evidence of positive autocorrelation in returns at horizons of one or two quarters. However, at horizons of a year or more, there is evidence of negative autocorrelation, or return reversals. The magnitude of the reversals is somewhat larger in absolute terms than those identified in industrial countries, though perhaps smaller in relative terms when the greater overall volatility of emerging market returns is considered. That is, there is only limited evidence that emerging markets have been more subject than mature markets to extended deviations from fundamental values in prices.

As financial markets become more open, residents and foreigners benefit because risk is spread more widely. As a result, smaller changes in asset prices will be required to equalize the demand and supply of risky assets. The required rate of return on domestic projects (i.e., the cost of capital) should therefore fall in response to market liberalization. Of course, to the extent that capital inflows are excessive, the liberalization of markets may lead to unwarranted appreciation of the real exchange rate, unsustainable current account deficits, and bubbles in asset prices. To minimize the likelihood of damaging fluctuations in asset prices and capital flows, national authorities should focus primarily on avoiding unsustainable economic policies. Strong prudential regulation and supervision will be important, along with the regular and timely publication of economic statistics. There may also be a case for gradual liberalization and a focus on structural reform to ensure that capital inflows do not occur more rapidly than the ability of an economy to absorb these flows. If appropriate economic policies are in place, return volatility in emerging markets should continue to fall toward industrial country levels.

I. Introduction

The attractiveness of emerging equity markets is now well known. Between 1987 and 1993, the proportion of foreign portfolio investment from industrial countries that was directed to emerging markets rose from 0.5 percent to 16 percent (IMF, 1995a). Growth in emerging equity markets has indeed been so strong that market capitalization is larger in relation to GDP in some emerging markets than in many so-called "mature" markets. 1/

Despite the rapid growth in emerging equity markets there has been relatively little published research into the behavior of these markets. Much of the early work this area did little more than demonstrate the low correlations between emerging markets and mature markets and to infer the large mean-variance gains from the addition of stocks from these countries into portfolios of industrial country equities. More recently, serious work on these markets has begun, as witnessed by a conference on emerging markets organized by the World Bank in 1993 (see Claessens and Gooptu, 1993). There has also been research in the wake of the Mexican crisis of late 1994 and early 1995 (e.g., IMF, 1995a, 1995b). 2/

A widely held perception about emerging equity markets is that price or return indices in these markets are frequently subject to extended deviations from fundamental values with subsequent reversals, as seen recently in Mexico. In addition, there is a perception that these swings may be due in large part to the growing influence of highly mobile foreign capital, which may have increased volatility in these markets. For example, The Economist (May 13, 1995, pp.71-73) discusses the emerging markets boom of 1993-94 when "fund managers rushed lemming-like to buy [emerging market stocks]. ... But, as so often in financial markets, boom was followed shortly by bust. ... The evidence now suggests that it was investment-fund managers who panicked, in fear of mass redemptions". And the Financial Times (October 6, 1995, p.S6) suggests that "The creeping globalization of capital flows more or less guarantees that there will be greater volatility in the future - and other Mexicos".

Similar views have also been expressed by academics and practitioners. For example, Williamson (1993) suggests that foreigners may tend to show herd-like behavior in their investment decisions and that bubbles in asset prices in emerging markets may develop. Gooptu (1993) also suggests the

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1/ The terms "country" or "market", as used in this paper, do not in all cases refer to a territorial entity that is a state as understood by international law and practice; the terms also covers some territorial entities that are not states, but for which statistical data are maintained and provided internationally on a separate and independent basis.

2/ See also Gooptu (1993) and IMF (1995a) for a discussion of recent trends and market participants and institutions, and El-Erian and Kumar (1995) and Feldman and Kumar (1995) for a discussion of the benefits of the liberalization of equity markets.

possibility that increased volatility will result from herding and rapid switching of portfolios between markets. He notes also that many emerging stock markets suffer from a shortage of good-quality, large capitalization shares which results in rapid overheating when domestic and international interest is stimulated by market liberalization. And Howell (1993) suggests that there is an absence of domestic long-term investors in emerging markets, that foreign investors have become the marginal investors in emerging markets, and that the mobility of these investors will result in high price volatility in emerging markets.

This paper examines the evidence for these propositions. To investigate this conventional wisdom, I first test the proposition that the volatility of emerging equity market returns has increased in recent years. While it is true that the volatility of emerging markets is, on average, higher than the volatility of mature markets, I find no evidence to support the proposition that there has been a generalized increase in volatility in emerging markets in recent years. Misperceptions about volatility may therefore be more a function of greater focus on emerging markets: price changes that might previously have gone unnoticed now attract significant attention in the international financial press.

To investigate the possibility of long swings in asset prices, I test for long-horizon predictability of returns in emerging markets using tests that have so far only been applied to data for mature markets. It must be acknowledged, of course, that a study of long-horizon return predictability in emerging markets is hampered by the relatively short time series available, not to mention the differences in the degree of openness of different markets and the significant structural change of recent years as market liberalization has occurred. While these factors represent an important qualification to the tests in this paper, it should still be possible to gain some understanding of the process by which returns in less developed markets are generated. The results may allow inferences on how emerging markets may change as they are further liberalized and become more like mature markets.

These tests for predictability provide evidence that countries that have performed poorly or well in a quarter are likely to continue this performance in the subsequent quarters. However, at horizons of a year or more there is evidence of return reversals. In particular, countries which have under-performed in a given "ranking period" tend then to over-perform in the subsequent "test period", and vice-versa for initial over-performers. The test-period return differentials are large, at 10 percent per annum or more, though the relatively short data sample means that the statistical significance of these results is marginal.

This result is not wholly unexpected, given that similar "winner-loser" reversals have been shown for industrial countries (see Richards, 1996a,b). While the magnitude of the reversals is somewhat larger in absolute terms than for industrial countries, it is perhaps smaller in relative terms when the magnitude of the ranking-period return differentials are considered.

Preliminary investigations would suggest that the return differentials cannot easily be attributed to risk where this is measured either in terms of the variance of returns (the relevant measure of risk if markets are segmented) or the covariance with the world return (the relevant measure if markets are integrated), though a more sophisticated treatment of this issue might well yield a different conclusion.

The paper is organized as follows. Section II provides a discussion of related previous research. The data used in the study are discussed in Section III. Section IV investigates the short-term volatility of emerging markets. Tests for long-horizon return predictability are presented in Section V. Section VI concludes, and relates the results of this paper to discussions of the benefits and costs of market liberalization.

II. Relationship of the Current Study to Previous Research

There are few formal tests of asset pricing models using data from emerging equity markets. Claessens, Dasgupta and Glen (1995b) use data for individual stocks to conduct cross-sectional tests of the capital asset pricing model (CAPM) in 19 countries and find that the CAPM is typically rejected either because of significant alphas (regression intercepts) or insignificant betas (national-market risk exposures). Furthermore, where other variables such as company size are significant, they often show the opposite signs to such effects in industrial country data.

Using data for national market indices, Harvey (1995b) tests a simple one-factor international CAPM, under the implicit assumption that markets are integrated, and obtains betas (world-market risk exposures) that are typically much lower than those found in studies using data for mature markets. In contrast to the implication of the CAPM, alphas are positive for most countries, sometimes implying very large pricing errors. Furthermore, unlike in studies of mature markets, betas are not found to be a significant explanator of average country returns. This result, along with the significant correlation between average returns and the variance of monthly returns in emerging markets, suggests that these markets were not fully integrated into world capital markets in the period of the study (1976-1992).

Indeed, studies testing the extent of integration of emerging markets, including those by Claessens and Rhee (1994) and Errunza, Losq and Padmanabhan (1992), typically yield results that are consistent with complete or mild segmentation for stocks in most countries. Bekaert and Harvey (1995a) estimate a regime-switching model of expected returns that allows for returns to be determined at different times by domestic factors (segmented markets) or by world factors (integrated markets). Their results suggest that certain emerging markets (e.g., Greece, Korea, Malaysia and Taiwan, Province of China) have been fairly well integrated into the world market in recent years, while others are much more segmented. In many

cases, their model yields results that are consistent with the observed market regulations.

Studies investigating the volatility of returns in emerging markets have yielded mixed conclusions. Kim and Singal (1993) compute estimates of the volatility of domestic currency monthly returns and suggest that there has been no increase in volatility over time, and that volatility has tended to decreased following market liberalizations. On the other hand, Levine and Zervos (1995a) suggest that volatility may increase after liberalization. More generally, Bekaert and Harvey (1995b) test a variety of sophisticated models of conditional volatility and find that volatility is difficult to model in these markets. They find evidence, however, that the importance of world factors in emerging market volatility may be increasing, and that volatility tends to decrease following market liberalization.

A broader concept of volatility would, however, allow for the possibility that returns in different periods may be positively autocorrelated so that price changes in one period are accentuated in subsequent periods and result in long swings in asset prices. Claessens, Dasgupta and Glen (1995a) examine return behavior in emerging markets and test for autocorrelation and other "anomalies" that have been identified in mature markets. The authors find evidence of positive first-order autocorrelation in monthly returns in nine of twenty countries, and second-order autocorrelation in two countries. In addition, using variance-ratio tests, they reject the random walk hypothesis of stock prices for seven out of twenty countries, with test statistics suggesting positive autocorrelation in return horizons of up to four months.

This paper will expand on previous tests for volatility of returns by taking a longer-term view of volatility using monthly data for the period December 1975-September 1995 and weekly data for the period December 1988-September 1995. Three different methodologies will be used to estimate volatility, and cross-country average volatility measures will be calculated based on volatility estimates for individual countries.

Tests for the predictability of returns will also be presented for return horizons of up to three years, in contrast to the shorter-horizon tests of Claessens, Dasgupta and Glen (1995a). First, tests for stationarity and cointegration of total return indices will be conducted, because each would imply a very strong form of long-horizon predictability. The second methodology used will be the regression approach of Fama and French (1988) which in the case of the United States has revealed the presence of positive autocorrelation at horizons of a few quarters, and negative autocorrelation at horizons around two years or more. The third methodology is a test of relative return predictability using the "winner-loser" methodology introduced for portfolios of U.S. stocks by DeBondt and Thaler (1985). Those authors show that at horizons of three to five years there is a tendency for U.S. stocks to undergo reversals in their relative

performance: winners and losers in a "ranking" period tend to undergo return reversals in the following "test" period.

A pattern of positive autocorrelation at short horizons followed by negative autocorrelation at longer horizons has been identified by Cutler, Poterba and Summers (1991) in a wide range of asset classes, including equities, currencies, precious metals, real estate and collectibles. This pattern of "speculative dynamics" might be explained by the existence of fads, sentiment or some other form of irrationality (e.g., Poterba and Summers, 1988). However, other explanations are also possible. Positive autocorrelation and predictability at short horizons might be due to predictability in risk premia or risk exposures (Harvey, 1995b). Negative autocorrelation at longer horizons could also be consistent with infrequent changes in required rates of return which have immediate effects on asset prices in one direction and an offsetting influence in subsequent periods (Fama and French, 1988).

It should therefore be stressed that evidence of return predictability will not be evidence against market efficiency unless there is predictability in risk-adjusted returns. Furthermore, predictability in relative returns--e.g., in winner-loser reversals--will not be evidence against market efficiency unless there are no barriers between these markets. This paper will address the issues of risk and market access only in passing, so the results of this paper cannot be used as evidence for or against market efficiency. Instead, the goal of this paper is to characterize the returns process in emerging markets and the manner in which they differ from mature markets.

III. Data

For the emerging markets, all data used in this paper are from the Emerging Markets Data Base (EMDB) produced by the International Finance Corporation (IFC). The IFC includes as "emerging markets" those stock markets in countries or territories with income levels that are classified by the World Bank as low- or middle-income. There is significant variance in market development across emerging markets: market capitalization and turnover rates range from very low (e.g., for Nigeria which is 100 percent closed to foreign investors) to very high relative to most mature markets (e.g., Chile and Korea). The EMDB includes two countries--Greece and Portugal--that are typically classified as industrial countries. It does not include the stock markets of Hong Kong or Singapore which are generally regarded as mature markets.

The EMDB contains indices of national stock market performance based on a reasonably large number of representative stocks in each country: the IFC "global" indices aim for coverage of at least 60 percent of total market capitalization (see IFC, 1994, 1995). Data for nine countries are available from December 1975, and additional countries have been added over time: the EMDB included 27 countries at end-1995.

With the exception of Nigeria (see footnote 1 on page 7), all countries with at least ten years of monthly data are used in the monthly and quarterly tests. This includes the following 16 markets: Argentina, Brazil, Chile, Greece, India, Korea, Mexico, Thailand, Zimbabwe (all available from December 1975); Jordan (from December 1978); and Colombia, Malaysia, Pakistan, the Philippines, Taiwan (Province of China), and Venezuela (all from December 1984). For the volatility tests that use weekly data, all markets with weekly data from end-1988 are used. This includes the following 16 markets: Argentina, Brazil, Chile, Colombia, Greece, India, Jordan, Korea, Malaysia, Mexico, the Philippines, Portugal, Taiwan (Province of China), Thailand, Turkey and Venezuela. In all cases, the IFC global index series are used, and market capitalization data are based on the stocks included in the global indices.

For tests requiring data for mature markets, the Morgan Stanley Capital International (MSCI) total returns indices are used. Data for the following 16 markets are used: Australia, Austria, Canada, Denmark, France, Germany, Hong Kong, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The MSCI world index is also used for some tests in Section Va.

End-quarter data are used in the tests for predictability of long-horizon returns, while the tests for volatility use end-week and end-month data. Returns at these horizons should be largely free of the usual non-trading biases that plague daily returns data, as well as problems of non-synchronous trading due to different time-zones. 1/ For all tests, indices for total returns (price plus dividends) will be used to capture the total return available to investors. To ensure the cross-country comparability of results, most tests are conducted using U.S. dollar return indices, and excess returns are calculated as returns in excess of the U.S. risk-free interest rate. The latter is proxied by the return on the Treasury bill index published by Ibbotson Associates, updated for 1994 and 1995 from International Financial Statistics (IFS).

1/ It is highly likely, for example, that non-trading biases will cause positive autocorrelation in daily returns series in emerging markets and an underestimation of short-term return variances used in variance-ratio tests. Also, asynchronous trading will most likely suggest that returns in the United States predict returns in Asian countries. Finally, as market activity increases and non-trading effects are reduced, price indices will be less "time-averaged" so that daily returns calculated from market indices will appear to show greater volatility. All these effects will be spurious.

Because the returns are all measured in U.S. dollars, the return behavior identified in this paper will include the effect of both equity and exchange market behavior. Equity market returns tend, however, to be far more volatile than foreign exchange returns so it is likely that the results identified in this paper predominantly reflect equity market behavior. 1/

However, a more important point on the exchange rate issue relates to the existence of capital controls and restrictions on foreign investment. The U.S. dollar exchange rates used by the IFC are intended to represent market rates at which a foreign investor could trade, and where there is no market rate an official rate is used (IFC, 1995). 2/ However, in periods of restrictions on foreign investment, capital controls and administered exchange rates, U.S. dollar returns may not be entirely meaningful.

An alternative would be to conduct the analysis in terms of domestic currency excess returns. This is impossible, however, because of the absence of reliable short-term interest rate data for most countries in the study. A further alternative is to conduct the analysis in terms of real domestic currency returns (i.e., returns in excess of domestic CPI inflation). A problem with this is that price index data are typically monthly-average or mid-month data while the stock return data are end-month. Despite this timing difference, most of the results in this paper have been replicated using real domestic currency returns (for the sample period to June 1995 because more recent CPI data were not available for many countries). 3/ This will enable a judgment as to the robustness of the results using U.S. dollar returns data. To foreshadow the results, it appears that the conclusions from U.S. dollar returns data are very similar to those based on real domestic currency returns, indicating that the return behavior identified in this paper is primarily that of equity markets rather than currency markets.

1/ Richards (1996) shows, for example, that winner-loser reversals identified in industrial countries are primarily an equity market effect.

2/ Exchange regime changes in Nigeria in January 1994 and March 1995 illustrate a potential problem with the use of U.S. dollar series. The EMDB switched in these months from a parallel rate to the official rate and then to a newly introduced free market rate, resulting in an apparent exchange rate gain of around 100 percent and then an apparent loss of 75 percent. Because of these problems, Nigeria is omitted from the analysis. There are apparently no other examples of such extreme regime changes in the IFC data (IFC, 1995).

3/ Consumer price data are from IFS, with the exception of Taiwan (Province of China) where data are from the Monthly Bulletin of Statistics.

IV. Assessing the Volatility of Returns in Emerging Equity Markets

a. Methodology

To explore the conventional wisdom that emerging equity market returns have become more volatile, I use three different methodologies and two data sets to estimate volatility. The first data set includes the nine markets for which monthly data are available for the period December 1975-September 1995. The second dataset consists of the 16 markets with weekly data available for the period end-1988 to end-September 1995. In each case log-differenced returns are used.

For the monthly data, three techniques are used. First, volatility is proxied by the rolling 12-month standard deviation of monthly excess returns. Second, a two-step regression technique due to Schwert (1989) is used to estimate the conditional absolute unexpected monthly excess return. This method, which is similar to an ARCH approach, has been widely used to infer volatilities where only relatively low frequency data are available (see also Kim and Singal, 1993; Levine and Zervos, 1995a). In the first step, expected returns are obtained from a regression of monthly returns on 12 lagged returns and monthly seasonal dummy variables. 1/ In the second step, the absolute value of the unexpected return is regressed on 12 lagged values and monthly seasonal dummies. When multiplied by $(2/\pi)^{-0.5}$, the fitted values from the second regression can be used as a proxy for the conditional standard deviation (see Schwert, 1989, for further details). Because this measure is noisy, and for consistency with the first method, the charts showing this estimate of volatility use a rolling 12-month average of estimated values.

A third, more ad-hoc, measure of volatility is given by the relative frequency of extreme movements in equity prices. To implement this measure, I calculate the standard deviation of returns in each country over the entire sample period, and identify as extreme outcomes all months where returns are more than two standard deviations from the mean return for that country. 2/ For each country, a rolling 12-month average is used to represent the percentage frequency (or probability) of extreme outcomes. The time profile of these probabilities can be used to infer if extreme return outcomes have become more frequent over time.

In the case of the weekly data, the same three methods are used to proxy volatility. In this case, the rolling average volatility measures are constructed over 13-week periods (corresponding to one quarter). For the

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1/ The equation for expected returns is clearly simplistic: there is no attempt to model price jumps at regime changes such as liberalizations, and the measure of volatility may therefore be overstated at such times.

2/ The frequency of large price changes is also used by IMF (1995a) and El-Erian and Kumar (1995) as a measure of volatility, except that those studies concentrate only on falls in prices.

Schwert methodology, 13 lagged values are used in each regression, without seasonal dummies. Weekly returns are measured in simple (rather than excess) U.S. dollar terms.

For both monthly and weekly data, volatility measures are estimated separately for each market. A measure of average volatility for all emerging markets is then constructed as the weighted average of individual volatilities, based on fixed average market-capitalization weights. 1/ This will enable judgments as to whether or not return volatility has changed on average in emerging markets.

b. Results

Estimates of the rolling standard deviation of monthly returns and the Schwert measure are shown in Charts 1 and 2, for nine emerging markets and two groups of eight mature markets, grouped by average market capitalization over the 1975-94 period. While there is no necessary relationship between total market capitalization and the extent of capital market development, the larger markets (the United States, Japan, the United Kingdom, Canada, Germany, Switzerland, France and Australia) have tended to be more liquid and more open than the smaller markets (the Netherlands, Italy, Hong Kong, Spain, Sweden, Denmark, Norway, Austria) over this period. 2/ Two series for the emerging markets are shown, one for U.S. dollar excess returns and the other for real domestic currency returns. The series show very similar movement so the conclusions about volatility will not be sensitive to the currency unit used for the emerging markets.

While the two measures fluctuate significantly, they provide a very similar picture of return volatility. First, it is apparent from both measures that the largest industrial country markets have fairly consistently had lower volatility than the smaller industrial country markets, and that the emerging markets on average have had the highest volatility. The higher volatility of emerging markets is not unexpected and will be discussed further below.

In the case of the industrial countries, there appears to be no long-run trend in volatility. Recent peaks in volatility correspond to the October 1987 market crash and the August 1990 invasion of Kuwait. For the emerging markets, there is also no obvious long-run trend. There are two similar spikes in emerging market volatility, with a peak being reached

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1/ Fixed weights are used so that average volatility estimates are not affected by shifts in the relative market capitalization of high and low volatility countries: the results do not, however, appear especially sensitive to the use of fixed weights.

2/ For example, using the P1 index of stock market development of Demirguc-Kunt and Levine (1995) which is normally distributed around zero, the average development indices for the larger mature, smaller mature, and emerging markets are 1.07, 0.10 and -0.30, respectively.

around the year to February 1991. 1/ Since then, volatility has been quite low by historical standards, even when the recent Mexican crisis is included. According to the raw Schwert estimates, the period 1992-1995 which has seen foreign institutional investors playing a more significant role in emerging markets (see, e.g,, IMF, 1995b) has been characterized by volatility that is marginally lower than the remainder of the sample period. The point estimate for the decline in this period is 6 percent, though the statistical significance of this decline is very marginal. 2/ The equivalent declines for the large and small industrial countries are around 6 and 3 percent respectively. That is, there is little to suggest that emerging market volatility has increased either in absolute or relative terms in the recent period.

Chart 3 shows the probability over time of extreme outcomes in monthly returns, weighted across nine emerging markets. First, it might be noted that the average probability of extreme return outcomes fluctuates around five percent, as would be expected based on the definition of extreme outcomes as those where returns are more than two standard deviations away from the mean return. With regard to the pattern over time, these data provide a similar picture to the earlier measures, with high volatility around the 1987 crash and Gulf War, with relatively low volatility more recently. Estimates for the industrial countries (not shown) display similar patterns.

For weekly returns, the conventional standard deviation and Schwert estimates of volatility in emerging markets are shown in Chart 4. These series show an increase in volatility at the time of the Mexican crisis, and a larger spike earlier in 1994 following the tightening in U.S. monetary policy. Nonetheless, the volatility in these episodes is estimated to be lower than for much of the first half of the sample period. The average probability of extreme weekly return observations is shown in Chart 5. This reveals a similar picture with volatility that is higher than normal in the two recent episodes, but still somewhat below the earlier peak.

Finally, because regional patterns may vary, estimates for the rolling standard deviation measure of volatility are shown in Chart 6 for the six Latin American countries as a group and the ten other countries. These

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1/ In contrast to these measures which appear to show some correlation in volatility, Kim and Singal (1993) find no correlation between emerging and developed market volatility. The positive correlations in this study might be due to the use of rolling-average measures of volatility rather than noisy monthly measures, and U.S. dollar returns rather than domestic currency returns.

2/ The statistical significance of the decline was assessed via a regression of the volatility measure on 12 seasonal dummies and a dummy for the later observations. Standard errors were obtained using the Newey-West correction with 12 lags to account for the method by which the dependent variable is generated.

CHART 1

AVERAGE STANDARD DEVIATION OF MONTHLY RETURNS

(12-month moving average, log-differenced returns)

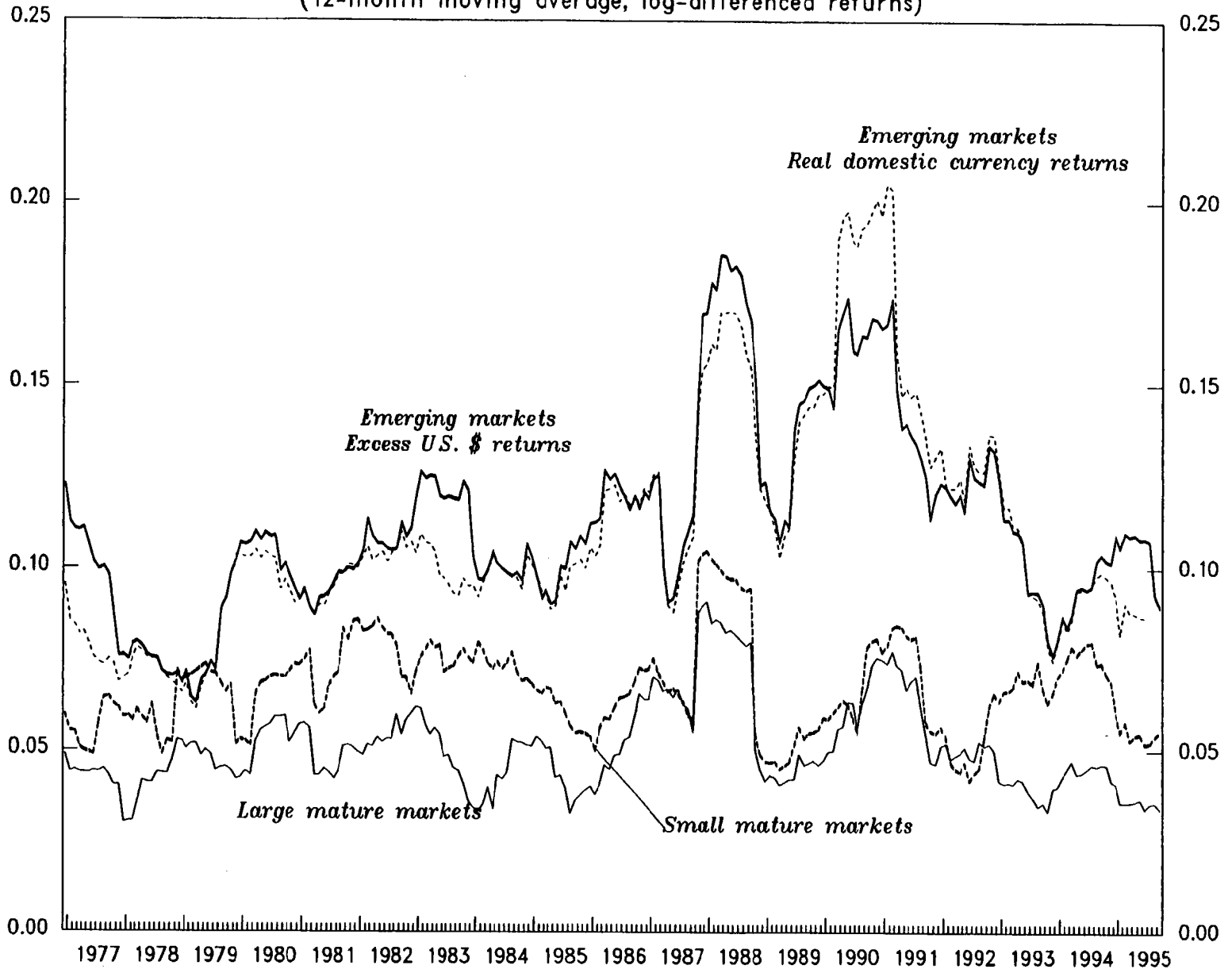


CHART 2

AVERAGE CONDITIONAL STANDARD DEVIATION OF MONTHLY RETURNS

(Schwert estimates, 12-month moving average, log-differenced returns)

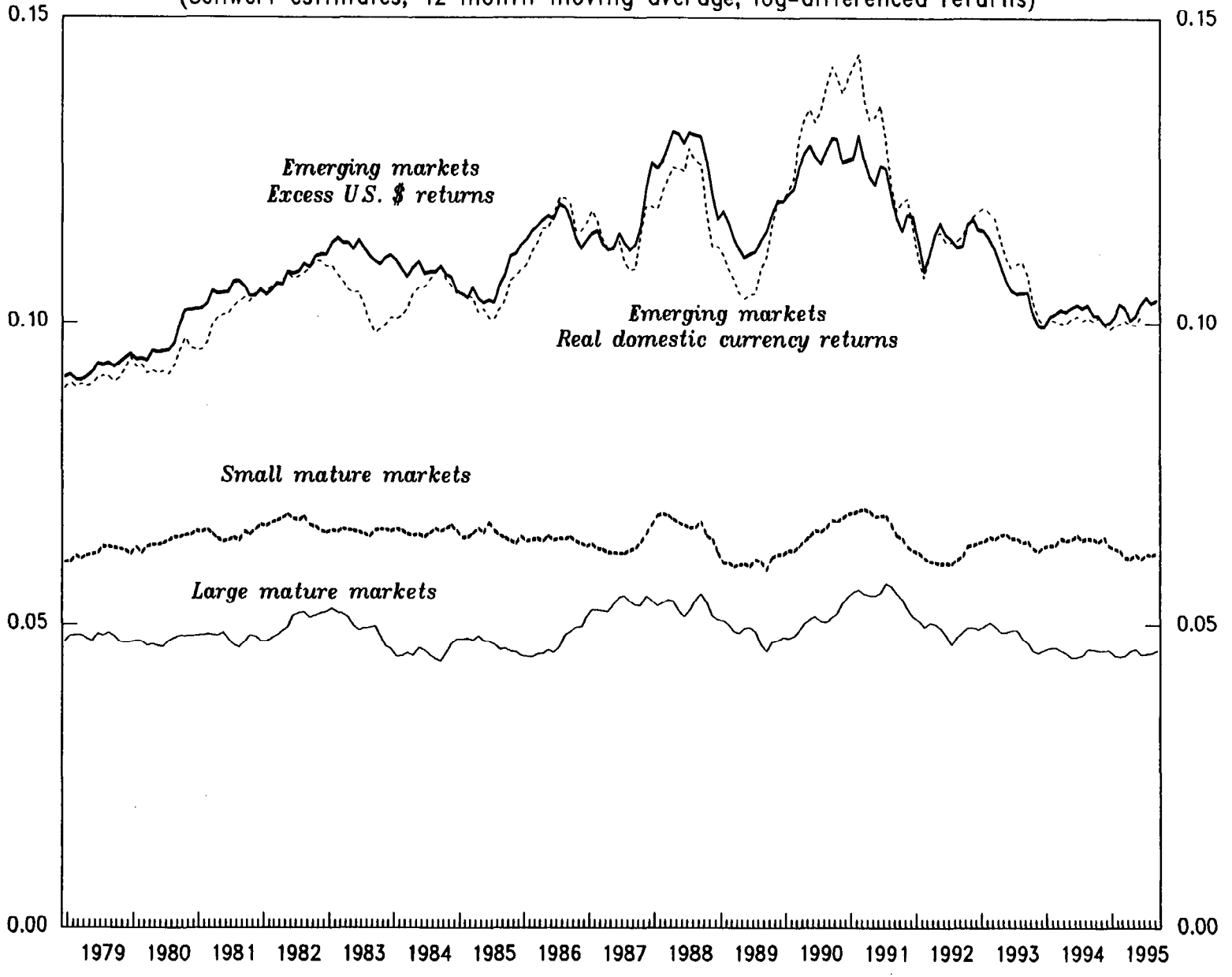
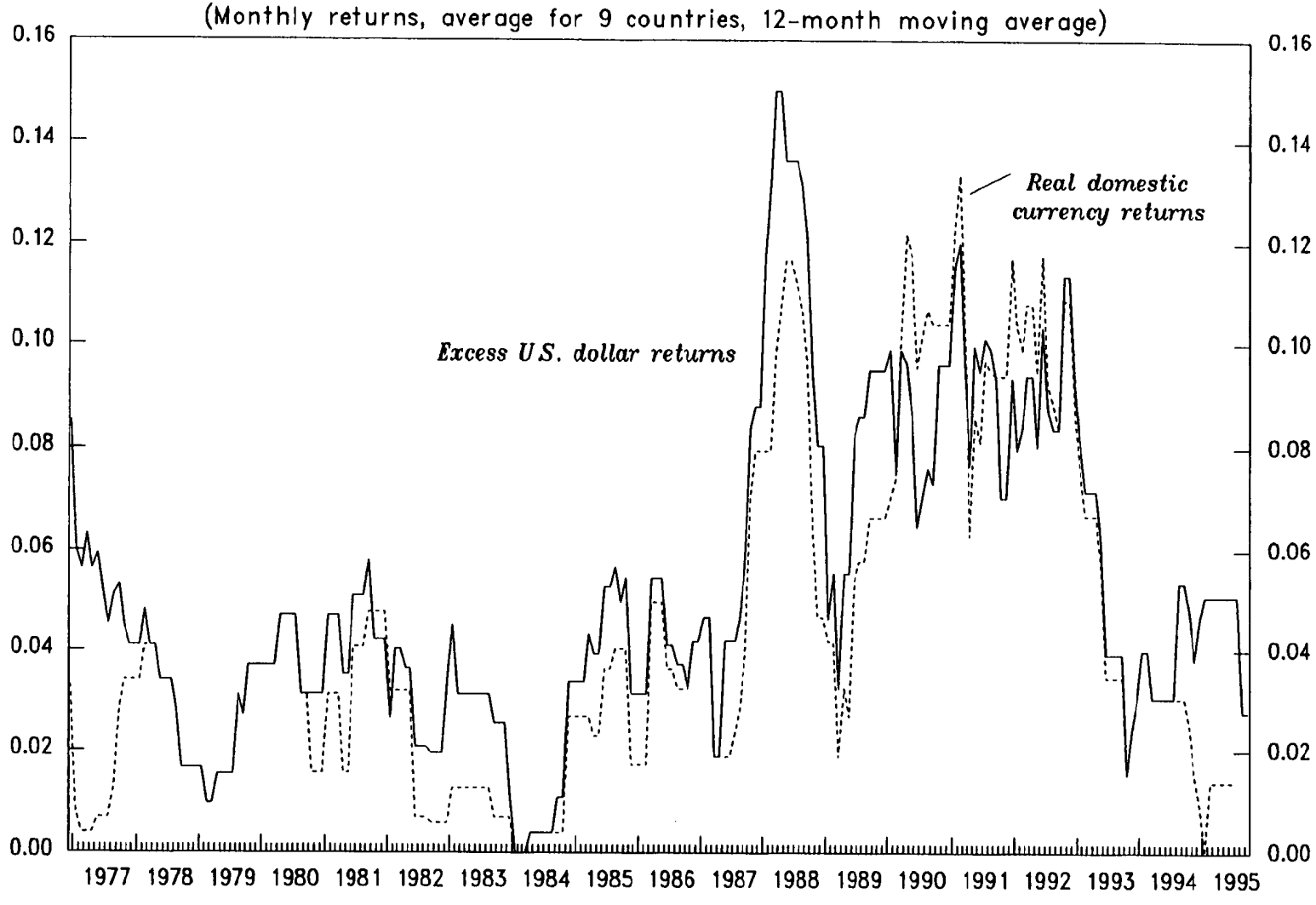


CHART 3

PROBABILITY OF EXTREME RETURN OUTCOMES IN EMERGING MARKETS

(Monthly returns, average for 9 countries, 12-month moving average)



Extreme outcomes defined as months in which log-differenced return is more than two standard deviations from its average.

CHART 4

STANDARD DEVIATION OF WEEKLY RETURNS IN EMERGING MARKETS

(Average for 16 countries, log-differenced returns)

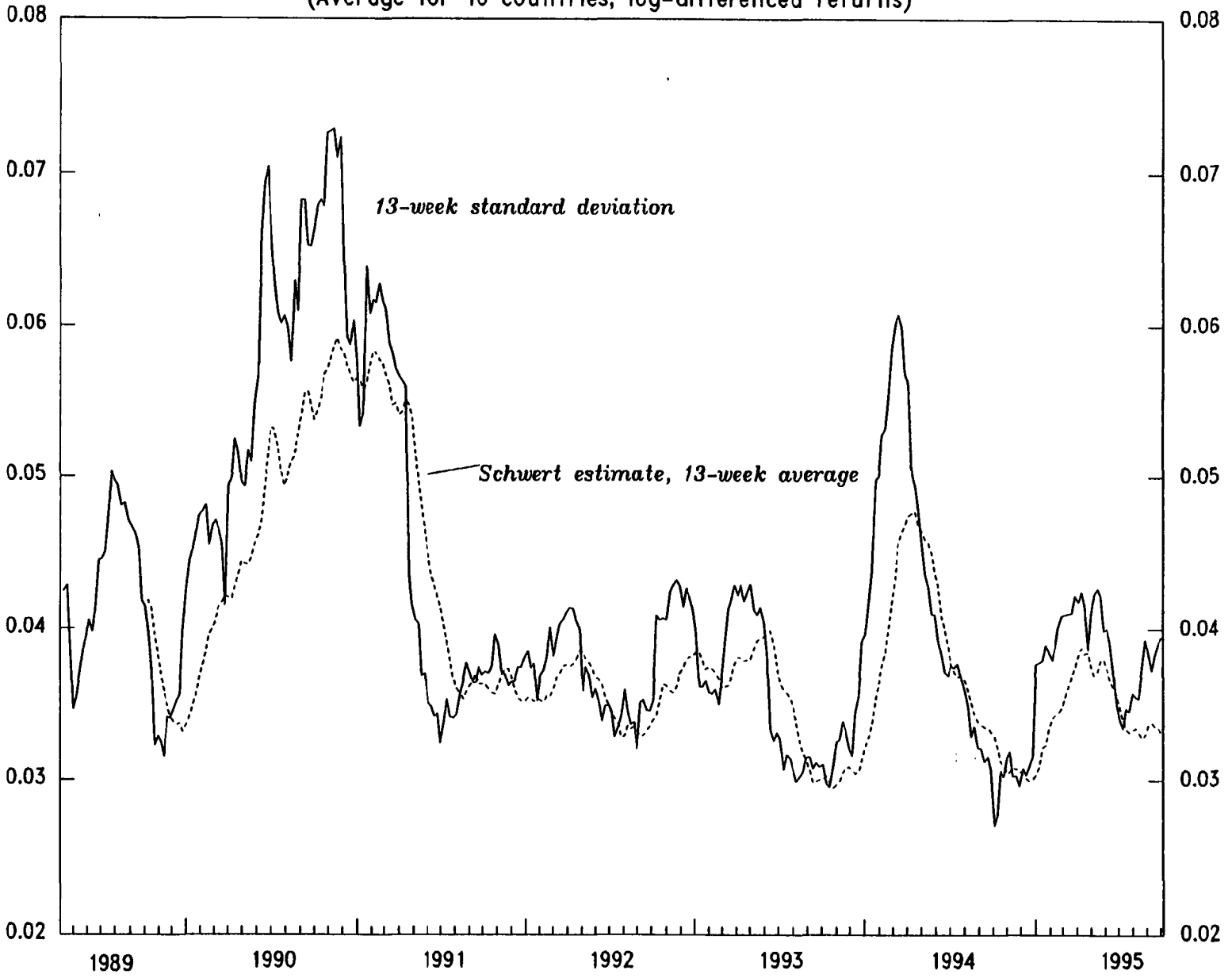
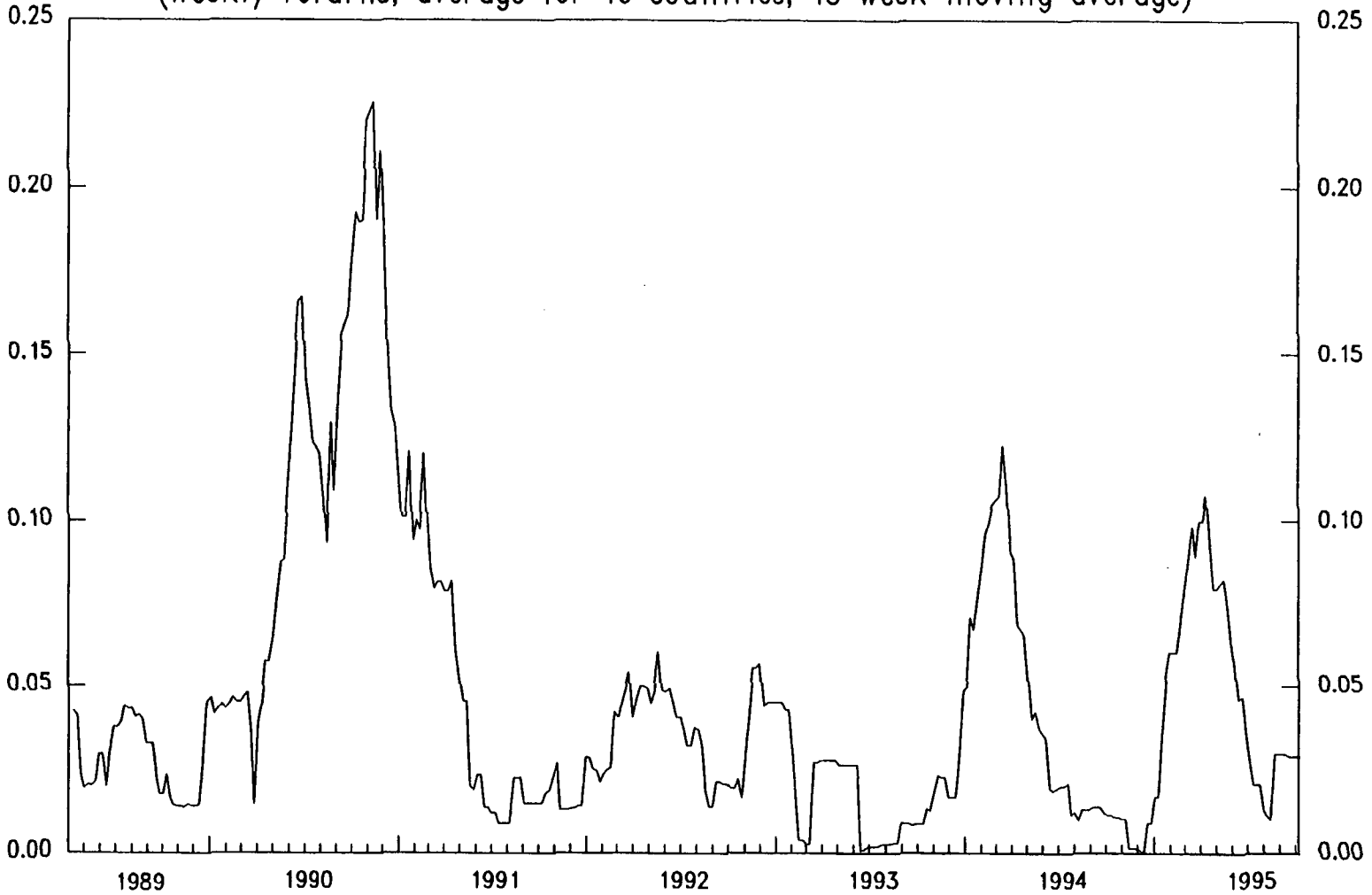


CHART 5

PROBABILITY OF EXTREME RETURN OUTCOMES IN EMERGING MARKETS
(Weekly returns, average for 16 countries, 13-week moving average)

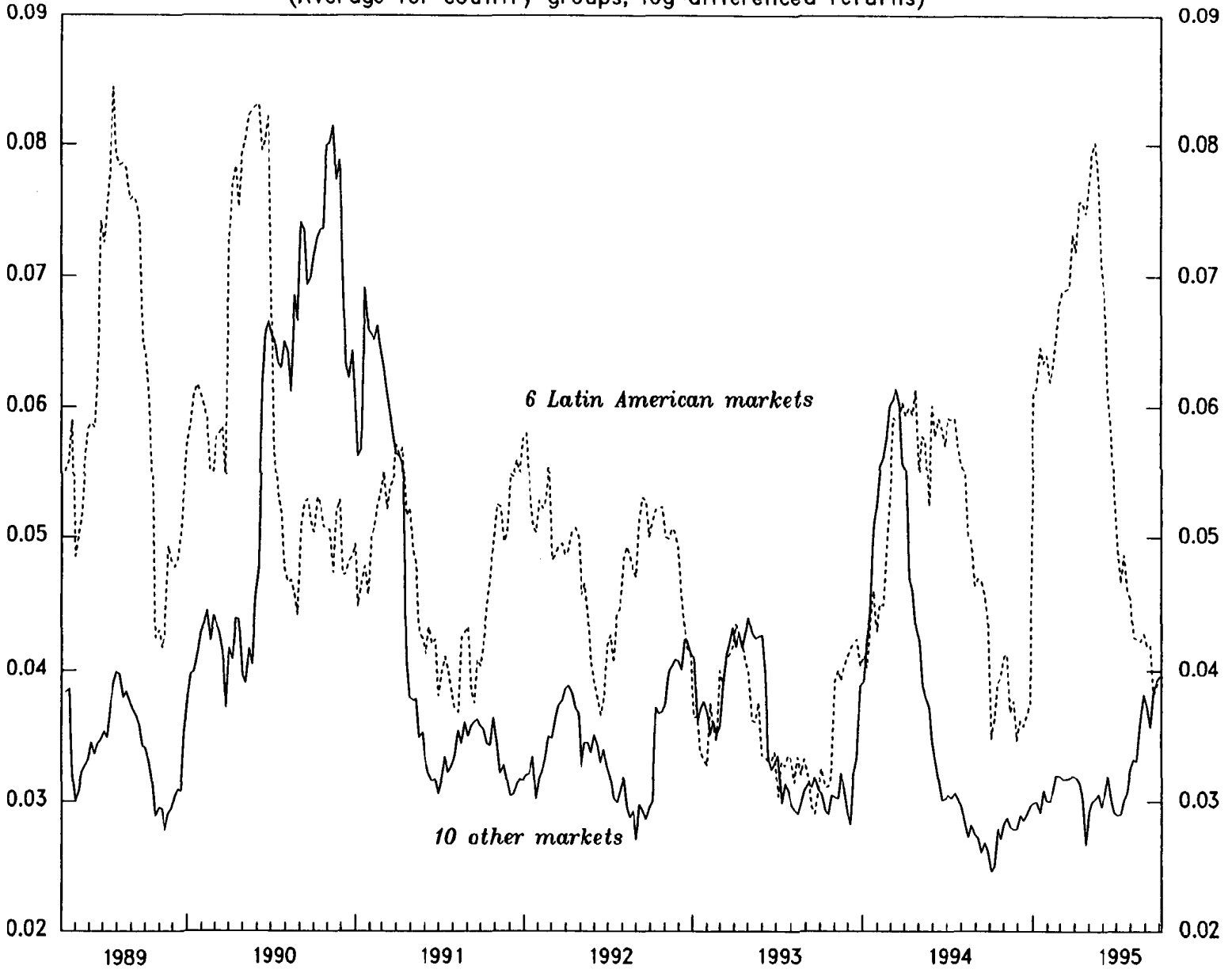


Extreme outcomes defined as weeks in which log-differenced return is more than two standard deviations from its average.

CHART 6

STANDARD DEVIATION OF WEEKLY RETURNS IN EMERGING MARKETS

(Average for country groups, log-differenced returns)



suggest that volatility can differ quite significantly across emerging markets, but that there is no clear trend for increasing volatility in either group of markets. The Schwert estimate of volatility for all 16 countries suggests a decline of around 20 percent between the 1989-91 and 1992-1995 periods. The decline appears to have occurred in both groups of countries: the decline for the Latin American countries is 11 percent while the decline for the other countries is 24 percent. Both these changes are strongly statistically significant. 1/ Indeed, of the 16 countries with weekly data available, a statistically significant decrease in volatility was recorded in 8 countries, with statistically significant increases in volatility in only 2 countries (Colombia and--not surprisingly--Mexico), with the remaining countries showing no significant change. 2/

The conclusion that the volatility of weekly returns has tended to fall may actually be stronger than suggested by the evidence shown above. In particular, non-trading biases will cause national market indices to be excessively smooth, and measured short-term (i.e., daily and probably weekly) return volatility to be underestimated relative to the (unobservable) underlying volatility. However, to the extent that turnover has increased in recent years, this bias will have fallen and, other things being equal, returns should appear to be more volatile. If measured return volatility has fallen, then underlying volatility may actually have fallen by more. In any case, the results for weekly returns would confirm the analysis of the monthly volatility estimates: on average, there seems to be no tendency for an increase in volatility in emerging equity markets, even when the "dice are loaded" by conducting such tests soon after a period when volatility is known to have been especially high.

c. Discussion

The evidence of the previous section suggests, therefore, that the volatility of returns in most emerging equity markets may recently have fallen rather than increased, though the relatively short post-liberalization sample means that this conclusion remains somewhat

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1/ The statistical significance of the changes was estimated via a regression of the volatility measure on a constant and a dummy for the later observations. Standard errors were obtained using the Newey-West correction with 13 lags to account for the method by which the dependent variable is generated.

2/ Significant market liberalizations occurred around the middle of the sample in one of the countries (Colombia) that experienced an increase in return volatility. However, there were also liberalizations in some of the markets that experienced falls in volatility (e.g. Argentina, Brazil) or no change in volatility (Korea), so no relationship between liberalization and volatility can be inferred. See, e.g., Kim and Singal (1993) for a listing of significant liberalizations in EMDB markets.

tentative. 1/ There is, however, support in other research for the proposition that the participation of foreigners need not lead to an increase in the volatility of returns. Bekaert (1995) finds that volatility is unrelated to any measure of market openness, but may be negatively correlated with a measure of market integration. He concludes that fears that opening up a market will lead to greater market volatility may therefore be mistaken. Kim and Singal (1993) study the effect of the liberalization of equity markets in 20 countries and conclude that liberalizations are typically accompanied by increases in stock prices and decreases in the volatility of monthly stock price changes. Bekaert and Harvey (1995b) also examine the impact of market liberalization and find that volatility is unchanged or lower in 13 of 17 countries. Finally, Tesar and Werner (1995) find no evidence that U.S. investment activity contributes to volatility in equity returns in emerging markets, while Reinhart and Reinhart (1994) find no generalized increase in volatility in emerging markets as equity inflows into these markets have increased. 2/

If volatility has actually fallen, what then explains the perception of increasing volatility? One factor may be that volatility is still higher than in mature markets, so that portfolio managers shifting for the first time into emerging markets may--depending upon covariances--experience an increase in the volatility of their portfolios. Similarly, if market capitalization is growing faster in emerging markets than in mature markets, the volatility of the world portfolio may be increasing. Most likely, however, perceptions of increased volatility may be due more to increased attention to these markets by the financial press than to actual increases in volatility. Increased holdings by investors from industrial countries draw press coverage, and price changes in these markets that previously went unnoticed now attract attention in the international financial press.

Another factor could be that the volatility of the return on a portfolio of emerging market equities might have increased over time even though the volatility of individual emerging markets may on average have fallen. Indeed, when the volatility measures used above are calculated for the return on a portfolio of emerging markets, some of them suggest a tendency for volatility to have increased modestly. This is due to a

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1/ One possibility is that the underlying volatility of returns in emerging markets has increased, but "peso problems" have not yet revealed the full impact of this shift. Such hypotheses are impossible to rebut or confirm except with more data.

2/ Levine and Zervos (1995a) present some conflicting evidence that volatility may increase after liberalization, but those authors also show that liberalization leads to increased integration into world markets. If volatility does increase, it may be fairly benevolent since those authors show in other work (Levine and Zervos, 1995b) that volatility does not affect economic growth, but that increased integration is associated with higher growth.

tendency for increasing correlations between countries, perhaps due to increasing integration of emerging market economies into the world economy. 1/

While it is possible that highly mobile foreign investors may at times contribute to large changes in asset prices, it is also clear that emerging markets were highly volatile before the arrival of large numbers of these investors. If the greater volatility in returns is due to variability of dividends or earnings, it might be due in part to the dependence of many developing countries on volatile commodity export earnings, reflecting either variability in commodity prices or in export volumes due, for example, to weather-related factors. Alternatively, for companies with earnings driven by local conditions, higher volatility might be the result of more pronounced business cycles in emerging markets, say due to the presence of greater liquidity constraints in these economies because of less developed financial markets. Finally, earnings may show greater volatility because of greater volatility in economic policies in emerging markets (see also Mullin, 1993). 2/

Alternatively, the greater variability of emerging market returns may be due to larger shifts in required rates of returns in emerging markets. The most important factor in this regard might be the lesser degree of integration into world markets, caused by various types of capital controls. The effects of the degree of integration on asset pricing can be explored in terms of the standard CAPM or mean-variance approach to asset pricing. According to the CAPM, the required return on an asset is determined by the expected covariance of its returns with the return on the relevant market portfolio and by the risk premium on the market portfolio (which will depend on the variance of the return on that portfolio). In a segmented market, the relevant market portfolio for asset pricing will be the national market index. In this case, an increase in country-specific risk cannot be diversified away as would be possible in an integrated market, so it will result in an increase in the risk premium and a fall in asset prices. Closed markets should therefore be subject to greater variance in asset prices and returns than open markets which have the benefits of diversification, and required rates of return (e.g., as proxied by E/P ratios) will be higher in closed emerging markets. Required rates of return should fall and prices should rise when markets are opened to foreign investors (see Bekaert, 1995).

1/ Alternatively, the higher correlations might be attributed to increasing (irrational) "contagion" effects between emerging markets. If so, this contagion is still fairly benign because it has typically not prevented declines in the volatility of individual emerging markets.

2/ See Hausmann and Gavin (1995) for a discussion of the causes of business cycle volatility in Latin America, and Bekaert and Harvey (1995b) for cross-sectional tests of factors associated with volatility.

V. Testing for Predictability in Returns in Emerging Markets

The results of the previous section provide no support for the notion that the volatility of weekly or monthly return in emerging markets has increased in recent years. Velasco (1993) notes, however, that the volatility of short-term returns may be of less concern to policy makers than the possibility of long swings in asset prices that are followed by large reversals. A related issue is the apprehension expressed by some authors about the possibility of speculative bubbles in emerging markets. If they occurred, bubbles would be characterized by above-normal positively autocorrelated returns in the period that the bubble was building, followed large negative returns when the bubble burst. This type of volatility is addressed in the remainder of the paper, via three types of tests for the predictability of long-horizon returns based on their own history.

a. Tests for stationarity of, and cointegration between, return indices

The first methodology to be used to test for predictability in returns involves the use of time-series tests for stationarity of return indices and for cointegration between return indices. 1/ The motivation for these tests is that each could potentially provide evidence of strong forms of return predictability. Other weaker forms of predictability will be addressed in Sections Vb and Vc. It should be noted at the outset that the tests in this section use total return indices, rather simple returns which are the first difference in return indices.

Tests for the order of integration of a return index will reveal if it is stationary or non-stationary. 2/ Stationarity or trend-stationarity would indicate a strong form of predictability based on a series' own recent history. In particular, a stationary return index would consistently demonstrate reversion to its mean, while a trend-stationary index would show a tendency to return to its deterministic trend. For example, periods of high returns that took an index above its mean or trend would be followed by a period of low returns during which the index would revert back to its mean or trend.

Tests for cointegration could reveal an equally strong form of relative predictability. Cointegration between return indices would imply they have a very strong tendency to move together in the long run. Cointegration would imply the rejection of a random walk model of stock prices and would instead imply the existence of an error correction mechanism (see Engle and

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1/ To be precise, the null hypothesis for these tests makes them tests of non-stationarity and non-cointegration.

2/ It should be noted that there is no connection between the time-series concept of integration and the capital markets concept of integration of financial markets which requires that assets of similar risk should have similar required rates of return even if traded in different markets (see Richards, 1996a).

Granger, 1987) which implies that periods of relative overperformance in one market would be followed by exactly offsetting periods of underperformance, and vice versa. It should be noted, however, that standard asset pricing models would preclude cointegration between return indices in integrated markets since asset prices or price indices should respond differently over time to shocks (Richards, 1996a). Rejections of the null of no cointegration would therefore imply that markets are inefficient, segmented, or both. 1/

The time-series tests use log U.S. dollar excess return indices for all countries for which data are available since end-1975. Tests for non-stationarity using the Augmented Dickey-Fuller test are shown in Panel A of Table 1. 2/ The results indicate that the null hypothesis of non-stationarity is rejected only for India: all other indices are apparently non-stationary, with further tests (not shown) indicating they are integrated of order one. This is consistent with standard asset pricing theory which implies that return indices should contain a random walk component (Richards, 1996a) and should not demonstrate the extreme form of predictability that would be implied by stationarity. The case of India may well be a Type I error: this would not be surprising given that nine tests are conducted, each with a 10 percent significance level.

For those series which appear to be integrated of order one, standard tests for cointegration were then conducted. Three forms of cointegration were investigated. First, I test for cointegration between the return index for each emerging market and the index for the MSCI (industrial country) world portfolio. That is, I test if emerging market indices are linked by a long-run relationship to the world market index. The Engle and Granger (1987) methodology is used, with a time trend included in each case unless it appeared statistically insignificant. The results, shown in Panel B of Table 1, provide strong evidence that emerging market indices are not cointegrated with the world index; the hypothesis of no cointegration is not rejected for any of the eight countries. This confirms the expectation that cointegration, and a strong form of predictability, should not exist between return indices. It might also not be surprising in light of the low correlations between monthly or quarterly returns in emerging markets and industrial markets.

1/ Granger (1986) also asserts that cointegration will be contrary to market efficiency, while Loughran and Newbold (1995) conclude from an empirical study that "It is perhaps overly cynical to suggest that applying cointegration tests to financial markets data is a superb mechanism for generating random numbers. Nevertheless, the inconsistencies in results reported in applied studies ... suggest extreme caution in inferring structural conclusions from the test statistics."

2/ For all ADF tests, the number of augmentation terms was selected using the "Akaike plus 2" rule in Version 4.3 of TSP, with a maximum of eight lags. The tests for non-stationarity allow for a deterministic trend.

Second, I use the Engle-Granger methodology to test for bivariate cointegrating relationships among all possible pairs of emerging markets. 1/ The results, summarized in Panel C of Table 1, indicate that the hypothesis of no cointegration is rejected at the five (ten) percent level in only 7 (11) percent of cases. These rejections are little different to what would be implied by the respective size of the tests, so there is very little evidence that emerging market indices are cointegrated with each other. 2/ This is further evidence that there is a need for caution in the burgeoning practice of regressing large numbers of price or return indices against each other in search of "cointegrating relationships".

Finally, since it has sometimes been asserted that cointegrating relationships are likely in groups of countries within a similar region, I use the Johansen and Juselius (1990) methodology to test for a cointegrating system among the four Latin American countries (Argentina, Brazil, Chile, and Mexico) with data available since end-1975. 3/ The test results in Panel D of Table 1 would suggest the presence of a single cointegrating vector in the four-country system of Latin American markets: the hypothesis of zero cointegrating vectors is rejected but the hypothesis of no more than one cointegrating vector is not rejected. An examination of the estimated vector suggests that the rejection is due to the presence of an apparent relationship between the return indices of Chile and Mexico. These countries were indeed one of the few pairs for which the Engle-Granger tests in Panel C suggested cointegration. This finding may again be an example of a Type I error: the relatively low short-run correlations between these countries might suggest that it is spurious. 4/ In any case, it is very clear that there is no evidence for three cointegrating vectors, so despite evidence that Latin American markets are sometimes subject to similar influences (see Calvo, Leiderman and Reinhart, 1993), one would conclude that the return indices of the four Latin American countries are not all simply determined in the long run by a single common trend that would imply a high degree of predictability in relative returns.

1/ The tests are conducted in "both directions", i.e., with each country as both dependent and independent variable, resulting in 56 country pairs.

2/ The apparent evidence that rejections of the null hypothesis are slightly more frequent than the size of the test may be related to a transitory or mean-reverting component in returns (see Section Vc) which in small samples may occasionally dominate the permanent component and may cause return indices to appear to be cointegrated.

3/ A constant term is included in both the VAR and differenced equations. Critical values are from Table A1 of Johansen and Juselius (1990) multiplied by T/(T-nj) (i.e., 1.11), to offset the poor small-sample properties of these tests, where T=78 is the number of observations in the VAR equation, j=2 is the number of lags in the VAR, and n=4 is the number of variables.

4/ It might also be noted that trade links between Mexico and Chile are quite small: trade between them in 1994 accounted for around 2 percent of Chile's total trade and around 0.4 percent of Mexico's total trade.

b. Regression tests for predictability

The regression tests in this section will test for a possibly weaker form of predictability than would be implied by the stationarity of a return index. In particular, they will test for predictability of excess U.S. dollar returns based on their own history. Following Fama and French (1988), I test for long-horizon predictability in returns by regressing the k-month return upon the lagged k-month return as follows:

$$r_i(t,t+k) = \alpha_i(k) + \beta_i(k) r_i(t-k,t) + \epsilon_i(t,t+k), \qquad (1)$$

where r_i is the log-difference in the relevant total return index for country i. 1/ The expected value of the $\beta(k)$ in equation 1 will depend on the time-series properties of the relevant total return index (Fama and French, 1988). If the index is a pure random walk with no stationary component, then after correction for the usual negative bias in estimated autocorrelation coefficients, the estimated $\beta(k)$ should be equal to zero for all k. If the index contains a stationary component but no random-walk component, the $\beta(k)$ should be close to zero for low k and approach -0.5 for high k. Finally, if there is both a stationary and a random-walk component, one might expect a U-shaped pattern for the $\beta(k)$, being close to zero for small k, then moving toward -0.5 at those horizons where the transitory component is relatively more important, before returning to zero for large k where the random-walk component dominates.

The results of the regression tests will be assessed using simulated critical values, for several reasons. First, it is necessary to adjust for the usual bias in estimated autocorrelations. Second, in order to maximize the power of the tests using the short data set available, these tests will use overlapping data. Simulated critical values are necessary to take account of the moving-average error term which is introduced by overlapping data, given that standard asymptotic corrections (the Hansen-Hodrick and Newey-West corrections) have been shown to have poor properties in small samples in related tests (see Kim, Nelson and Startz, 1991). Third, emerging market returns may be characterized by non-normality (see e.g., Harvey, 1995b; Claessens, Dasgupta and Glen, 1995a) which will render many

1/ Log-differences are used to avoid potential econometric problems due to the skewness in conventional percentage returns which are bounded below at minus 100 percent. Such problems may be more extreme than usual because of the long horizons and the high volatility of emerging market returns.

conventional test distributions incorrect. 1/ The simulated critical values used in this paper are therefore derived using the empirical distribution function rather than from standard Monte Carlo simulations which assume normally distributed innovations.

Since the tests involve a null hypothesis of no predictability, simulations are used to generate "randomized" series that have no temporal dependence in returns. These are constructed by cumulating the innovations drawn (without replacement) from the actual innovations in the logged return index. Tests for significance are based on the distribution of the $\beta(k)$ under 1000 randomizations under the null hypothesis of no predictability in returns.

The results for the regression tests for predictability in excess returns are shown in Table 2. The countries are divided into two groups, the first with data for December 1975-September 1995 and the second with data for December 1984-September 1995. The table shows bias-corrected regression estimates from equation 1 (the actual estimate less its mean value from simulations), with rejections of the null of no predictability denoted by asterisks. While return horizons of 3, 6, 12, 24 and 36 months are shown for the first group of countries, the 36-month results are omitted for the second group because of the shorter data sample. Average 90 percent confidence intervals derived from simulations are shown for the two groups; exact confidence intervals vary by country.

The results indicate only a few rejections of the null of no temporal dependence in returns. This is primarily a function of the short data sample and wide confidence intervals: with less than 20 years of data, it is difficult to reject the null of no autocorrelation in returns, especially at longer horizons: Poterba and Summers (1988) argue that the use of higher-than-normal significance levels may be appropriate in these conditions. Indeed, even if a series were fully mean-reverting at a three-year horizon (i.e., $\beta(36)=-0.5$), the null of no temporal dependence in returns would only just be rejected based on the average 5 percent test statistic (-0.45).

However, the few rejections that do occur suggest a pattern of positive autocorrelation at short horizons and negative autocorrelations at longer horizons. The five rejections at the three- and six-month horizons all indicate positive autocorrelations, while six of the nine rejections at

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1/ The strong findings of non-normality in previous work may, however, be due in part to the use of percentage returns which are bounded below at minus 100 percent and therefore cannot strictly be normally distributed. To examine this, I tested the quarterly excess returns series for normality using the Bera-Jarque test. At the five percent significance level, the hypothesis of normality was rejected for 13 of 16 countries with conventional percentage returns data, but only 7 out of 16 countries for log-differenced returns. The median reduction in the test statistic from the use of log-differenced returns was nearly 80 percent.

longer horizons indicate negative autocorrelations. The strong rejections for India and the estimate for β of around -0.50 are not surprising given the evidence of the previous section that the return index for India appears trend-stationary. It might also be noted that the results for individual countries at the three month horizon appear to be qualitatively consistent with the estimates of Claessens, Dasgupta and Glen (1995a) for autocorrelations in one and two month returns. Results for real domestic currency returns (not shown) indicate a similar pattern.

c. Tests for winner-loser effects across markets

Overall, the long-horizon results of the previous section do not yield firm evidence that returns are subject to the type of strong reversals that would be suggested by regular long swings or bubbles in asset prices. This may, of course, be a function of the problems of short samples and wide confidence intervals in regressions involving individual countries. An alternative methodology is suggested by the winner-loser approach introduced by DeBondt and Thaler (1985) in a study of stocks within the U.S. market, and applied to developed country national markets by Richards (1996a,b). This methodology will provide a test for a weaker form of predictability of relative returns than would be implied by cointegration between return indices.

In this approach, at the end of each quarter, I allocate countries into four hypothetical market-capitalization-weighted portfolios based on their relative performance in a "ranking" period, and then simulate the performance of the portfolio in the subsequent "test" period. The portfolio of countries that has performed worst (best) in the ranking period is referred to as the "loser" ("winner") portfolio. The ranking- and test-period returns quoted are annualized "market-adjusted returns", i.e., returns relative to the return on a market-capitalization-weighted portfolio of all emerging markets included in the test. The average return measures quoted are calculated as the geometric return of all return observations and will not be subject to the problem of skewness in returns identified in Ball, Kothari and Shanken (1995). 1/ Under the null hypothesis of no predictability in returns, there should be no correlation between average ranking- and test-period portfolio returns.

The portfolio strategies replicated here should not be considered formal trading rules, since capital controls, thin markets, and restrictions on equity ownership would have rendered them impossible during most if not all of the sample period that is being tested. Instead, they should be thought of as a means of grouping countries so as to reduce country-specific noise and increase the low power of country-by-country tests like the regression tests presented above. Furthermore, while a notional "zero-net-investment" portfolio return will be defined as the return on the loser

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1/ See Ball, Kothari and Shanken (1995) and Richards (1996b) for further discussion of possible methodological problems in winner-loser tests.

portfolio minus the return on the winner portfolio, a portfolio like this would not be possible in reality because of the absence of short selling in most markets. Instead, this should simply be thought as a means of summarizing the difference in returns on extreme winners and losers.

The tests use overlapping data and the empirical significance of test-period return differentials is again assessed using simulated critical values based on randomizations. The innovations in the series are reshuffled in parallel to maintain within-period correlations in the return indices and capitalization weights while destroying any time dependence in returns. A null hypothesis of similar expected returns across all countries is assumed, and confidence intervals are based on the distribution in 1000 randomizations of test-period returns. 1/

Table 3 shows the results for a group of eight countries with data available from December 1975, where the markets are divided into four portfolios of two countries, while Table 4 shows the results for a group of 16 countries with returns data available since December 1984, where the countries are divided into four portfolios of four countries. 2/ In each table, Panels A and B show the average annualized return on the portfolios in the ranking and test periods, respectively, while Panel C shows 90 percent confidence intervals for the ranking period return. Returns are all relative to the market-weighted return on all countries. The final column in each table shows the results in real domestic currency terms and provides evidence that the results described below are not due solely to the use of U.S. dollar returns. The tests weight each portfolio by market capitalization but similar results are obtained if equal-weighted portfolios are used.

The data in Panel A of Tables 3 and 4 indicate very large return differences in the ranking period which are consistent with the high variance and low cross-correlations of short-term returns. For the one-quarter returns, for example, the winner-loser return differential is typically over 200 percent, with the strongest markets typically outperforming the average return by around 150 percent while the weakest markets have underperformed the average return by around 60 percent, with all returns quoted on an annualized basis. As would be expected, return differentials are reduced as the return horizon increases.

The test-period returns in Panel B provide some evidence of predictability of returns. At short horizons, ranking-period winners appear to continue to outperform ranking-period losers, though confidence intervals

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1/ Monte Carlo simulations show that when innovations for all countries have a similar mean, winner-losers tests have a zero expected return, so that there is no bias corresponding to the autocorrelation bias in regression tests.

2/ Zimbabwe, which has the smallest market capitalization of the nine countries with data from end-1975, is omitted from the longer sample tests.

are again wide because of the short sample and high volatility of returns. 1/ In terms of statistical significance, the strongest positive autocorrelation appears at the six-month horizon in the longer sample where the annualized return differential of 11.8 percent is significant at the nine percent one-sided level. At horizons of one year or more, however, autocorrelations in returns appear to be negative. In statistical terms, the strongest predictability is at the three-year horizon in the long sample, where prior losers appear to outperform prior winners on average by 14.6 percent per year; this result is significant at the six percent one-sided level.

The returns on the zero-net-investment portfolio for emerging markets for the three-year return horizon are shown in Chart 7. It indicates that the return on the zero-net-investment portfolio is highly variable, even if it has tended to be positive. Some preliminary attempts to assess if return differentials were related to risk were not, however, successful. 2/

1/ The one-quarter results would appear to suggest counterintuitively that the four ranked portfolios may on average all outperform the market portfolio in the test period. This is due to the combination of: (i) a negative correlation between portfolio returns and the share in total market capitalization of the portfolios, a form of "small country effect"; and (ii) the use of an unweighted (geometric) average of all outcomes in the calculation of the average portfolio returns over time, regardless of the relative size of the portfolios.

2/ In a preliminary attempt to investigate if risk factors might explain the test-period differences in returns, I estimated both the average variance of returns and the average world market beta for the four ranked portfolios, concentrating on the two-year return horizon. The return variance was proxied by the variance of the eight test-period quarterly returns, while average world market betas were estimated based on two-year total test-period returns: two-year returns should increase the probability of obtaining substantial differences in betas.

The results of this initial exploration were not promising. While two-year returns on the emerging market portfolios were correlated with the world return and the beta on the winner portfolio was estimated to be lower than the beta on the loser portfolio, the difference was not statistically significant nor large enough (based on standard estimates of the equity risk premium) to explain more than a small part of the return differential. When betas were allowed to be a linear function of time, there was no consistent pattern for increases over time as would be suggested by increasing integration into the world market. Nor did the variance of returns play the role that might have been expected if markets were segmented: the average variance of returns on the loser portfolio was actually somewhat below that of the winner portfolio. Furthermore, regressions indicated that above-average returns on the portfolios were not generally associated with above-average variance outcomes. Finally, regression models of portfolio returns that allowed for time-varying impacts from the world market and the own-

(continued...)

The return reversals in emerging markets are compared with those in 16 mature markets in Table 5. To compare the strength of any mean reversion in the return on the zero-net-investment portfolio, the ratio of the average test-period return to the average ranking-period return is shown in Panel C. This is calculated using log-differenced data and is referred to as the implied autocorrelation coefficient on the zero-net-investment portfolio. Confidence intervals for test-period outcomes are not shown but are fairly large, given the short sample period and small number of countries in the portfolios. The conclusions that follow should therefore be considered indicative rather than statistically significant. It should be noted, however, that when winner-loser tests are conducted on the group of 16 industrial countries with data from end-1969, there is strong evidence--at the one-percent level--for winner-loser reversals at the three- and four-year horizons (see Richards, 1996a,b).

The results in Panel A indicate that ranking-period return differentials are typically far larger in emerging markets than in mature markets. Further, return differentials appear to be larger in the smaller industrial country markets than in the larger markets. These results are consistent with the evidence of Section IVb on short-term volatility in these country groups. The results in Panels B and C suggest the presence of positive autocorrelation in returns at the three- and six-month horizon in all markets, with mature markets apparently demonstrating positive autocorrelations which are as large as those in the emerging markets. The data also suggest the presence of return reversals at longer horizons in all three groups of markets. The reversals in emerging markets appear, however, to be larger and to appear more quickly: at the one-year horizon, emerging market returns have already demonstrated reversals while returns in mature markets still demonstrate positive autocorrelations. If the return reversals were evidence of fads or bubbles, one might conclude that liquidity in emerging markets is lower and therefore less able to maintain stock prices far from fundamentals over an extended period of time.

The possible importance of fads, bubbles or other mean-reverting behavior can perhaps be best addressed by considering the magnitude of the autocorrelation coefficients in Panel C. As noted in Section Vb, a fully mean-reverting series would be characterized by an autocorrelation

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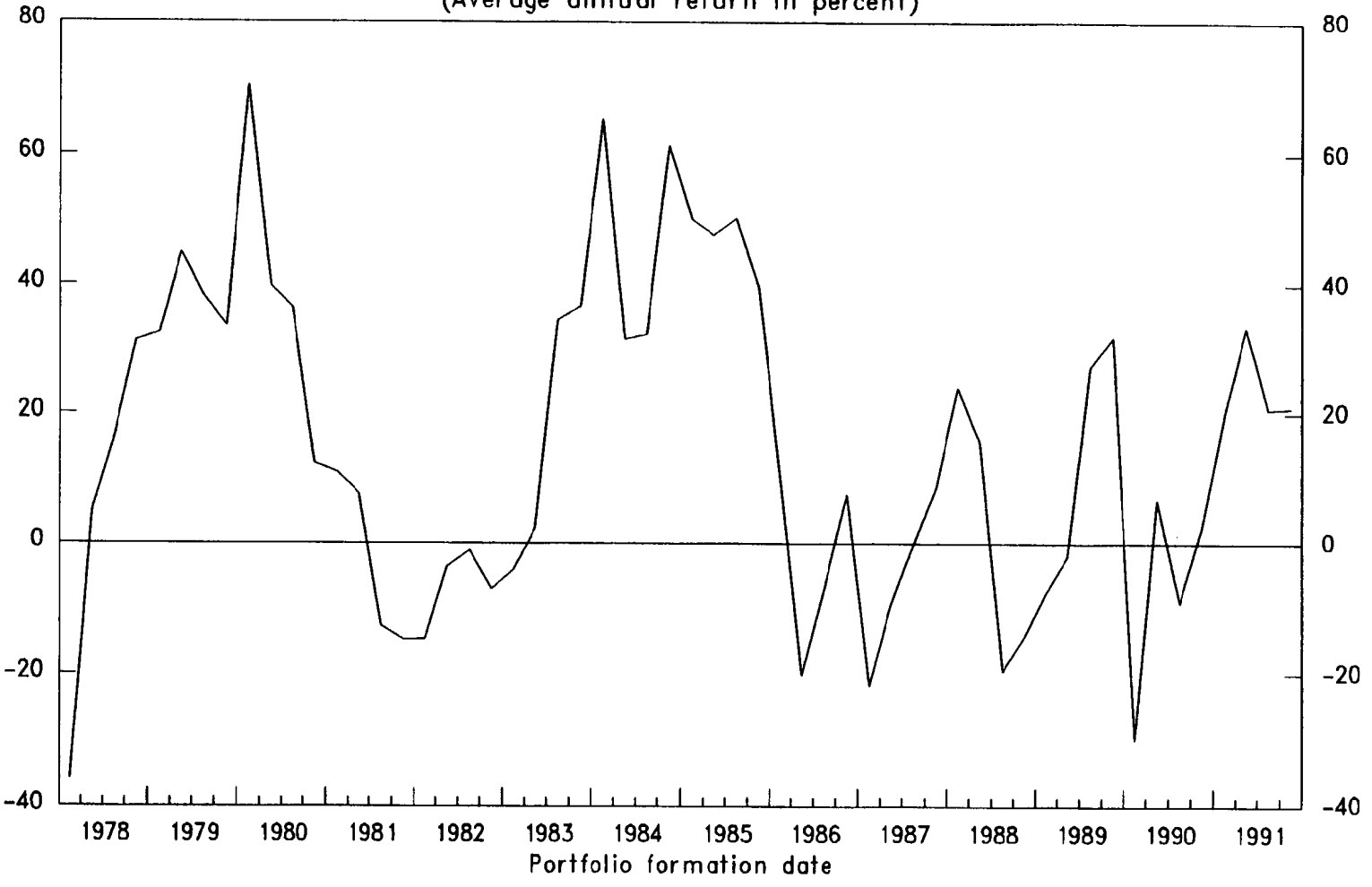
2/ (...continued)
variance were not promising.

The failure of this exploratory test may be a reflection of the general failure of asset pricing models in emerging markets. Alternatively, it may be a reflection of the very simple measures of risk used, and the assumption that the risk of the winner and loser portfolios can be thought of as a fairly stable concept despite continual changes in their composition. Finally, it may indicate the need for a more sophisticated treatment of time variation in risk, possibly along the lines of Bekaert and Harvey (1995a).

CHART 7

DIFFERENCE IN RETURNS ON WINNER AND LOSER PORTFOLIOS
IN EMERGING MARKETS
(Average annual return in percent)



Test-period return on loser portfolio less return on winner portfolio, both calculated relative to average return in 8 emerging markets. Winner (loser) portfolios include two countries with highest (lowest) returns in the previous ranking period.

coefficient of -0.50 at the horizon where the mean reversion is complete. 1/ The data suggest that none of the groups of countries demonstrate this degree of mean reversion, but the smaller mature markets appear to be closest. It should be stressed again that there are very large confidence intervals around such estimates. Nonetheless, the data would suggest that while larger in absolute terms, the reversals in emerging markets may well be smaller in relative terms than in some mature markets. Concern over the possibility of return reversals in emerging markets may therefore be somewhat overdone, at least in comparison with the possibility of similar behavior in the smaller mature equity markets.

VI. Conclusion

The results of this paper would cast doubt on two reasonably widely accepted "facts" about emerging equity markets. First, there appears to be little evidence to support the assertion that the volatility of returns in emerging markets has increased in recent years. Second, while there is evidence of positive autocorrelation in emerging market returns at horizons up to about six months, there is only mixed evidence for subsequent negative autocorrelation that would be implied by models of investor overreaction or bubbles in stock prices.

With regard to volatility, the analysis of this paper suggests that emerging equity market returns have always been volatile, but may actually have become less volatile in the recent period when foreign participation has increased. Domestic capital may not have been "hot" in the sense that it could easily move abroad in the pre-liberalization period, but it appears to have been "hot" in the sense of being able to bring about large changes in asset prices. The opening of markets allows more investors to share a given amount of risk and should therefore reduce volatility of returns.

The conclusion of this paper flies in the face of the conventional wisdom that volatility has increased in recent years. The reason for this misperception may simply be that investors in industrial countries now have larger holdings of emerging market equities and therefore pay greater attention to developments in those markets. Large price changes in these markets that previously went unnoticed now attract the attention of these investors and of the international financial press.

This finding on volatility may also caution against attributing excessive importance to foreign investors in the determination of asset prices. As indicated by the Mexican crisis of late 1994 where domestic

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1/ It is perhaps possible, however, that an autocorrelation smaller in absolute magnitude than -0.50 could be consistent with full mean reversion. In particular, if different markets demonstrated full mean reversion at different horizons, an average autocorrelation coefficient, such as is derived here, might never reach -0.50.

investors appear to have been the major players in capital outflows (see IMF, 1995a), domestic investors may still play the dominant role in the determination of the volatility and level of asset prices. More generally, based on an analysis of balance of payments data, Claessens, Dooley, and Warner (1995) caution that supposedly "hot" short-term capital flows may in fact show no more volatility than supposedly stable long-term flows.

The second finding of the paper relates to the predictability of returns. Returns at short horizons, notably around one or two quarters, appear to be positively autocorrelated. However, at longer horizons, there is evidence from winner-loser tests that relative returns show negative autocorrelation. The estimated return differentials on winner and loser portfolios--at 10 percent per annum or more--are economically significant, but show only marginal statistical significance because of the relatively short data sample that is available.

The existence of positive autocorrelation in short-horizon returns might conceivably be explained by insider trading by market participants who have superior information to others (Claessens, Dasgupta and Glen, 1995a). Alternatively, it might be due to a group of uninformed traders, perhaps including foreign institutional investors (IMF, 1995b), who have little information and may simply extrapolate past return behavior. The existence of such uninformed traders might also help to explain the existence of negative autocorrelation at longer horizons since the actions of these traders might potentially cause prices to overreact to information flows, requiring subsequent correction. It should be noted, however, that there is evidence for the same pattern of autocorrelations in markets in industrial countries 1/, implying that mature markets might be subject to the same "imperfections" as emerging markets.

While return reversals would be consistent with various models of investor overreaction or fads, it should not be forgotten that they may also be compatible with equilibrium models of time-varying risk and required returns. However, due to structural change, short-sample problems, and segmentation from the world market, a completely satisfactory measure of risk in emerging markets may not be possible. In the end, therefore, one can do little more than speculate on the causes of the observed patterns in return autocorrelations.

It should also be noted that the return reversals estimated in this paper are only moderately larger in absolute terms than those observed in industrial countries. And relative to their ranking-period return differentials, the return reversals in emerging markets may actually be somewhat smaller than those in some mature markets. One interpretation of these results would be that in the period studied here, there have not

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1/ For example, Chan, Jegadeesh and Lakonishok (1995) provide evidence that the returns on even large U.S. companies display significant positive autocorrelation, or "momentum", over periods of several quarters.

consistently been fads or bubbles in emerging markets, or at least that they have been no more significant than in some mature markets.

The results of this paper would appear to bolster the case for the liberalization and opening of financial markets in developing countries. At a macroeconomic level, the opening of financial markets allows residents and foreigners to engage in mutually beneficial consumption-smoothing and risk-diversification. As risk is spread more widely, smaller changes in asset prices will be required to equalize the demand and supply of risky assets. The required rate of return on domestic projects (i.e., the cost of capital) should therefore fall in response to market liberalization.

At a more microeconomic level, the reductions in controls on capital flows into national equity markets may bring a host of benefits including greater efficiency of asset pricing, and a demand for higher standards of financial reporting and legal frameworks that are more favorable to investment. Further, the growth of stock markets may increase the volume of long-term investment since the liquidity of stock markets allows risk-averse savers to participate in the financing of long-term investment projects. For example, Levine and Zervos (1995b) provide evidence that countries with more liquid stock markets in 1976 experienced above average growth in both investment and GDP in the period 1976-93.

Of course, to the extent that capital inflows are excessive the liberalization of markets may lead to unwarranted appreciation of the real exchange rate, unsustainable current account deficits, and bubbles in asset prices (see IMF, 1995a). Investment in emerging markets may at times be driven less by the economic outlook in the emerging markets and more by factors such as the low level of returns in mature markets (Calvo, Leiderman and Reinhart, 1993). It is also possible that institutional investors may at times view all emerging markets as a single asset class so that shocks in one country may be transmitted to other markets with little economic rationale (IMF, 1995b).

While these factors may sometimes cause large movements in market prices, the volatility estimates presented in this paper indicate that similar or larger price movements occurred also in the pre-liberalization period. However, the nature of these price changes may recently have changed. In particular, if equity markets were closed to foreigners, the major impact of a change in expectations would be on domestic currency asset prices, perhaps with little effect on the economy as a whole. However, when foreign investors participate and foreign exchange is fully convertible, the impact falls more on the foreign exchange market. The effects of such shocks to the exchange rate may well be far larger and felt by more sectors of the economy than the effects of equivalent changes in stock prices in small undeveloped equity markets.

To minimize the likelihood of damaging swings in asset prices and capital flows, national authorities should focus primarily on avoiding unsustainable economic policies. Strong prudential regulation and

supervision may help to avoid such swings and minimize the subsequent damage should they occur. There may also be a case for gradual liberalization and a focus on structural reform to ensure that capital inflows do not occur more rapidly than the ability of an economy to absorb these flows. Finally, the publication of economic statistics on a regular and timely basis may also help: economic news that is released in stages may be less destabilizing than news released later in a single announcement, in part because the initial release of information may prompt an earlier policy response to an imbalance. It seems unlikely, however, that volatility and swings in asset prices will be caused solely by the growth and liberalization of markets or by the participation of foreigners. Indeed, provided appropriate economic policies are in place, return volatility in emerging equity markets should gradually fall toward industrial country levels.

Table 1. Tests for Stationarity of, and Cointegration between, Return Indices

Market	A. Tests for stationarity of excess return indices		B. Tests for cointegration with world index	
	ADF statistic	5 percent crit.value	ADF statistic	5 percent crit.value
Argentina	−2.03	−3.41	−2.11	−3.80
Brazil	−2.00	−3.41	−2.08	−3.37
Chile	−1.85	−3.41	−1.88	−3.80
Greece	−1.35	−3.41	−1.72	−3.80
India	−3.34 *	−3.41	n.a.	n.a.
Korea	−2.29	−3.41	−2.82	−3.80
Mexico	−1.82	−3.41	−1.54	−3.37
Thailand	−1.74	−3.41	−1.77	−3.80
Zimbabwe	−1.98	−3.41	−2.79	−3.80
MSCI World	−2.17	−3.41	n.a.	n.a.

C. Testing for bivariate cointegration between markets

	Significance level for ADF statistic			Total
	0−5%	5−10%	10−20%	
No. of country pairs	4	2	4	56

D. Testing for cointegration among Latin American countries

Null hypothesis	Max. eigenvalue test		Trace statistic test	
	Test statistic	5 percent crit.value	Test statistic	5 percent crit.value
r <= 0	35.72 **	30.16	57.12 **	52.61
r <= 1	13.68	23.37	21.39	33.07
r <= 2	7.57	15.68	7.71	17.17
r <= 3	0.14	4.19	0.14	4.19

** (*) denotes rejection at the 5 (10) percent significance level of the null hypothesis of non−stationarity (Panel A) or no cointegration (Panels B and D).

All tests use end−quarter U.S. dollar excess returns series in logarithms for the period December 1975−September 1995.
In Panel A, the null hypothesis is non−stationarity and the alternate hypothesis is trend−stationarity. For the tests in Panels B and C, the levels equation includes a constant, and, in most cases, a time trend. For the tests in Panel D, the VAR includes 2 lag terms and a constant.

Table 2. Regression Tests for Predictability in Excess Returns

Country	Return horizon				
	3 months	6 months	12 months	24 months	36 months
	A. December 1975–September 1995				
Argentina	−0.03	−0.01	−0.12	−0.04	0.05
Brazil	−0.11	0.08	−0.19	−0.16	−0.02
Chile	0.23 **	0.37 **	0.39 **	0.32	0.02
Greece	0.10	0.24 **	0.11	0.23	0.41 *
India	−0.12	0.05	−0.50 **	−0.37 *	−0.47 **
Korea	0.10	0.10	0.27 *	0.14	−0.04
Mexico	−0.04	0.12	0.08	0.16	0.08
Thailand	−0.06	0.05	0.19	0.05	0.18
Zimbabwe	0.45 **	0.40 **	0.13	−0.16	−0.12
Memo item: Average five percent one–sided significance levels					
H0: Beta < 0	−0.18	−0.22	−0.29	−0.40	−0.45
H0: Beta > 0	0.18	0.22	0.30	0.41	0.52
	B. December 1984–September 1995				
Colombia	0.15	0.11	−0.33 *	−0.20	n.a.
Jordan	0.16	0.07	0.20	0.30	n.a.
Malaysia	0.01	−0.20	−0.33 *	−0.17	n.a.
Pakistan	−0.11	0.17	−0.53 **	−0.02	n.a.
Philippines	0.18	0.23	0.12	0.28	n.a.
Taiwan (China)	−0.10	−0.14	0.26	0.23	n.a.
Venezuela	0.12	0.21	0.08	−0.34	n.a.
Memo item: Average five percent one–sided significance levels					
H0: Beta < 0	−0.24	−0.29	−0.39	−0.52	n.a.
H0: Beta > 0	0.24	0.30	0.41	0.60	n.a.

** (*) denotes rejection of null hypthesis of no predictability in 5 (10) percent one–sided test.

This table shows the bias–corrected regression coefficients from equation 1, a regression of the k–month excess return in U.S. dollars on the lagged non–overlapping k–month return excess return and a constant. Significance tests are based on the 5, 10, 90 and 95 percent fractiles from 1000 simulations of randomized data under the null hypothesis of no temporal relationship in returns.

Table 3. Testing for Winner–Loser Effects Among Emerging Market Return Indices: End–Quarter Data, December 1975–September 1995

Number of months in ranking and test period	U.S. dollar returns					Real returns
	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Zero–net–investment	Zero–net–investment
	A. Ranking–period average annual return (percent)					
3	−64.1	−30.4	9.4	163.0	−227.0	−212.8
6	−54.7	−27.6	4.1	98.2	−152.9	−143.3
12	−46.0	−23.4	2.3	51.9	−97.9	−96.8
24	−39.1	−20.2	0.3	26.8	−65.9	−64.5
36	−33.8	−17.8	0.5	16.9	−50.7	−48.3
	B. Test–period average annual return (percent)					
3	−0.1	16.8	0.8	7.6	−7.7	−0.7
6	−1.7	−9.1	10.1	10.1	−11.8	−15.8
12	6.2	0.7	9.3	−5.0	11.3	9.2
24	2.8	7.3	5.8	−6.6	9.3	9.8
36	6.9	7.9	−2.0	−7.8	14.6	14.2
	C: Empirical 90 percent confidence interval for test–period return (percent)					
3	−13.3, 13.8	−11.7, 13.1	−11.2, 11.3	−12.6, 13.8	−22.6, 20.9	−21.5, 21.8
6	−11.0, 10.5	−9.0, 9.5	−9.0, 10.1	−9.7, 10.8	−18.8, 17.5	−17.9, 16.2
12	−10.0, 10.3	−7.6, 7.4	−7.0, 8.0	−9.5, 10.0	−17.5, 16.3	−14.8, 14.3
24	−9.4, 9.3	−6.8, 7.3	−6.7, 7.5	−8.8, 9.6	−15.4, 15.0	−15.6, 14.5
36	−9.5, 9.0	−6.8, 7.6	−6.7, 8.7	−9.1, 9.6	−14.7, 15.1	−14.4, 13.6

This table summarizes the ex–post simulation of a trading rule in which the performance of national stock markets in a k–month ranking period is used to choose portfolios to be held for the subsequent k–month test period. Portfolio 1 (4) comprises the weakest (strongest) markets in the ranking period, and the zero net investment portfolio is long portfolio 1 and short portfolio 4. Market capitalization–weighted portfolios are formed at the end of each quarter and average returns are calculated as the geometric average of all test outcomes. Returns for portfolios 1 to 4 are calculated relative to the return on the capitalization weighted average return for all markets. 90 percent confidence intervals are based on 1000 simulations using randomized data.

Table 4. Testing for Winner–Loser Effects Among Emerging Market Return Indices: End–Quarter Data, December 1984–September 1995

Number of months in ranking and test period	U.S. dollar returns					Real returns
	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Zero–net–investment	Zero–net–investment
	A. Ranking–period average annual return (percent)					
3	−65.2	−29.5	8.6	146.3	−211.5	−211.7
6	−54.0	−23.6	2.6	93.4	−147.4	−147.6
12	−46.3	−20.9	2.6	52.8	−99.1	−101.5
24	−38.5	−20.7	0.0	31.4	−69.9	−73.8
	B. Test–period average annual return (percent)					
3	2.9	18.4	−3.7	7.5	−4.6	0.3
6	−6.5	3.9	7.6	3.8	−10.2	−2.3
12	8.4	−0.3	14.2	−8.0	16.4	10.1
24	4.4	5.4	9.3	2.9	7.3	17.6
	C. Empirical 90 percent confidence interval for test–period return (percent)					
3	−13.7, 15.8	−13.4, 13.9	−12.8, 13.4	−13.0, 13.9	−22.4, 24.8	−24.2, 24.1
6	−12.4, 12.8	−9.5, 10.1	−9.3, 9.3	−10.8, 12.1	−21.5, 20.5	−21.3, 20.6
12	−10.6, 10.2	−7.6, 8.2	−7.2, 7.9	−10.3, 10.2	−17.9, 17.2	−17.9, 17.0
24	−10.1, 10.6	−7.0, 7.6	−6.8, 7.7	−9.2, 8.9	−16.0, 16.8	−16.8, 16.0

This table summarizes the ex–post simulation of a trading rule in which the performance of national stock markets in a k–month ranking period is used to choose portfolios to be held for the subsequent k–month test period. Portfolio 1 (4) comprises the weakest (strongest) markets in the ranking period, and the zero net investment portfolio is long portfolio 1 and short portfolio 4. Market capitalization–weighted portfolios are formed at the end of each quarter and average returns are calculated as the geometric average of all test outcomes. Returns for portfolios 1 to 4 are calculated relative to the return on the capitalization weighted average return for all markets. 90 percent confidence intervals are based on 1000 simulations using randomized data.

Table 5. Winner–Loser Reversals in Emerging and Mature Markets

Number of months in ranking and test period	Dec. 1975–Sept. 1995			Dec. 1984–Sept. 1995	
	8 large mature markets	8 small mature markets	8 emerging markets	16 mature markets	16 emerging markets
A. Average annual ranking–period return differential (percent)					
3	−71.1	−92.4	−249.9	−82.9	−237.6
6	−51.7	−63.2	−161.9	−59.9	−156.5
12	−36.5	−49.4	−102.1	−43.9	−102.9
24	−26.7	−37.6	−67.1	−31.7	−71.4
36	−21.4	−28.7	−51.4	n.a.	n.a.
B. Average annual test–period return differentials (percent)					
3	−12.1	−2.0	−7.9	−0.3	−3.9
6	−3.9	−13.1	−14.2	−3.6	−10.3
12	−1.5	−3.6	12.2	−2.4	18.0
24	4.6	4.4	9.1	5.0	7.4
36	4.4	11.9	14.4	n.a.	n.a.
C. Average reversal coefficient					
3	0.17	0.02	0.04	0.00	0.02
6	0.08	0.20	0.08	0.06	0.07
12	0.04	0.07	−0.11	0.06	−0.16
24	−0.17	−0.12	−0.13	−0.16	−0.10
36	−0.20	−0.41	−0.26	n.a.	n.a.

This table shows the simulated return differences on extreme winner and loser portfolios. Panels A and B show the average return on the loser portfolio minus the average return on the winner portfolio in the ranking and test periods, respectively. Returns are annualized and in percent. The returns are all calculated relative to a market capitalization–weighted average return for all countries in the group, and the average return is the geometric average of the return relatives. Panel C shows the implied autocorrelation coefficient in ranking– and test–period returns, calculated from log–differenced returns (rather than percentage returns as in Panels A and B).

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