

"Stock Market Crises in Developed and Emerging Markets"

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ABSTRACT

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We empirically examine stock price index data for eight developed and ten emerging markets from 1970 to 1997. There were nine stock market crises over our sample period, three each in the developed stock markets, the Asian stock markets and the Latin American stock markets. We find important differences in the characteristics of stock market crises between the developed and emerging stock markets. While each developed market crisis has been less severe than the previous one, both in terms of the extent of price decline and the duration of the crises, this is not so for the emerging stock markets. For emerging markets stock crises, prices tend to fall rapidly and steeply, but take longer to recover, in about three years on average. For both developed and emerging markets, prices fall for at least three years subsequent to recovery from a crisis. All the crises we study are associated with contagion---i.e., most individual markets in a region are in crisis when the regional market is also in crisis. Finally, for U.S. investors with long investment horizons (six months or more), international stocks continue to provide diversification benefits even during times of market crises.

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The recent episodes of large price declines in Asian stock markets have once again drawn attention to the consequences of international stock market crises. What are the magnitudes of stock price declines during crises? Is there evidence of contagion during these crises---i.e., do several markets experience a crisis simultaneously? Finally, international investments are beneficial to U.S. investors if correlations between U.S. and non-U.S. stock markets are low. How do stock market correlations change during a crisis, and is this dependent on how long investors hold their stocks for?

There is relatively little research on international stock market crises, whereas there is an extensive literature on international currency crises and the U.S. stock market crash of 1987. Roll (1989) provides a summary of the literature on the U.S. stock market crash of 1987 and Kaminsky, Lizondo and Reinhart (1997) review the results of 25 selected studies on currency crises. In the next section we provide an updated and comprehensive review of the literature on currency and U.S. stock market crises.

This article contributes to the crises literature by empirically examining stock price index data for 8 developed and 10 emerging markets from 1970 to 1997. Our methodology identifies nine stock market crises in the 18 countries during our sample period. These nine crises coincide with several well-known financial crises of recent times: the oil price shocks of 1974 and 1979, the Latin American debt crises of 1982 and 1994, the 1987 U.S. stock market crash, and the East Asian crisis of 1997 (see Box one). We study stock price changes before and after these episodes to document price increases prior to crashes and the price recovery following crashes. We document the extent of contagion during crises and examine whether the correlation between stock market indices changes during episodes of significant price declines.

The remainder of the paper is organized as follows. The first section summarizes the literature on currency and U.S. stock market crises. The second section describes the data, and the construction of regional indices. We proceed to identify stock market crises for our sample period, and characterize the behavior of stock market indices surrounding the crises episodes. Finally, we analyze the extent of contagion and the change in correlations between markets during these crises. To supplement the technical analysis, we provide in Box one a chronology of economic and political events surrounding the stock market crises identified in the paper.

Literature survey

The crises literature has mostly focused on currency crises and the U.S. stock market crash of 1987, and examined issues related to the causes of crises, price changes (including, among other economic variables, stock returns) surrounding the crises, international market linkages, contagion, and changes in benefits to international diversification. In our paper, we examine these same issues for 18 international stock markets from 1970 to 1997.

The U.S. stock market crash of October 1987 inspired several studies. Black (1988), Fama (1989) and Roll (1989) seek to explain the crash in terms of shifts in fundamental factors, such as downwards revisions in expectations about global economic activity, or higher equilibrium required returns. In contrast, Seyhun (1990) concludes, based on the behavior of corporate insiders, that investor overreaction was an important part of the Crash. His evidence showed that, while the Crash was a surprise to insiders, they bought stocks in record numbers immediately after the Crash, especially those stocks which had declined the most, and these stocks had large

positive returns in 1988.¹ Norden and Schaller (1996) use regime-switching regressions to conclude that the degree of prior market overvaluations explain subsequent U.S. stock market crashes for the period 1926-89.

The U.S. stock market crash inspired several studies on the international links between stock markets. In early literature, Solnik (1974) showed that international investments are beneficial for U.S. investors since correlations between U.S. and non-U.S. markets are low. Bennett and Kelleher (1988) find that the transmission of stock price volatility between markets was greater than normal during the Crash, and that periods of high daily volatility are associated with high correlations between markets. Neumark, Tinsley and Tosini (1991) show that correlations between stock market prices of different countries increase during times of extreme volatility and become small or close to zero during more normal periods and suggest that transactions costs may explain this pattern of asymmetric correlations. In a recent paper, Lin and Ito (1994) find a significant increase in the hourly return correlation between the S&P 500 index and the Nikkei 225 from the Tokyo Stock Exchange (TSE) during the 1987 crash period.²

In related research, Aderhold, Cumming, and Harwood (1988) conclude that direct international linkages cannot account for the worldwide decline in equity markets in October 1987. Cross-border selling of equity was a factor only in Tokyo and stock trading outside the

¹ Other papers have examined whether the October Crash was a speculative bubble---i.e., the crash occurred following a period when investors persistently overvalued the market. Shiller (1987) provides survey evidence that, before the Crash, almost 72 per cent of individual investors and 84 per cent of institutional investors thought the market was overvalued. Hardouvelis (1988) finds evidence that excess stock returns prior to the Crash were greater than normal in the U.S., Japan and Great Britain., and he attributes the abnormally high excess return to a bubble premium.

² One puzzling aspect of the 1987 crash was the behavior of the S&P 500 index of the New York Stock Exchange (NYSE). For example, the index exceeded the corresponding futures price (negative basis), displayed unusually strong and persistent serial correlation, and unusually low variance. Harris (1987) shows that nonsynchronous trading in the stocks making up the index cannot account for the large (absolute) value of the basis. Kleidon (1992) argues that stale limit buy orders can account for the behavior of the S&P 500 index.

home market mainly affected U.K. securities traded in the form of American Depository Receipts (ADRs). However, in the weeks after the crash, investors liquidated equities and reduced financial investments, but not to the extent anticipated.

There is a large literature on international currency crises. One strand of this literature seeks to develop early warning signals of exchange rate crises. Kaminsky, Lizondo and Reinhart (1997) review the results of 25 selected studies on currency crises and identify 103 crisis indicators. A second strand of the currency literature examines the issue of currency contagion. For example, Sachs, Tornell and Velasco (1996) show that countries with weak fundamentals are more susceptible to contagion. Eichengreen, Rose and Wyplosz (1996) find that, after controlling for the effects of economic and political variables, the probability of a speculative attack on a currency increases eight percent when a crisis occurs elsewhere in the world.³

Data and regional index construction

We use monthly dollar-denominated returns on stock indices, supplied by Morgan Stanley Capital International (MSCI), for eight developed countries (Switzerland and the G7 countries: Canada, France, Germany, Italy, Japan, U.K. and U.S.A.) from January 1970 till December 1997. We also use dollar-denominated returns on stock indices for ten emerging market countries: six Asian emerging markets (Indonesia, S. Korea, Malaysia, the Philippines, Taiwan, and Thailand) and four Latin American emerging markets (Argentina, Chile, Brazil, and Mexico). This data is

³ There is also a growing literature on international banking crises. Kapur and Ma (1997) review selected research from this literature. Rojas-Suarez (1998) proposes early warning indicators for banking crises in emerging markets, based on bank-specific variables.

available from January 1976 till December 1997, and was obtained from the Global returns series of the International Finance Corporation (IFC).⁴

The country returns are combined into three regional dollar-denominated index returns for the Developed markets, Asia and Latin America. The monthly regional return is constructed by equally weighting the monthly returns of each country in the region.⁵ The three regional index levels at time t are obtained by cumulating the corresponding monthly regional returns up to time t .

A History of Regional Stock Price Declines

To identify periods of significant price declines in the history of the regions, we define a variable called $CMAX_t$, which is the ratio of the regional index level at time t to the maximum regional index level for the period up to time t .⁶ Figure one graphs the value of $CMAX_t$ from 1970 till the present for the three regions, developed markets, emerging Latin America and emerging Asia.

All three regions have experienced episodes of large price declines. However, as may be expected, price declines in the emerging markets are typically larger in magnitude than price declines in developed markets. For example, in the developed markets, there were three episodes where the regional price index declined more than 20% relative to the previous historical

⁴ The MSCI and IFC data sets have been widely used in previous work. The methodological notes from both indices provide detailed descriptions of the data. To obtain the longest possible sample, we have used the Global (instead of Investible) returns series from the IFC. The sample period for Malaysia, the Philippines and Taiwan begins in January 1985 and that for Indonesia begins in January 1990.

⁵ Alternative weighting schemes may include market capitalization (which is not available for the full time series in our sample), nominal and purchasing power GDP. We could also have equally weighted the returns on an annual, rather than monthly basis.

⁶ The variable $CMAX_t$ is widely used by equity market practitioners. For example, it has been used in “MSCI Perspective”, a monthly publication of Morgan Stanley providing index and index-constituent data, and in the

maximum level, but there were six such episodes for Asian markets and four such episodes for Latin American markets. In addition, there was only one instance when price declines in developed markets exceeded 35 per cent, with the largest price decline being 39.9 percent in September 1974. In contrast, there were six such episodes for emerging Latin American and Asian markets---for example, Asian stock indices declined almost 68 per cent relative to their historical maximum by December 1997.

We define a stock market crash as an event when the regional price index declines, relative to the historical maximum, more than 20 per cent for the developed markets, and more than 35 per cent for the emerging markets.⁷ The beginning of the *crash* is the month when the price index falls below this threshold level. The beginning of a *crisis* is the month when the index reached its historical maximum *prior* to the month when the crash is triggered. The date of trough is the month when the price index reaches its minimum level during the crisis. The date of recovery is the first month when the index reaches the pre-crash maximum level *after* the crash is triggered. To avoid counting the same crisis twice, additional triggers occurring within a crisis are considered part of the existing crisis, instead of being an indicator of a new crisis.

To illustrate our definition, consider the Latin American crisis of 1981. In July 1981, the Latin American regional index fell 36.14% below its historical maximum level. Since the decline exceeds the trigger of 35%, we identify this episode as a crash. The beginning of the crisis was June 1980, the month that the Latin American regional index achieved its historical maximum. The crisis ended 65 months later, in November 1985, when the Latin American index recovered to

Barra-Forbes page of *Forbes* magazine. We define $C_{MAX,t}$ in nominal dollar terms. In future analysis, we may also define $C_{MAX,t}$ in real dollar or real local currency terms.

⁷ For the developed markets and Asia, the trigger price represents a level about two standard deviations below the mean value of $C_{MAX,t}$. For Latin American markets, the trigger price is about one standard deviation below the

its previous maximum level of June 1980. There were additional trigger points during this crisis, such as December 1982, when the regional index declined almost 69% below the historical maximum level of June 1980. These additional triggers are considered part of the June 1980 crisis, rather than the beginning of a new crisis.

Episodes of crises can be identified in many ways. Box one shows that our definition successfully captures nine well-known financial crises. Six of the nine crises were related to terms-of-trade shifts: the first developed crisis of 1973 and the crises affecting all three regions in 1980-1981 were related to the oil price increases; the Latin American crisis of 1994 and the current Asian crisis were related to currency over-valuation under pegged exchange rate regimes. Of the remaining three crises, the 1987 crises in developed and Latin American countries were associated with the U.S. stock market crash and the Asian crisis of 1990 was a result of several simultaneous political and economic shocks.

Table one provides further information on regional crises. The “Months to trough” column shows the number of months over which the regional index reached the trough. The “Months to recovery” column shows the number of months taken for the regional index to recover. The duration of a crisis is the number of months taken to fall to the trough and then recover to the previous peak.

Since 1970, there have been three crises in the developed markets, each less severe than the one before. The crisis duration for the developed markets has fallen from 59 months for the first crisis of June 1973 to 17 months for the last crisis of August 1987. The maximum price decline during a crisis has also fallen from almost 40 per cent for the first crisis to about 22 per cent for the final crisis.

mean value of $C_{MAX,t}$, reflecting the higher volatility of these markets. For the sake of consistency, we wanted to

There have been three crises each in the Latin American and Asian stock markets since 1970. In contrast to the developed markets, the severity of the crises shows no signs of declining. In fact, the emerging market crises have most in common with the first (and most severe) developed markets crisis of 1973. The emerging market crises tend to be quick and steep, but with long periods of recovery and crises duration. Even then, recovery occurs in less than three years. The maximum price decline in a crisis was around 40 per cent for four of the six crises, and exceeded 60 per cent in the other two.

In all nine crises, stock price crashes have been preceded by significant price increases, with the median value of the annualized returns for the three years prior to the crises being almost 49 per cent. This is consistent with the results of Roll (1988), who found substantial price increases in many international stock markets in the nine months prior to the October 1987 stock crash. Our results show that the magnitude of pre-crisis price increases is typically larger for emerging markets than for developed markets. Further, for emerging markets, the average annual price increase for the three years before the crises exceeds the maximum price decline in the crises—a feature that may be consistent with a “bubble” (see, for example, Allen and Gale (1998)). Interestingly, this “bubbles”-type feature is not present in the recent Asian crisis, where the annual pre-crisis price increase was only a third of the maximum price decline in the crisis.

A surprising result is that, in all nine crises, prices have fallen following recovery, with the median value of the annualized returns for the three years after the crisis being about negative nine per cent.

Lead-lag Relationship Between Stock Price Declines and Advances

We saw, in table one, that stock prices rise significantly prior to regional crises. To further examine the behavior of stock prices prior to episodes of significant price declines, we define a variable called $MINC_t$, defined as the ratio of the minimum index level for the three year period prior to time t to the index level at time t . Figure two graphs $MINC_t$ for the three regions and the period January 1970 till December 1997.

Analogous to figure one, there were several episodes of significant price increases in all regions and the magnitude of such increases were larger for the emerging markets. Further, for each region, price increases tended to be larger than price declines, reflecting the fact that stock prices tend to go up over time. The developed markets, for example, experienced price increases of more than 200 per cent leading up to the crash of 1987. The emerging Latin American markets experienced price increases close to 400 per cent leading up the crisis of the early 1980s.

These observations suggest that stock market crises may be *systematically* preceded by episodes of significant price increases. To examine this idea more formally, we calculate the correlation between $CMAX_{t+lag}$ and $MINC_t$ for various values of lag ranging from - 60 months to + 60 months. When the value of lag is negative, the correlation indicates whether price increases lead the subsequent price decline. For example, suppose lag is - 60 months (i.e., 60 months prior to t), and t is January 1990, and the correlation between $CMAX_{t-60}$ and $MINC_t$ is positive. This means that if, five years ago in January 1985, the index level was close to its historical high, then in January 1990, the price is likely to be close to its previous minimum. In this case, above-average index levels are likely to be followed by below-average index levels---i.e., prices are mean-reverting. If the correlation is negative, then high values of index levels are likely to be followed by still higher index levels---i.e., prices are positively auto-correlated.

We plot, in figure three, the correlation between $CMAX_{t+lag}$ and $MINC_t$ for different values of lag . In addition, figure three includes bands for values of three standard deviations above and below the mean correlation. The correlation declines from a modest positive value to a large negative value for all three regions, as the lag value goes from negative 60 months to zero. This means that, over short intervals of time (small values of lag), prices are positively autocorrelated. This is consistent with Roll (1989), who finds similar positive autocorrelation for holding periods from 2 days to 20 days for stock returns of 23 countries in the pre-1987 crash period. A new result here is that the degree of short-horizon autocorrelation is larger for emerging markets than for the developed region. For longer time intervals (large values of lag), prices are mean-reverting. This result is consistent with previous work on developed markets (see Campbell, Lo and MacKinley (1997) for a summary).

When the value of lag is positive, the correlation indicates whether price declines lead the subsequent price increases. From figure three, for all regions, the correlation is negative for small positive values of lag but increases to a positive value for larger positive lag values. The lag value at which the correlation turns positive varies by region, being about 7 months for the developed markets, 15 months for Asian markets, and 33 months for Latin American markets. As the lag values increase further, the correlation reaches a peak and then starts declining again. The lag value at which the correlation peaks is the period of time after which the probability of recovery is the strongest. This lag value, too, varies by region, being largest for Latin America, followed by Asia, and the developed region. These results indicate that, consistent with our earlier findings, the period of recovery is longer for emerging markets than it is for developed markets.

Individual Market Crises and Contagion

Is a regional crisis typically associated with an individual market crisis?⁸ In figure four, we show, corresponding to each regional crisis, the individual markets in the region that are also in crisis. Each band illustrates the duration of an individual market crisis, with the beginning and end of a band dating the beginning and end of the crisis. It is clear that, for all episodes of regional crises, half or more of the individual markets were affected. An interesting aspect of figure four is that there were several instances when individual markets were in crisis, but this did not spill over into a regional crisis. However, since 1990, there is an increasing tendency for markets in Asia and Latin America to move together.

In table two, we examine the behavior of individual country stock prices when the region is in crisis. All regional crises are associated with contagion, in the sense that most countries in the region participate in the stock market decline. For the developed markets and Latin America, there is little difference in the means and medians of individual country crises duration, which suggests that all countries participating in the regional crisis suffer for roughly equal amounts of time, although the dates when the crisis began and ended varied between countries. However, this is not the case for Asia, where Indonesia and S. Korea have been in crisis longer than the other Asian stock markets. The means and medians of the maximum country stock price declines are similar in all regions, including Asia, indicating that, in almost all regional crises, the individual countries in crises are about equally affected. Most individual stock markets experience negative post-crisis returns for at least three years.

An examination of when individual countries in a region go into crisis reveals a “bunching” effect---that is, two or more markets become critical in the same month or within one month of

⁸ Markets in a region may move together for various reasons. The markets may be regionally integrated through trade flows, and so shocks in one market are naturally transmitted to other markets. Alternatively, shocks may be

one another. This is particularly true for the developed markets. For example, in the 1987 crisis, France and Italy became critical in April 1987, Canada, Germany and the United States became critical in August 1987, while Switzerland and the UK followed suit in September 1987. All these countries experienced negative returns following the end of the crisis, except Italy.

Even though contagion within a region is endemic, the evidence does not indicate significant contagion across regions. This leads us to examine how the diversification benefits of U.S. investors are affected during a crisis.

Diversification Benefits of U.S. Investors

In this section, we examine the crises from the point of view of an U.S. investor. U.S. investors are often advised to hold both U.S. stocks and non-U.S. stocks in their portfolio. Since U.S. and non-U.S. markets do not move one-for-one (they are imperfectly correlated), such a portfolio can be less risky, without sacrificing returns, relative to a domestic stock portfolio. However, a common belief is that U.S. and emerging markets have high correlations when the U.S. market is falling, so that “when you need diversification, you don’t get it, and you get it when you don’t need it.” (Graja, 1998).

To address this issue, we examine the correlation between the U.S. markets and the remaining developed markets (excluding Japan), as well as Asia and Latin America. We first sort the monthly index returns for all three regions by the value of the U.S. returns, and then, for each region, we distribute the observations into the lowest and highest twenty five percent of U.S. returns, and the middle 50 per cent U.S. returns. Correlations between the U.S. returns and returns of the other two regions are calculated for the lowest, highest, and middle U.S. returns, as

transmitted even when economic links between countries are weak. We document the degree to which markets

well as for the whole sample. We repeat this exercise after sorting the observations by the non-U.S. returns.

The results are in table three. Panel A reports the correlations for a hypothetical investor who holds stocks for one month and then liquidates his portfolio. The correlations are high and positive for all three regions for the lowest quarter returns, and close to zero or negative for the highest quarter returns. These results show that, for one month holding periods, U.S. and international markets move together in periods when U.S. returns are low. The same result holds when the monthly returns are sorted by the non-US market returns. Thus, U.S. investors' diversification benefits are diminished in periods when markets perform poorly.

Panel B of table three displays the same set of correlations, except that we assume that the investor holds the stocks underlying the indices for a period of one year. The procedure for computing correlations is the same as before, except that we first compute one year returns for all regions. The results are quite different, especially for Asia. The overall correlations are lower. More important, the correlation for the lowest returns is zero for Asia. Again, the result is true whether we sort the returns by the U.S. returns or the non-U.S. returns.

These results are generalized in figure five, where we show correlations for holding period returns between zero and 30 months. For each holding period, we compute the corresponding holding period returns for the U.S. returns. For the lowest 25% returns, figure five shows the pair-wise correlations between the U.S. and non-U.S. markets. The correlations between U.S., other developed markets and emerging markets (*both* Asian and Latin America) decrease with the holding period, eventually becoming zero for a sufficiently long holding period. Our results

demonstrate that emerging market investments reduces the risk of U.S. investors' stock portfolio, provided the investor holds the stocks for a sufficiently long time.

CONCLUSION

We empirically examine stock price index data for 8 developed and 10 emerging markets from 1970 to 1997. We identify episodes of significant price declines ("crashes") and discuss stock price behavior surrounding these episodes. We examine stock price changes before and after these episodes to document price increases prior to crashes and the price recovery following crashes. We document the extent of contagion during crises and examine whether the correlation between stock market indices changes during episodes of significant price declines.

We identify nine stock market crashes over our sample period: three in the developed markets, when price index levels declined more than 20 per cent relative to their historical maximum, and six in emerging markets, when index levels fell more than 35 per cent relative to their historical maximum. Crashes tend to be quick and steep, but prices do recover, usually in three years or less. Emerging markets tend to have larger price declines and longer recovery times than developed markets. The process of crash and recovery together typically lasts about 31 months. However, for the three years subsequent to the recovery, stock prices tend to decline again, although not with the same severity as during the crash.

Prices tend to rise prior to a crash, and the magnitude of price increases is also larger for emerging markets. For short horizons, prices are autocorrelated, whereas for longer horizons, there is evidence of mean reversion. This means that, over longer horizons, prices do recover from a crash. However, the recovery time is longer for emerging markets and, within emerging markets, longer for Asia than Latin America.

There is strong evidence of contagion within regions, in that most countries in a region participate in a crisis. Those stock markets affected by the crisis are about equally affected, both in terms of the severity of the price decline, and the duration of the crisis. The crisis perpetuates rapidly from one market in a region to the next, with consecutive markets being affected in the same month or within one month of one another.

We confirm the often-held belief that correlations between U.S. and emerging markets tend to become higher in times of market decline. However, this is only true for investors who hold stocks for short periods of time---for less than one year, in the case of Asian stocks. For longer-horizon investors the correlations remain very small even when markets fall. For these investors, emerging market stocks continue to provide important diversification benefits even during periods of significant market declines.

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Box 1

A History of Stock Market Crises

The Developed Markets

1. **The 1973-74 crisis**, involving all eight developed markets in our sample, was preceded by the quadrupling of the oil price by OPEC in 1973 and the consequent increase in the external debt of non-oil producing developed countries. In addition, the Gold Standard was suspended and the foreign exchange market closed down for two weeks following frequent revaluations of the world's major currencies. The developed country stock markets, with the exception of Canada, had all peaked by June 1973. The Italian stock market crashed first, in July 1973, followed by the U.K. stock market a month later. Stock markets in Japan, France and Germany crashed between November and December of 1973. Canada and the U.S. crashed in April and June of 1974, respectively.

Recovery Germany recovered in only four months, and Switzerland in 16 months. The other six countries took between 27 months (U.S.) and 52 months (Canada) to recover.

2. **The 1980-81 crisis**, involving Canada, Japan, France, Italy and the U.K., was preceded by dramatic increases in gold prices in 1980, and the doubling of the oil price by OPEC in 1979, leading to balance of payment problems for non-oil producing countries, especially in the emerging market countries. Canada, France, Italy and the U.K. peaked between October 1980 and May 1981. The French stock market crashed first, in April 1981, followed two months later by Italy and by France and the U. K. after another three months. The Japanese stock market did not peak until December 1981 and it did not crash until July 1982.

Recovery Japan recovered in only two months, and Canada and the U.K. took 19 months or less. But France and Italy took more than three years to recover.

3. **The crisis of 1987**, involving all developed markets in our sample other than Japan, originated in the U.S., when prices at the New York Stock Exchange fell by one third over five trading days in October, triggered by high trade deficits and proposed takeovers related legislation. The major developed stock markets had all reached their peaks between April and September of 1987. The crisis spread to all of them, except Japan, in October 1987 (except Switzerland, where the market crashed in November).

Recovery The recovery took between 11 months (Switzerland) and two years (Italy).

Box 1 (contd.)
A History of Stock Market Crises

The Latin American Markets

1. **The 1980-81 crisis**, involving Argentina, Chile and Mexico, originated with the doubling of the oil price by OPEC in 1979, leading to balance of payment problems for non-oil producing countries, especially in the emerging market countries. In 1982, Brazil, Argentina and Mexico announce their inability to meet foreign debt obligations. Argentina, Chile and Mexico had peaked between April 1979 and June 1980. The stock market in Argentina crashed first, in May 1980, followed by Chile and Mexico in July 1981.
Recovery Recovery was prolonged, lasting between four years for Chile and 75 months for Argentina.
2. **The crisis of 1986-87** involved Brazil and Mexico. The Brazilian stock market peaked April 1986, thanks to increased economic growth following the economic stability, or Cruzado, Plan, but crashed in September of the same year due to the government's failure in implementing economic reforms. The U.S. stock market crash of 1987 perpetuated the Brazilian crisis and brought on a new crisis in Mexico, where the stock market peaked in September 1987 and crashed the following month.
Recovery Recovery took 29 months for Mexico and 71 months for Brazil.
3. **The crisis of 1994-95**, involved Argentina, Brazil and Mexico. The crisis was preceded by an increase of almost 85 per cent in the U.S. Federal Funds interest rate over the course of 1994, and the unexpected devaluation of the Mexican peso in December 1994. Stock markets of all three Latin American countries peaked in 1994, with the Mexican and Argentinian stock market peaking in January, followed by Brazil in September. The Mexican stock market crashed first, in December 1994. The so-called "Tequila effect" next affected Argentina, where local banks lost one-fifth of their deposits, interest rates increased and net capital flows turned negative, and the stock market crashed in February 1995. Brazil followed in March 1995.
Recovery Recovery took 22 months for Brazil and 23 months for Argentina. The Mexcian stock market is yet to recover to its pre-crisis peak.

Box 1 (contd.)
A History of Stock Market Crises

The Asian stock markets

1. **The 1979-80 crisis** , involving S. Korea and Thailand, was preceded by the doubling of the oil price by OPEC in 1979, leading to balance of payment problems for non-oil producing countries, especially in the emerging market countries. The S. Korean stock market peaked in August 1978 and crashed in May 1979. The stock market in Thailand peaked in October 1978 and crashed in January 1980.

Recovery Recovery was prolonged, lasting five years for Thailand and five years and one month for S. Korea.

2. **The 1990 crisis** , involved Indonesia, S. Korea, Philippines, Taiwan and Thailand. The crisis was preceded by tight monetary conditions, high interest rates and slowing economic growth in many countries, and the Gulf war in August 1990. For the Asian countries, the crisis was also a time of political uncertainty, natural disasters and a deterioration of the external trade balance for some countries. The five Asian stock markets in crisis all peaked between March 1989 and July 1990, thanks to international investor interest and gradual economic deregulation. The stock markets in Philippine and Taiwan crashed first, in May 1990, followed by S. Korea in August 1990, Thailand in September 1990 and Indonesia in October 1990.

Recovery Thailand recovered in 23 months and the Philippines in 35 months, but the other three stock markets are yet to recover to their pre-crisis peak levels.

3. **The crisis of 1996** involved Indonesia, Korea, Malaysia, Philippines and Thailand. Prices in the Thailand stock market had increased almost three times between 1990 and 1994, peaking in October 1994. Subsequently, prices declined over concerns about high interest rates and bad bank loans, and the market crashed in October 1996. The Malaysian and Philippine markets peaked in early 1997 and crashed together in August 1997. The Indonesian and Korean stock markets were holdovers from the 1990 crisis.

Recovery Indonesia and Korea are yet to recover from the 1989 crisis. All five markets remain in crisis at the time of writing.

Box 2
Summary of analysis and results

- Empirical analysis of stock price index data for eight developed and ten emerging markets from 1970 to 1997.
- Nine stock market crashes over our sample period, three in each region.
- Each developed market crisis has been less severe than the previous one, both in terms of the magnitude of price decline and the duration of the crisis.
- For emerging markets, prices fall rapidly and steeply, and take long to recover, usually in about three years or less.
- For all markets, prices decline for at least three years subsequent to the recovery from the crisis.
- There is evidence of contagion---most markets in a region participate in the crisis.
- For U.S. investors with long horizons (one year or more), international investing is beneficial even during periods of market declines.

Table 1: A Chronology of Regional Crises

A crash is triggered when, relative to the previous maximum, the regional stock price index declined more than 20 percent in the developed markets or more than 35 per cent in the emerging markets. The beginning of a regional crises is the date when the index reached its maximum just *prior* to the trigger time. The end of a crisis is the date when the index reached the pre-trigger maximum level the first instance *after* the trigger time. We exclude triggers occurring within six months of the initial trigger time.

Beginning of crisis	Beginning of crash	Date of trough	Date of recovery	Months to trough	Months to recovery	Price decline to trough	Annual returns before crisis		Annual returns after crisis	
							one year	three years	one year	three years
Panel A: Developed stock markets										
197306	197405	197409	197802	15	41	39.9	25.0	24.2	-5.0	-7.5
198010	198206	198206	198303	20	9	22.9	31.1	25.7	-5.0	-15.5
198708	198711	198801	198901	5	12	21.5	26.8	48.7	-7.4	-5.3
Panel B: Latin American stock markets										
198006	198107	198212	198511	30	35	68.4	71.0	66.8	-4.0	-10.1
198709	198711	198711	198805	2	6	38.2	67.9	64.4	-29.0	-37.4
199409	199502	199502	199702	5	24	38.2	63.5	37.2	-2.5	-1.6
Panel C: Asian stock markets										
197812	198008	198010	198510	22	60	43.7	33.8	51.6	-7.9	-15.8
199003	199009	199009	199308	6	35	37.7	44.7	55.6	-10.3	-6.4
199604	199708	199712	199712	20	NA	67.9	20.3	21.6	NA	NA

Table 2: Individual Market Crises and Regional Crises

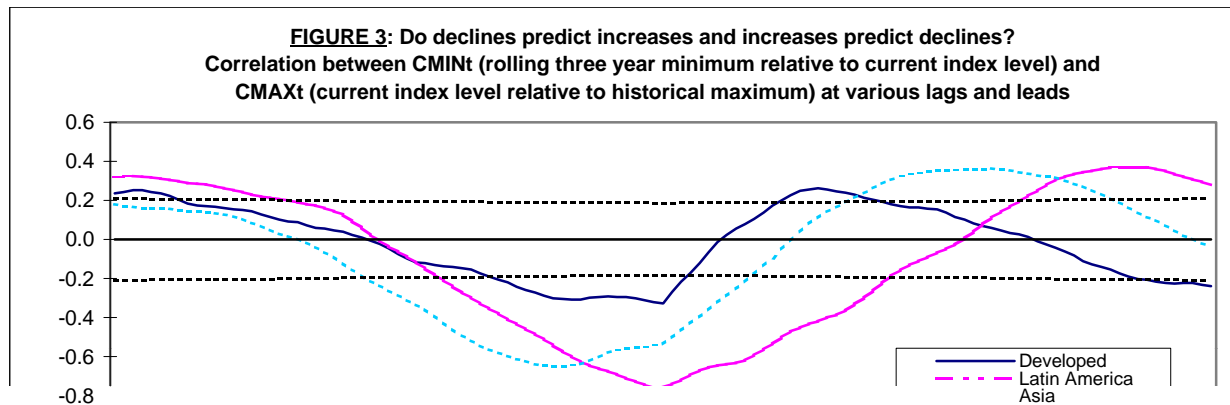
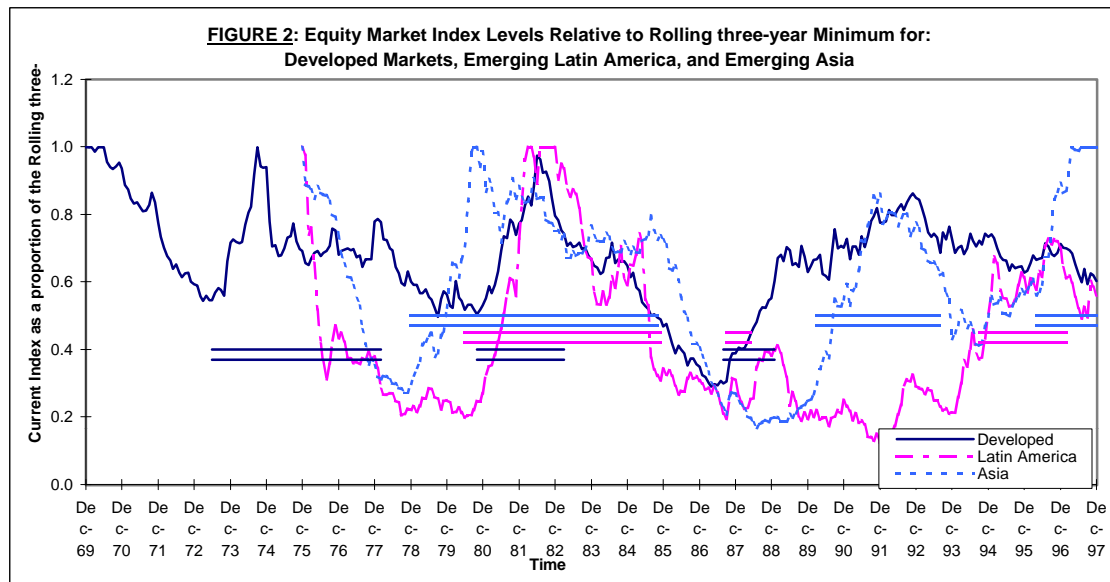
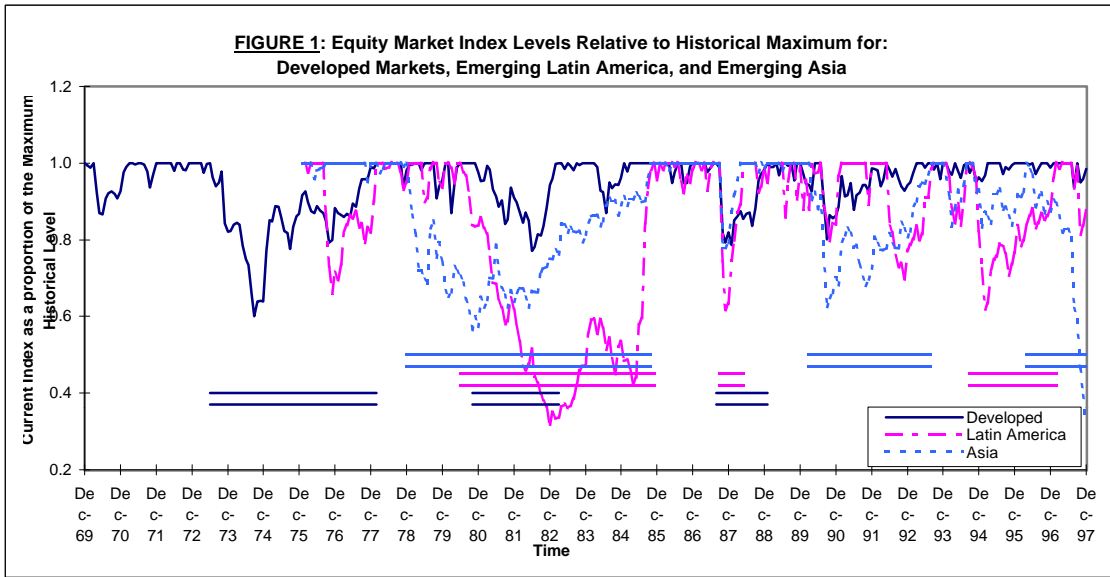
A crash is triggered when, relative to the historical maximum, a country's stock price index declined more than 20 percent in the developed markets or more than 35 per cent in the emerging markets. The beginning of an individual market crises is the date when the index reached its maximum just *prior* to the trigger time. The end of a crisis is the date when the index reached the pre-trigger maximum level the first instance *after* the trigger time. We exclude triggers occurring within six months of the initial trigger time.

Number of countries in crisis	Beginning of first crisis	Beginning of first crash	Duration of crises (months)				Maximum price decline in crises		Annualized mean returns			
			Months to trough		Months to recovery		Mean	Median	Before crises		After crises	
			Mean	Median	Mean	Median	Mean	Median	one year	three years	one year	three years
Panel A: Developed stock markets												
8	197204	197308	22.4	18.5	33.5	38.5	47.6	43.9	40.6	23.2	-3.1	-4.1
5	198010	198104	12	11	23	19	38.8	43.8	46.8	30.9	-10.4	-12.3
7	198704	198710	7	5	17	18	31.1	29.4	36.0	46.5	-3.2	-8.1
Panel B: Latin American stock markets												
3	197904	198005	54	56	58	51	90.2	87.6	239.3	76.0	-1.4	-7.4
2	198604	198609	11.5	*	50	*	80.3	*	411.4	99.9	-9.5	-9.4
3	199401	199412	10.7	13	NA	NA	52.2	47.5	85.8	72.0	NA	NA
Panel C: Asian stock markets												
2	197808	197905	31	*	61	*	54.6	*	42.1	59.1	-8.0	-14.0
5	198903	199008	44.2	8	NA	NA	68.6	76.2	83.6	62.2	NA	NA
5	198903	199005	51.4	38	NA	NA	77.5	77.1	41.9	31.7	NA	NA

Table 3: Stock Market Correlations

U.S. stock returns are sorted by their magnitude. Pair-wise correlations are computed for the overall sample, for the bottom and top quartiles, and for the middle half separately. For the second set of correlations, the non-U.S. stock returns are sorted by their magnitude, and pairwise correlations are computed as above. The developed markets exclude the U.S. and Japan.

Region	Sorted by U.S. stock returns				Sorted by non-U.S. stock returns			
	Overall returns	Lowest quarter returns	Highest quarter returns	Middle half returns	Overall returns	Worst quarter returns	Highest quarter returns	Middle half returns
Panel A: One Month Returns								
Developed	0.5753	0.5593	0.1676	0.1605	0.5753	0.5235	0.2419	0.264
Asia	0.2235	0.3627	0.0520	-0.0775	0.2235	0.4540	-0.0850	-0.0635
Latin America	0.1664	0.413	-0.2388	-0.2268	0.1664	0.4324	-0.1656	0.1076
Panel B: One Year Returns								
Developed	0.5461	0.3966	0.0696	0.1745	0.5461	0.5612	0.3011	0.2274
Asia	-0.095	-0.0001	0.0432	0.1184	-0.095	-0.1373	0.1031	-0.1165
Latin America	0.1358	0.3586	-0.2241	-0.0241	0.1358	0.0449	0.5688	-0.0767



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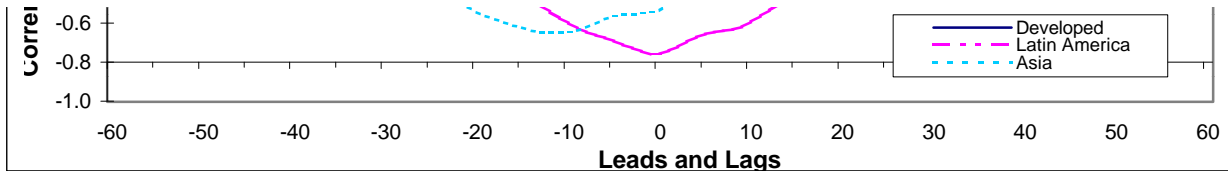


FIGURE 4: Individual country and regional Times from the beginning to the end of crises separated into times to identification, trough and recovery

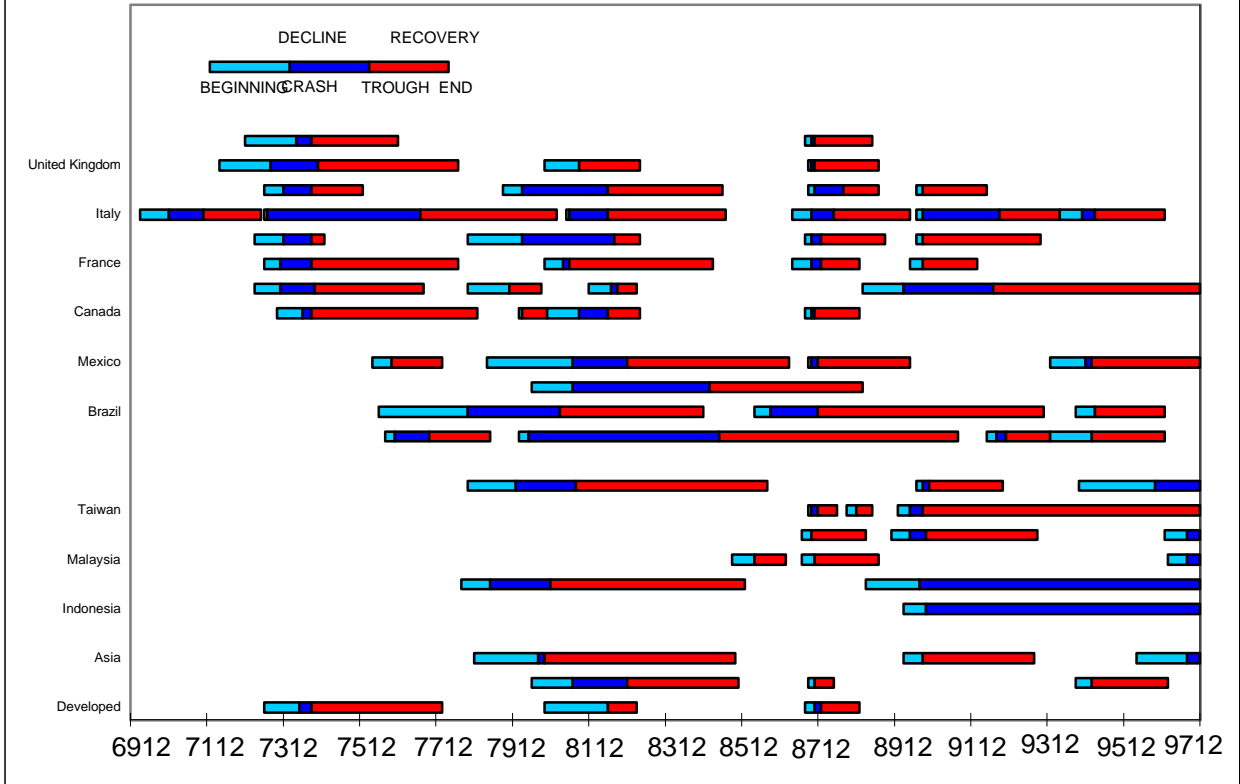
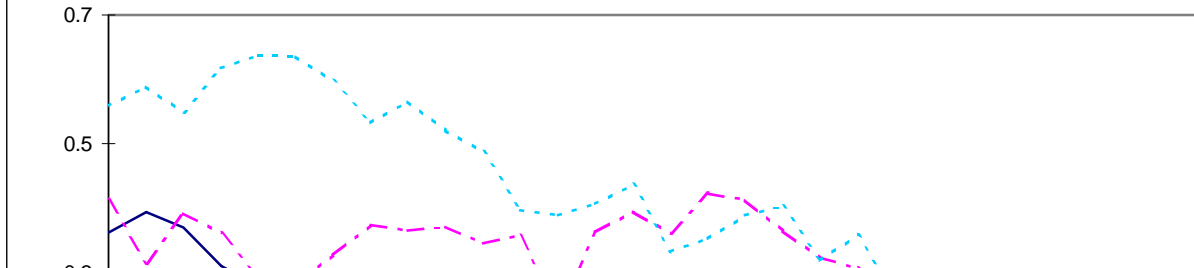


FIGURE 5: U.S. investors' diversification benefit from international investing change in periods of low US returns? Correlation of lowest quarter of US returns for different investment horizons with emerging Asian, Latin American and developed countries



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