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Fatal Attraction:
A New Measure of Contagion

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Abstract

This paper proposes a new measure of contagion that is good at anticipating future vulnerabilities. Building on previous work, it uses correlations of equity markets across countries to measure contagion, but in a departure from previous practice it measures contagion using the relationship of these correlations with distance. Also in contrast to previous work, our test is good at identifying periods of "positive contagion," in which capital flows to emerging markets in a herd-like manner, largely unrelated to fundamentals. Identifying such periods of "fatal attraction" is important as they provide the essential ingredients for subsequent crises and rapid outflows of capital.

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I. INTRODUCTION

The succession of emerging market crises over recent years, including the "Tequila" episode in Mexico in 1995, the Asian crisis of 1997, Russian default of 1998, and the Argentinean collapse in late 2001, has led to intense scrutiny of the causes, mechanics, and consequences of such events.[2] One area of particular interest has been examining contagion between countries, by which we mean a situation in which difficulties in one emerging market lead to herd behavior by investors that creates problems elsewhere in economies whose fundamentals appear sound.[3] This phenomenon appears to have been particularly evident in the Asian crisis, as the devaluation in Thailand rapidly led to a regional crisis that engulfed Indonesia, Korea, Malaysia, and the Philippines.

Several authors have used correlations of movements in financial prices to develop measures of contagion.[4] The logic is that over a period when investors behave in a herd-like manner across a range of economies, equities, exchange rates, and interest rates will react similarly across this group regardless of fundamentals. This approach has been regarded as sufficiently useful to be operationalized even for surveillance purposes.[5] While such an approach appears intuitive, and is straightforward to implement, it is open to a number of concerns. First, it appears to provide a contemporaneous measure of contagion, whereas ideally one would prefer a measure which helped predict it. Second, a rise in correlations could reflect either herd behavior or a change in fundamentals affecting a wide swath of emerging markets. For example, if the crisis in Thailand provided information to investors about potential problems across other emerging markets, the higher correlations would not necessarily reflect herd behavior, in the sense of indiscriminate withdrawal of funds. Recognition of this point has led some to include "fundamental" contagion (based on links such as trade) into the definition. Such a differentiation, however, can cause confusion as it blurs the focus on the central issue, namely the importance of herd-like behavior of investors as opposed to rational responses to changes in fundamentals. Third, on a technical level, larger movements in a series may also tend to create higher correlations, so that such a test may simply be

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[2] See Calvo (2002), Reinhart and Calvo (2000), Dornbusch and others (1995) on sudden stops of capital, and the survey by Flood and Marion (1998) on first- and second-generation crisis models.

[3] See Pericoli and Sbracia (2001) for a survey, as well as Edwards (2000), Eichengreen, Rose, and Wyplosz (1996), Kaminsky, Lizondo, and Reinhart (1998), and Pesenti and Tille (2000).

[4] See King and Wadhwani (1990) for an early exposition of such an approach and Corsetti and others (2000) for a discussion of the methodology.

[5] See IMF (2001, 2000).

identifying periods of turmoil (see Corsetti and others, 2000, 2002). Fourth, these correlations have tended to increase over time, suggesting that they may simply be reflecting increasing globalization in the underlying markets.

This paper suggests a new test to assess the existence of contagion that avoids these difficulties. Our test uses correlations of financial prices, but rather than looking at the *level* of these correlations, it looks at the *relationship* across them and, in particular, how these correlations are related to the distance between nations. The logic, supported by strong evidence, is that distance is closely linked to fundamental linkages across countries, such as trade, institutional structures, and external creditors. More specifically, the test is based on the premise that when investors move from being concerned about fundamentals to herd behavior, the (absolute) value of the coefficient on distance will fall. In short, changes in the coefficient on distance provide a proxy for discrimination across countries by investors on the basis of fundamentals.

Furthermore, since our test focuses on the relationship between correlations rather than their absolute levels, it is not subject to the second and third criticisms noted above and, in practice, also eliminates the trend seen in the levels data. More importantly, as regards the first issue, our test turns out to have strong predictive power about future crises and contagion, as it is surprisingly good at identifying periods of "positive" contagion associated with herd-like *inflows* of capital to emerging markets. The focus of the literature on emerging market crises and contagion to date has been almost exclusively on rapid and indiscriminate outflows of capital from countries.[6] However, as the recent developments in Brazil with limited spillover effects suggest, this is potent only if investors have earlier supplied money into countries with insufficient care—in other words, been lured by the "fatal attraction" of emerging markets—just as the bursting of a stock market bubble requires an earlier period of euphoric price increases. Our results clearly identify two major periods of such positive contagion (i.e., undifferentiated capital inflows), *in the early 1990s before the Tequila crisis* and in *the mid-1990s before the Asia crisis and Russian default*, as well as some increase in the run up to the Argentine default. Being able to identify such positive contagion is clearly an important element in taking steps to avoid the rapid outflows of capital characteristic of crises and "negative" contagion.

The next section presents a brief discussion of the different definitions of contagion in the literature, and how our own test fits into it. In section 3 we discuss the empirical framework; our datasets and econometric estimates are presented in Section 4, and Section 5 concludes.

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[6] The major exception being the intertemporal crisis-models (Calvo and Vegh, 1999, and references therein).

II. Contagion? What is it?

Unfortunately, there is no universally agreed definition of contagion. In this section we present a brief overview of the different measures used in the literature and show how they relate to the issues discussed in this paper.

The type of contagion we are trying to measure is herd behavior by investors. Such behavior is generally modeled as being driven by information (see Calvo, 1999, Calvo and Mendoza, 1999, Kodres and Pritsker, 1999, Pritsker, 2000, and Kumar and Presaud, 2001).[7] The key point in these papers is that in an increasingly globalized, volatile and complex environment, gathering information becomes an increasingly costly activity and this results in investors following other, so-called, informed investors who specialize in a particular country or region. When the informed investors are forced to meet margin calls or are obliged to liquidate their holdings for other portfolio balancing reasons, the uninformed investors interpret this action as a signal of poor returns, leading to herd behavior and information cascades. While this kind of behavior does not necessarily imply that investors are irrational (see Pritsker, 2000), it does imply behavior unrelated to fundamentals. As discussed above, however, we also extend the definition of contagion to herd-like capital inflows (which we call positive contagion) as well as similar outflows (negative contagion).

By contrast, our test is not designed to measure "contagion" through typical real, financial, and political linkages, as these fundamental relationships are captured through the distance and other variables, although it will pick up changes that may occur in crisis situations. The most obvious real linkage is through trade.[8] As the exchange rate depreciates and real output falls in one country, there is downward pressure on exports in neighboring economies through a fall in demand both from the crisis country itself and in third markets where goods from both countries compete. This increases pressure on the external position and, through its impact on domestic incomes, reduces domestic demand. In addition, a crisis in one country may focus investors' attention on other countries with similar trends and general structural similarities and vulnerabilities, often called "common-weakness" contagion.[9] Fundamental financial linkages come from countries having common lenders, and include the impact of a crisis through: loan losses causing banks to withdraw from other emerging markets;[10] the crisis's generating a liquidity crunch in financial intermediaries;[11] and losses in one equity

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[7] However, see also sunspot-equilibria models (Jeanne, 1999).

[8] See Gerlach and Smets (1994), Eichengreen and others (1996), and Glick and Rose (1999).

[9] See Sachs, Tornell, and Velasco (1996) and Eichengreen and others (1996)

[10] See Kaminsky and Reinhart (1999), Caramazza and others (2000), and Pesenti and Tille (2000).

[11] See Goldfajn and Valdés (1995), Calvo (1999), and Pritsker (2000).

markets causing a withdrawal from another.[12] Less work has been devoted to political sources of contagion, but there are some clear examples in the literature.[13]

While such fundamental linkages can lead to difficulties in one country affecting another, it remains unclear to us whether most of these links should be described as contagion. Certainly, from a policy standpoint, it is essential to distinguish between crises that are sparked by informational asymmetries, herd behavior, and portfolio rebalancing considerations (our preferred definition of contagion), where temporary assistance from the international community can avoid temporary liquidity problems, and those that reflect underlying linkages, which are likely to require a more lasting solution.

III. TESTING CONTAGION USING DISTANCE

Distance has been found to be an important and extremely robust factor in a range of economic relationships, most famously through the gravity model of trade, but a similar specification also works for FDI and other asset markets.[14] The gravity model borrows its name from the equation describing the force of gravity in a Newtonian Physics, where the attraction force between two objects is proportional to their mass and inversely proportional to the distance between them. Similarly, trade between two countries can be modeled as an increasing function of the size of the two economies, and a decreasing function of in their cost of transport, measured by their distance.[15]

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[12] See Kaminsky and Reinhart (1999), and Kodres and Prisker (1999), Forbes and Rigobon (1999), and Kumar and others (2002).

[13] Drazen (1999) suggests that political contagion can occur due to the desire of a country to be part of a political and economic union, where the benefit of membership depends on the other members. Once a club member has devalued, the political cost involved in exiting from the system is much lower, inducing a revision of the exchange rate policy in the "home country." Buiter and others (1998) provide another example of political contagion, based on a center-periphery model of monetary cooperation. A negative shock to the center induces a rise in domestic interest rates, which, in turn, induces a revision of exchange rate policy in peripheral countries. If the latter countries decide on full cooperation, this may lead to a generalized devaluation. In contrast, if the periphery threatens to devalue unilaterally, the center may then be forced to relax its monetary policy in order to curb the effects of the potential loss of competitiveness. This, in turn, would reduce the pressure on the peripheral countries and they may avoid the need to devalue. In this kind of model, the spillover of a negative shock to the center country can have a negative or positive impact on peripheral countries, depending on the degree of cooperation.

[14] Loungani, Mody, and Razin (2002).

[15] The gravity model has been often criticized because of the lack of theoretical foundations. Rose (2000) notes ironically that this is one of those cases where attempts have been made to prove that a model works, not only in practice, but also in theory.

When using correlations of asset prices, the mass variables become irrelevant, as there is little reason to believe that such correlations are related to the size of the country. Accordingly, we use only distance in our specification, as a measure of interdependence based on the numerous fundamentals discussed above, and *interpret greater contagion through herd behavior by investors as a fall in the (absolute) value of the coefficient on distance.* Given the focus on the behavior of investors, we use the distance between financial centers.[16]

The model was tested on two panels, containing pair-wise correlations between the log changes of stock prices and real exchange rates, respectively.[17] Both panels are defined for a set of 16 countries comprising: Argentina, Brazil, Chile, Mexico, and Venezuela in Latin America; Indonesia, Korea, Malaysia, the Philippines, and Thailand in Asia; the Czech Republic, Hungary, Poland, Russia, and Turkey in Europe; and South Africa. Due to data availability, the Czech Republic enters the sample in 1993 and Russia enters in 1995. Despite the limited span of data, we regard the inclusion of Russia as offering an important dimension to the analysis as it is the country that is generally identified as starting the wave of contagion in 1998–99. Data are monthly and span the period from October 1991[18] to October 2001 for both panels. We therefore capture key recent financial crises, namely the "Tequila" crisis of 1994-1995, the Asian crisis of 1997–98, the Russia crisis of 1998–99, and the run up to the Argentine crisis in 2001.

The dependent variable in our specification is the upper diagonal matrix of correlations of equity market or real exchange rate returns across all countries in the sample (see the data appendix for more details on all variables discussed here and below). The equity indices are expressed in local currency, and the returns are month-to-month.[19] The correlations are calculated over the last 12 monthly returns for each pair of countries, giving us a matrix of $n(n-1)/2$ pair-wise correlations (120 observations for the full sample).

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[16]Alternative measures of distance include the distance between capital cities, the distance between the most highly populated cities, the distance between the centers of the country, the distance from the equator, in order to interpret distance as a measure of endowment. However, this seems the distance definition appropriate to our analysis.

[17] A third panel, consisting of interest rate correlations, was dropped because it generated few significant results.

[18] This starting date is dictated by the need for a reasonable number of correlations in order to have significant results. Going further back would have reduced the number of correlations and compromised the reliability of the results.

[19] The exchange rate appears on the right-hand side and therefore its effect is controlled for.

The independent variables in our panel regressions include distance, dummies for geographic contiguity and language[20] (standard additions in recent representations of the gravity model), and a vector, Z, of fundamentals, specified below. Hence, the stock-market-returns panel has the following form:

$$\text{Corr}(r_i, r_j)_t = \alpha + \beta(d_{ij}) + \psi_{ij}' Z_{ijt} + D_{\text{contiguity } ij} + D_{\text{language } ij} + \varepsilon_t \tag{1}$$

Where the series of stock returns r_t is computed as the logarithmic monthly change of the stock price, and Z_{ijt} vector of fundamentals (included to control for any interdependence over-and-above that captured by distance):

$$Z_{ijt} = [VAR, \Delta STIR, \Delta IP, \Delta CPI, \Delta EXP, \Delta IMP, \Delta RES, \Delta EX]' \tag{2}$$

Where VAR is the variance of returns, STIR is the short term interest rate, CPI is the consumer price index, IP is industrial production, EXP is exports, IMP is imports, RES are foreign exchange reserves, EX is the nominal exchange rate, expressed as U.S. dollar value for the national currency, and Δ is the annual change.[21]

The real exchange rate regression has the following form:[22]

$$\text{Corr}(\Delta e_i, \Delta e_j)t = \alpha + \beta(d_{ij}) + \psi'_{ij} Z_{ijt} + D_{\text{contiguity } ij} + D_{\text{language } ij} + \varepsilon_t \tag{1'}$$

Where the logarithm of the real exchange rate, e_t, is defined as:

$$e_t = s_t + p_t - p^*_t \tag{3}$$

And s is the U.S. dollar rate per national currency unit, and p and p* are the domestic and foreign consumer price indices, all expressed in logarithms. In contrast to the first panel, the consumer price index is removed from the fundamentals, as it is already in the formulation of the real exchange rate, and stock returns are added as an explanatory variable. Hence, the Z_{ijt} vector for the real exchange rate panel is,

$$Z_{ijt} = [VAR, \Delta STIR, \Delta IP, \Delta CPI, \Delta EXP, \Delta IMP, \Delta RES, \Delta STK]'. \tag{2'}$$

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[20] $D_{\text{Contiguity}}=1$ if the two countries share a common border. $D_{\text{Language}}=1$ if the two countries' populations adopt a common official language.

[21] All of the fundamentals variables, apart from variances and interest rates, are transformed into natural logarithms, and are three-month averages.

[22] While the use of nominal exchange rates might appear desirable, the use of real exchange rates was dictated by the fact that for some subperiods some countries enjoyed spells of fixity in their exchange rate regime, leaving no variability in their nominal rates to compute the correlation coefficients.

These specifications were estimated for each month in a rolling regression of 12 months that allows the coefficients to vary over time, including both the intercept (that measures the "average" correlation) and the coefficient on distance.

IV. RESULTS

Figure 1 illustrates the results from a "standard" measure of contagion, namely the simple average of correlations in changes in equity markets over time, computed using a rolling window of 12 months. To help with interpretation, we also show a measure of overall capital flows to emerging markets as Figure 2, which provides some information as to the role and importance of foreign investors in emerging markets over time. There is a clear upward trend in the average over time, and a corresponding increase in capital flows. Partly as a result, during the early 1990s, the average correlation of equity markets remained at low levels (compared with the entire sample). Indeed, it only rose above the mean value of 0.335 at about the time of the tequila crisis and then falls below the average after the crisis erupted as capital inflows to Latin America were reversed. The average correlation turns up again in late 1996, some time after the postcrisis nadir in capital inflows to emerging markets, and rises both in the run-up to the crisis and as the crisis spreads, reaching its maximum value in late 1999, well after the Russian default. It then falls, but remains relatively high by historical standards, again apparently reflecting the upward trend in the measure. While this measure does illustrate periods of market turmoil, particularly following crises, when the cross-country correlations in equity returns increase, it is far from consistent and is clearly of limited value in anticipating crises. In short, the signaling and predictive aspect of this measure is low; at best, it is a contemporaneous (or even slightly lagging) indicator of contagious behavior.

Figure 3 shows our new measure of contagion, namely the coefficient on distance in a regression on correlations across countries. As expected, the coefficient is significantly negative through most of the sample, and shows no trend. More significantly, the behavior of this measure over time is completely different from the "standard" measure, and appears to provide a useful leading indicator of crises, in part because it identifies periods of large and relatively undifferentiated capital *inflows*.

Three distinct periods can be identified, comprising the run-up and immediate aftermath of the tequila crisis in Mexico, the run-up and immediate aftermath of the Asian crisis/Russian default, and the period since early 2000 (which, in retrospect, was the run-up to the Argentine crisis). In the first period, the coefficient on distance rises steadily during the early 1990s as capital inflows into emerging markets boomed, moving well above the sample means and becoming insignificantly different from zero in late 1993 and early 1994, indicating a period of strong positive contagion. Essentially, this appears to capture the "exuberance" or relatively undifferentiated nature of flows into emerging markets in this period. The coefficient then starts to fall to more normal levels in the run-up to the Tequila crisis as investors became concerned about the situation in Latin America, but continued to invest heavily in Asia, and stays relatively constant in the immediate aftermath.

As the Tequila crisis is resolved, there follows a second period of large capital inflows and positive contagion in late 1995 and early 1996, when the coefficient on distance again rises

markedly above the sample average and becomes insignificantly different from zero. Investors start becoming considerably more concerned about fundamentals from early 1996 up to the Thai crisis, on growing concerns about the situation in both Thailand and the Czech Republic (and their consequences for their respective regions), reaching a nadir just before the Thai crisis. In the aftermath of the Thai default, and as the crisis percolates through Asia and, eventually, Russia, the coefficient on distance rises back close to its average value, and stays there through 1999.

As banks disengaged from emerging market lending in 2000, the coefficient on distance again falls, indicating that investors were again becoming more concerned about differences in fundamentals between countries. As capital flows to emerging markets pick up modestly in 2001, however, the coefficient on distance rises fairly rapidly, although it remains well below the levels seen in late-1993/early-1994 or late-1995/early-1996. This suggests that the positive contagion was more limited, and hence the potential for negative contagion would be lower, as indeed proved to be the case when the Argentine crisis erupted late in 2001.

This analysis highlights several features of the behavior of our measure of contagion. First, and most importantly, it is good at identifying periods of undifferentiated capital inflows to emerging markets (in our terminology, positive contagion). This is the key to its success as a predictor of crises, as such inflows are a necessary (albeit not sufficient) precondition for the undifferentiated outflows normally identified as contagion. Second, these periods of undifferentiated inflows are generally followed by a period in which investors become more sensitive to fundamentals significantly before a crisis occurs. Finally, the test also picks up periods of generalized outflows from a region (negative contagion), as occurred in the wake of the Asia crisis/Russian default.

Thus far, the discussion has focused on the results using, not only distance, but also a number of other fundamentals. It is also of interest to examine how the results are changed if a simpler specification is used in which the other fundamentals are excluded form the regressions. As can be seen in Figure 4, the path of the coefficient on distance in the absence on other measures of fundamentals remains relatively similar to that in Figure 3, with one important exception, namely the period of positive contagion in the early 1990s is less clear. Hence, while the simpler regression provides a useful measure, the more complex regression appears to be a more reliable indicator.

A similar exercise was carried out on the real exchange rate. Looking at the standard measure of contagion (Figure 5), it is notable that the real exchange rates show lower overall correlations compared to the stock indices. The peak correlation, reached in December 2000, is just above 0.16. Other local peaks occur in August 1993 and July 1996, but these are only just over 0.1, while the correlation is close to zero over the remaining sample. This is probably due to the fact that most of the countries in the sample followed (overtly or in a less transparent manner) a managed float, intervening repeatedly in the exchange rate market to stabilize the external value of their currencies. This is reflected in the small variability of their nominal exchange rates and consequently in the low correlations, especially in the earlier part of the sample. The second interesting piece of evidence here is that correlations tend to peak before financial events (July 1997 and August 1998). Again, this probably

reflects the fact that greater exchange rate freedom normally follows the crisis outbreak. For example, after the Thai baht devaluation, we observe a series of devaluations, at least for the countries in our sample. This is confirmed by the fact that the average correlation reaches its peak in the more recent part of the sample, when most of the countries have opted for "free-floating" regimes.[23]

Figure 6 shows the evolution of the "distance" variable (including fundamentals) as a measure of positive or negative contagion using the exchange rate panel. A number of general results are worth commenting on. First, as in the case of the equity - markets panel, distance enters the regressions with the expected negative sign and is generally significantly different from zero. Secondly, the average impact of distance on the real exchange rates correlations is not very different in size from the impact on the stock - market correlations. Again, this seems to support the validity of our approach: it reflects the fact that distance is a good proxy for "fundamental interdependence," separate from the relative variability of other series. Third, and in contrast to the equity - market data, Figure 6 indicates that in the real exchange rate panel movements in the coefficient on distance tend to some extent mimic trends of average correlation. Generally, when correlation increases (decreases), the importance of distance tends to diminish (increase), that is, have a less (more) negative impact. This again probably reflects the switch between fixed and floating exchange rate regimes discussed earlier.

As a check on the robustness of our results, the potential non-linearity due to the bounded nature of the correlation coefficient was investigated. For example, since the correlation coefficient on the left-hand side of our regression is bounded between 1 and -1, it may be that our OLS estimates are biased when the left-hand side reaches more extreme values. In order to address this issue, we transform the correlations using an inverse logit transform, so that our left-hand-side variable can take any value. This was done by transforming the correlation coefficient using the following formula:

$$T\rho = \ln((1 + \rho)/(1 - \rho)).$$

As can be seen in Figure 7, this transformation had very little impact on the path of the coefficient on distance in the equity panel (the same is true for the exchange rate panel, although these results are not reported for the sake of brevity).

V. CONCLUSIONS

This paper has proposed a new measure of susceptibility of emerging markets to crises and contagion. Building on previous work, it uses correlations of financial market prices to measure contagion, but uses a completely different approach to extract the information.

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[23] The Asian crisis first, and the Brazilian *real* collapse later represent the turning point in the attitude of developing countries towards fixed exchange rates (except for Argentina). Still, the low correlation is likely to reflect the effect of foreign exchange intervention.

While earlier work has focused on the level of correlations across countries, our test uses the relationship between correlations and distance, which sidesteps a series of technical difficulties with the conventional approach.

This new test provides important insights into contagion. First and foremost, it is extremely good at identifying periods of "positive contagion," that is to say, periods in which capital has flowed to emerging markets in a herd-like manner, with little differentiation based on fundamentals. Identifying such periods is important as such periods of positive contagion provide the essential ingredients that help to create subsequent crises and rapid herd-like outflows (negative contagion). Just as an equity market bubble can generally only burst if there has been an initial rapid run up in prices leaving valuations out of synch with the fundamentals, crises and contagion generally only occur after a period when investors succumb to the fatal attraction of emerging markets, and provide them with large and relatively undifferentiated capital inflows, unrelated to potential risks. As a result, our test is a useful way of anticipating future vulnerabilities in emerging markets.

In addition, the results from our test indicate that in the run up to a typical crisis, positive contagion peaks somewhat before a crisis occurs, and then there is a period during which investors do become more sensitive to differences in fundamentals across countries, followed by a renewed period of negative contagion after the crisis occurs. This basic pattern is seen in the run up to the Tequila crisis, to the Asian crisis, and in early 2001 as the Argentine crisis started to form.

Creating a measure of contagion with a strong forward-looking element is extremely important for policymakers. As with any human endeavor, it is much easier to deal with a potential problem when one has adequate warning and are able to anticipate and take early steps to prevent it, than to respond as it unfolds. Hopefully, our test will be added to other measures that provide warnings of future crises, and can be used to reduce the likelihood of their occurrence.

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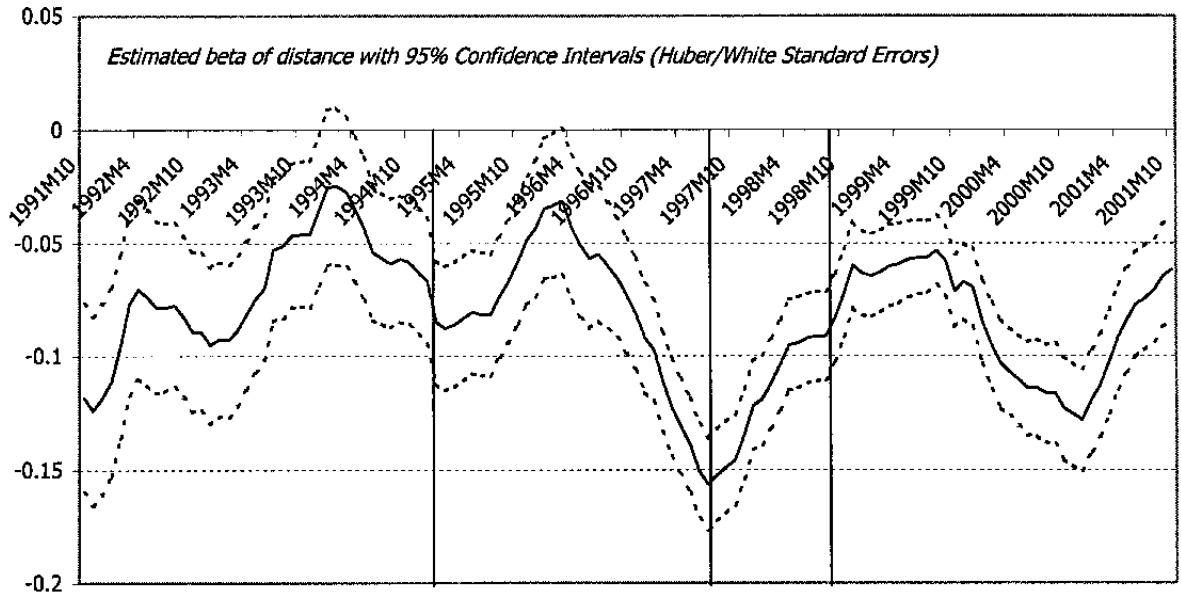
Figure 1. Stock Indices Average Cross-Sectional Correlation Over A 12-Month Window
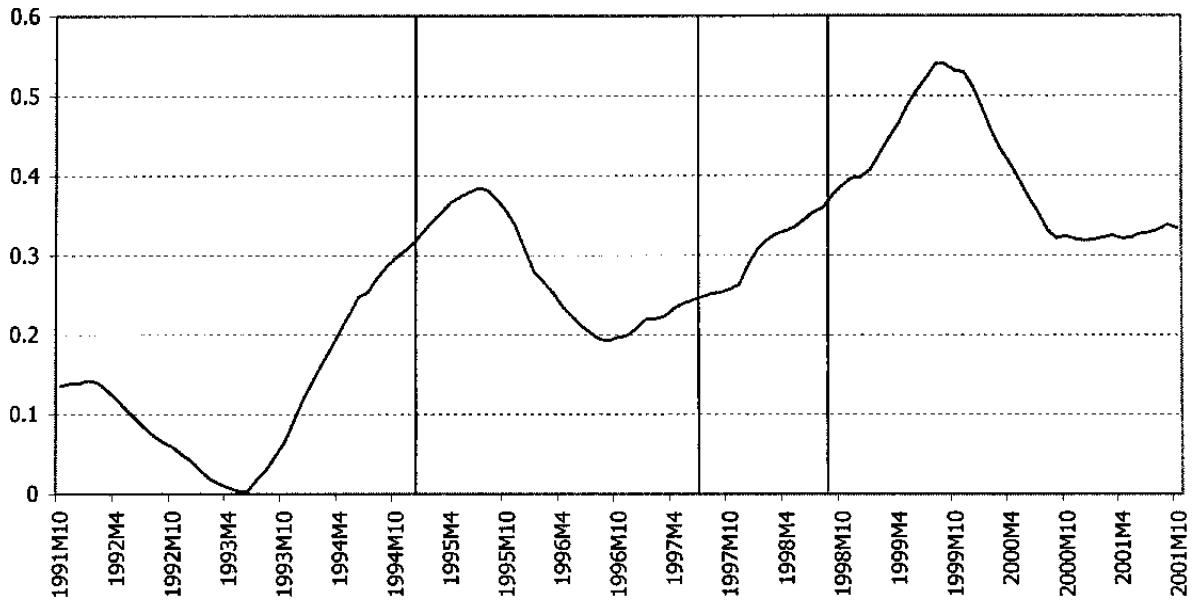
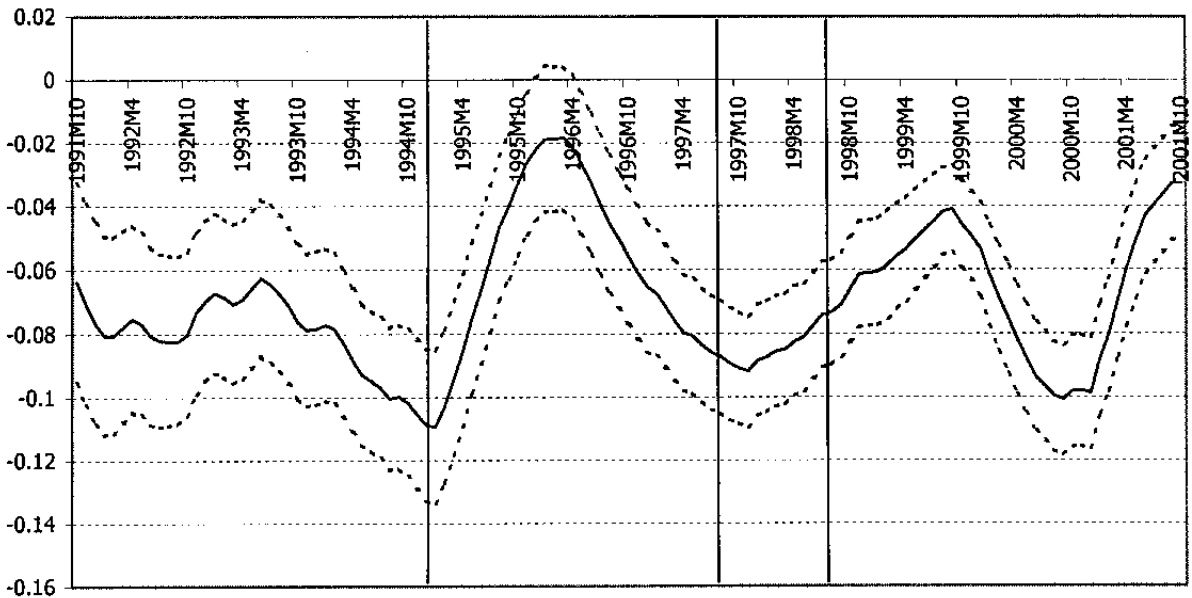**Figure 2. Gross Private Financing Flows to Developing Countries**

(U.S. dollars billions; annualized; three-month moving average)
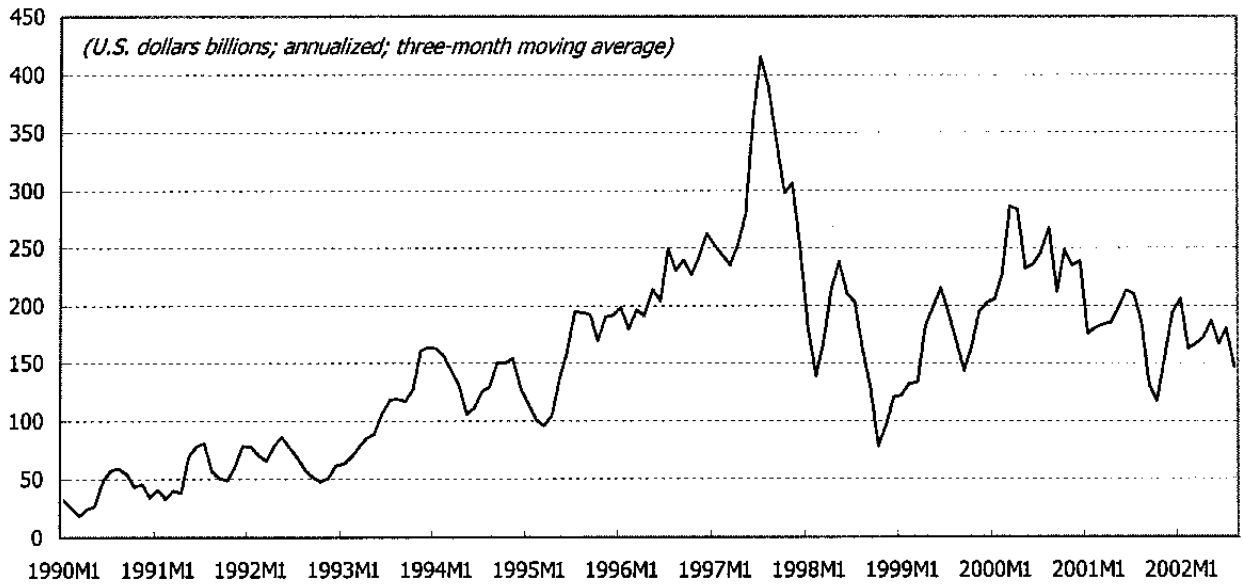
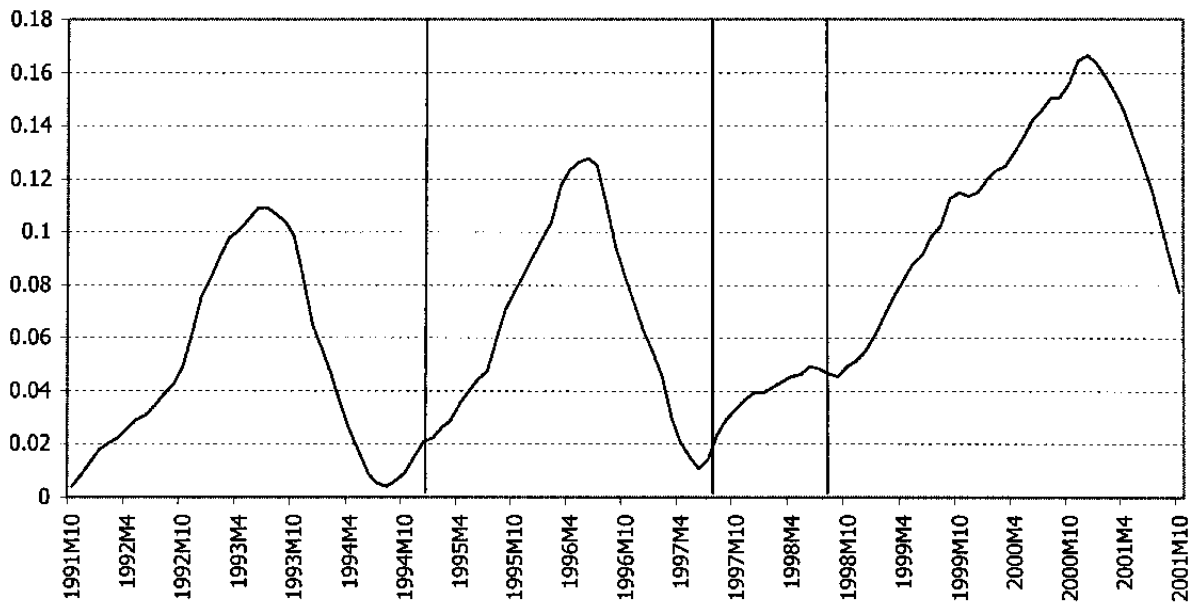## Figure 3. Regressions of Stock Correlations on Distance Plus Full Set of Variables*

Estimated beta of distance with 95% Confidence Intervals (Huber/White Standard Errors)

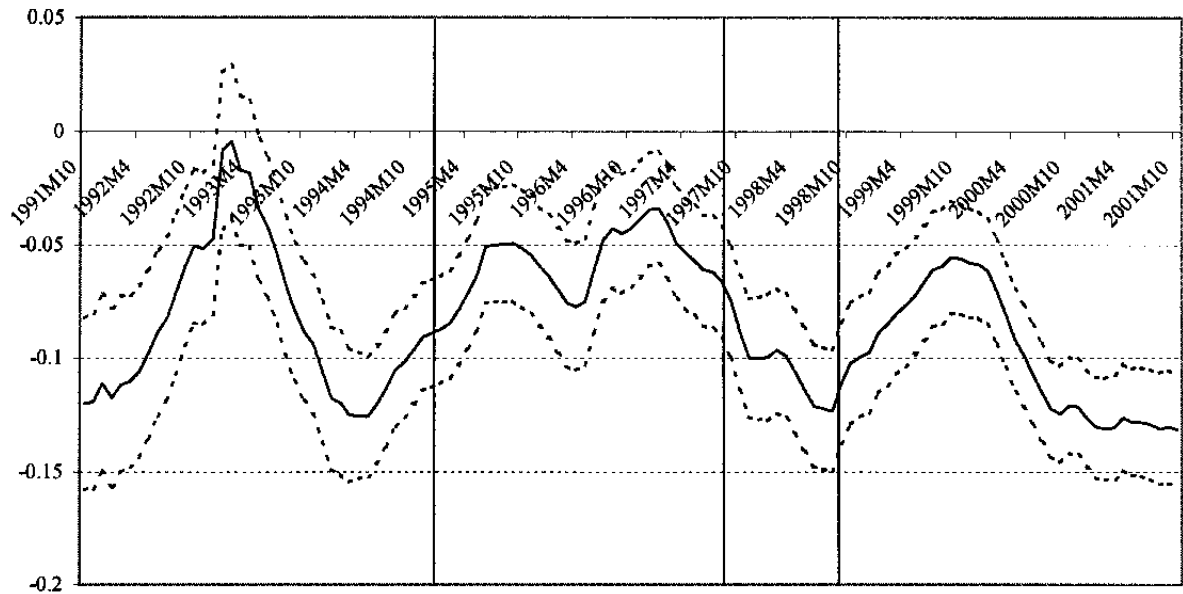## Figure 4. Regressions of Stock Correlations on Distance Only*

Estimated beta of distance with 95% Confidence Intervals (Huber/White Standard Errors)

Figure 5. Real Exchange Rate Average Cross-Sectional Correlation Over a 12-Month Window
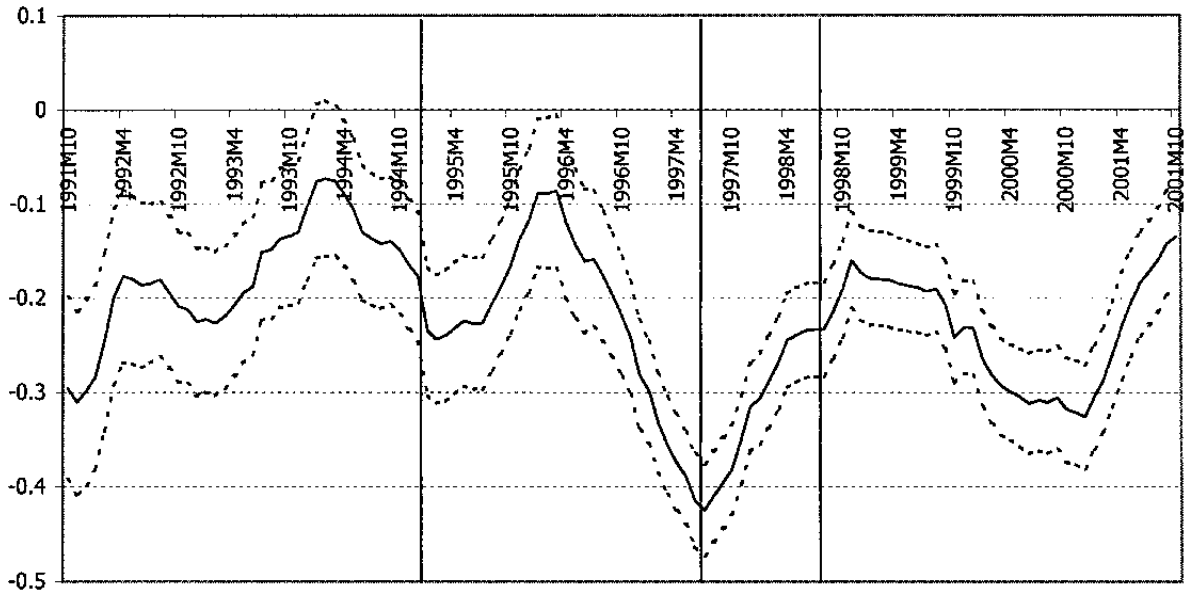

Figure 6. Regressions of RER Correlations on Distance Plus Full Set of Variables*

* Estimated beta of distance with 95% Confidence Intervals (Huber/White Standard Errors)

Figure 7. Regressions of Transformed Stocks Correlations on Distance Plus Full Set of Fundamentals*

Estimated beta of distance with 95% Confidence Intervals (Huber/White Standard Errors)

Data Appendix

Data sources are the IMF International Financial Statistics (IFS) database, the OECD database, statistical national offices and central banks. Missing data have been filled in by integrating information from the different sources.

Left-Hand Side

1.   Stock market indices are taken from Bloomberg and the IFS. They are expressed in national currency value.

2.   Real exchange rates are computed from the US$ value per national currency unit, and the consumer price indices from the IMF-IFS database and national sources.

Right-Hand Side

D_{ij} : distance "as the crow flies" between the two cities where the stock market takes place; taken from the web site: http://www.indo.com/distance. Distance is reported in kilometers, and enters the regressions in its logarithmic form.

VAR: *Variance* of stock returns over the same 12 months of the correlations.

Economic Indicators are all logarithmic changes from the previous year, except for interest rates (which are simple differences):

STIR: *Short-Term Interest Rates*, taken from IFS- IMF database;

CPI: *Consumer Price Index*, taken from line 64 of the IFS-IMF database;

GDP: *Gross Domestic Product*, is line 99b from the IMF-IFS database;

EXP: *Exports*, is line 70 from IMF-IFS database;

IMP: *Imports*, is line 71 from IMF-IFS database;

RES: *Reserves*, is line 1L.D from IMF-IFS database;

EX: end-of-period *Exchange rates* expressed as US$/NCU, taken mostly from IMF-IFS database. Missing data are integrated using different sources:

$D_{Contiguity}$: Dummy taking value 1 if countries share a common border:

$D_{Language}$: Dummy taking value 1 if the two countries adopt the same official language.