International Financial Contagion:

The Theory, Evidence and Policy Implications

Stijn Claessens (University of Amsterdam and World Bank)
and Kristin Forbes (MIT and CEA)

November 15, 2004

Abstract

This paper reviews the analytical and empirical literature on contagion. It begins by discussing how to define contagion, the theoretical evidence on how it might occur, and the empirical literature evaluating its causes during the financial crises of the 1990s. There has been less contagion during recent crises, however, as countries, investors, and the international financial institutions have learned from past experiences and undertaken a number of reforms. Nonetheless, the risk of international financial contagion during future crises still exists. The paper concludes with a discussion of several policy measures for countries, investors, and the international community. Although there is no way to fully insulate countries from crises that occur elsewhere, these steps would reduce the likelihood and intensity of any contagion in the future.

For the Conference 'The IMF´s Role in Emerging Market Economies: Reassessing the Adequacy of its Resources' organized by RBWC, DNB and WEF in Amsterdam on November 18-19. The opinions expressed do not represent those of the World Bank or the U.S. Council of Economic Advisors.

1. Introduction

"*Contagion**: 1. a.** Disease transmission by direct or indirect contact. **b.** A disease that is or may be transmitted by direct or indirect contact; a contagious disease. **c.** The direct cause, such as a bacterium or virus, of a communicable disease. **2.** Psychology: The spread of a behavior pattern, attitude, or emotion from person to person or group to group through suggestion, propaganda, rumor, or imitation. **3.** A harmful, corrupting influence: 'feared that violence on television was a contagion affecting young viewers.' **4.** The tendency to spread, as of a doctrine, influence, or emotional state."*

-American Heritage Dictionary

Before 1997, the term "contagion" usually referred to the spread of a medical disease. A Lexis-Nexis search for contagion before this year finds hundreds of examples in major newspapers, almost none of which refer to turmoil in international financial markets.[1] This changed in July of 1997. A currency crisis in Thailand quickly spread throughout East Asia and then on to Russia and Brazil. Even developed markets in North America and Europe were affected, as the relative prices of financial instruments shifted and caused the collapse of Long-Term Capital Management (LTCM), a large U.S. hedge fund. These global repercussions from what began in the relatively small Thai economy have sparked the widespread use of a new meaning for the term contagion. A Lexis-Nexis search of major newspapers since mid-1997 finds that almost all articles using the term contagion referred to the spread of financial market turmoil across countries. Although concern about contagion has recently declined, the term contagion has become standard language in the vocabulary of international economists and policy makers.

Although analogies comparing the spread of financial crises to the spread of a medical disease can be overdone, this comparison is useful on several levels. As the quote from the dictionary at the top of this paper suggests, contagion incorporates many different ideas and concepts. At one level, contagion is a "disease". The financial crises of the late 1990s that led to sharp contractions in income levels and standards-of-living in many emerging markets were certainly as devastating as many diseases. Contagion also refers to the "transmission" of a disease. As the Thai crisis spread across the globe, it became clear that

[1] The only exceptions are a few articles written directly after the Mexican peso crisis in 1994 and referring to the spread of this crisis to other Latin American countries.

understanding why the original crisis spread was just as important as understanding what prompted the initial events. This definition of contagion also emphasizes that it can occur through "direct or indirect" contact. This has also been a key aspect of the ongoing debate on international financial contagion. Do currency crises spread through direct economic linkages, such as bilateral trade flows? Or do they spread through indirect linkages, such as changes in investor sentiment?

Even the earlier, non-medical definitions of contagion, which the above dictionary definition includes as usages two through four, are highly applicable to turmoil in international financial markets. Some of the leading explanations for financial contagion, especially after the Russian default in 1998, were based on changes in investor "psychology," "attitude," and "behavior". Many countries subject to contagion in the late 1990s, and especially countries with relatively strong fiscal and current account balances, argued that the spread of contagion to their economies was unwarranted given their strong economic fundamentals. Many blamed their subsequent difficulties on the "harmful corrupting influence" of investors in other countries instead of on their own characteristics and policies. Finally, the last dictionary usage of the term contagion, "the tendency to spread," captures the heart of the debate about contagion. Why do local crises spread internationally? Why can an event in a relatively small economy have such pervasive global ramifications? What can be done to limit the spread of crises in the future?

Prior to the East Asian financial crisis, there was relatively little analysis of why country-specific crises could spread internationally. The financial turmoil that quickly spread across Asia and elsewhere, however, focused attention on this issue. The financial crises of the late 1990's seemed different from their precursors and standard theories explaining and predicting crises no longer seemed applicable. Economic models of financial crises had already progressed from first-generation, balance-of-payments models focusing on a country's weak fundamentals to second-generation, multiple-equilibriums models incorporating investors' expectations and governments' policy objectives. Even these second-generation models, however, did not seem to accurately explain the global financial

turmoil in the late 1990s. In particular, these models did not seem to capture contagion and why crises spread across countries.

Despite the surge of interest on contagion after the series of crises in the 1990's, many of the key questions raised above remain unanswered. Moreover, the most recent series of crises in emerging markets (such as in Argentina and Turkey) as well as in developed countries (such as the corporate sector and corporate governance scandals) caused minimal contagion. Has there been a structural change so that we can expect less contagion in the future? Or was this recent period an isolated case and we can expect continued contagion in the future? If so, what can be done about it?

This paper discusses each of these questions. Section two begins by discussing exactly what we mean by contagion and briefly surveys the different theories of how it can occur. Section three discusses the empirical evidence on the existence and causes of contagion. Section four discusses possible causes for the reduction in contagion during recent crises. Section five then discusses different policy measures that could reduce the incidence of contagion in the future: better country policies, better market/investor policies, and changes in global frameworks. Section six concludes.

2. The Definition and Theories of Contagion

Before discussing the potential sources of contagion, it is necessary to clarify exactly how contagion is defined. In the month following the 1998 devaluation of the Russian ruble, the Brazilian stock market fell by over 50 percent. Even without a precise definition, most people would agree that this transmission of a shock from Russia to Brazil was contagion. When the Russian ruble crashed and the Polish zloty depreciated by 11 percent in the same month, however, did this constitute contagion? Or if the U.S. stock market drops by 5% and this has a significant impact on the Canadian market, is this considered contagion?

These sorts of examples show the difficulty in defining contagion.[2] Most people agree that when two economies are located in separate geographic regions, have very different structures, and have virtually no direct linkages through channels such as trade, the propagation of a crisis from one to another is contagion. Some economists have proposed using the more specific term "shift-contagion" to describe this scenario, where shift-contagion is a significant increase in cross-market linkages after a shock to an individual country (or group of countries). On the other hand, there is some disagreement on whether the term contagion applies to the spread of a crisis between two countries that are similar and closely linked. For example, if two countries are located in the same geographic region, with many similarities in terms of market structure and history, and with strong direct linkages through trade and finance, they tend to be closely connected during stable periods as well as crisis periods. Transmission of a large shock during a crisis is just a continuation of the same cross-market linkages or "interdependence" that exists during more tranquil periods. There are mixed views on whether this type of transmission constitutes contagion.

Most policymakers and government officials prefer the broader and more inclusive definition of contagion. The broader definition captures the vulnerability of one country to events that occur in other countries—no matter why that vulnerability occurs or if those linkages exist at all times. Therefore, for the purposes of this paper, we will focus on this broader definition of contagion. At some points, however, it is useful to differentiate between the broader definition of contagion and the narrower definition of shift-contagion. For example, differentiating between these definitions is important when evaluating the effectiveness of interventions and financial assistance packages. More specifically, if one country is affected by a crisis in another country, but this is only a short-term effect and the two countries have few linkages through trade, finance and other channels (i.e., an example of shift-contagion), then a short-term loan to support the country and avoid contagion is more likely to be effective. On the other hand, if the two countries are closely linked through trade or financial flows (the broader definition of contagion), then a crisis in one

[2] See Forbes and Rigobon (2001) and Claessens, Dornbusch and Park (2001) for more detailed discussions of different definitions of contagion.

country would require that the other economy adjusts to this shock, and intervention would only prolong the necessary adjustment (unless other inefficiencies exist).

Focusing on this broader definition of contagion, there are a number of different theories why contagion can occur. This literature can be divided into two broad groups: fundamental causes (including common shocks, trade linkages and certain financial linkages) and investors' behavior (including liquidity problems, incentive problems, informational asymmetries, market coordination problems, and investor reassessment). The remainder of this section briefly summarizes this extensive literature.[3]

Contagion can occur due to a number of different fundamental causes. One type of fundamental cause is a common or global shock (which has also been called a "monsoonal effect").[4] For example, a major economic shift in industrial countries (such as changes in interest rates or currency values), a change in commodity prices, and/or a reduction in global growth can trigger crises and large capital outflows from emerging markets. Any of these common shocks can lead to increased co-movements in asset prices and capital flows.

A second major group of fundamental causes is trade linkages, which include linkages through direct trade and competitive devaluations.[5] A crisis in one country can cause a reduction in income and corresponding reduction in demand for imports, thereby affecting exports, the trade balance, and related economic fundamentals in other economies through direct trade links. Moreover, if a crisis in one country causes its currency to be devalued, this can reduce the relative export competitiveness of other countries that compete in third markets. This effect of "competitive devaluations" can put pressure on the other countries' currencies to depreciate or devalue. A series of competitive devaluations can cause larger currency depreciations than required by the initial deterioration in fundamentals.

[3] For a collection of studies on contagion, see Claessens and Forbes (2001), and especially the survey Claessens, Dornbusch and Park (2001). Also see the surveys Moser (2003) and Forbes (2004).
[4] For theoretical models of common shocks, see Masson (1998) and Calvo et al. (1996).
[5] For a discussion of these trade linkages, see Gerlach and Smets (1995), Eichengreen, Rose and Wyplosz (1996), Glick and Rose (1999), Corsetti, Pesenti, Roubini and Tille (2000), and Forbes (2002).

A final major group of fundamental causes is financial linkages.[6] In a world or region that is highly integrated, a crisis in one country can have direct financing effects on other countries, such as through reductions in trade credit, foreign direct investment, and other capital flows. More specifically, a crisis in one country can reduce the supply of capital from that country, thereby reducing the country's ability to provide bank lending and other forms of investment to a second country. The crisis could also indirectly affect the supply of capital through third parties (as discussed in more detail below). For countries heavily reliant on external funding, a reduction in capital inflows due to this effect can cause a sharp increase in borrowing costs and pressure on a currency to depreciate.

In addition to fundamental causes, the other major group of theories explaining contagion is based on investors' behavior. There is some overlap, however, between theories classified as fundamental causes and investors' behavior. More specifically, if actions of investors are ex-ante individually rational as well as collectively rational, this is often classified as a fundamental cause of contagion (such as through financial linkages). To simplify discussion, however, we group the various theories of contagion based on investor behavior below (even though some could also be classified as fundamental causes). These theories based on investor behavior can be grouped into five broad categories: liquidity problems, incentive problems, informational asymmetries, market coordination problems, and investor reassessment. One theme underlying most of these theories is that although investor behavior is often ex-ante, individually rational, it can still lead to excessive co-movements in market prices, in the sense that market prices are not explained by real fundamentals.

The first group of theories explaining contagion based on investors' behavior focuses on the role of liquidity problems.[7] Losses in one country may induce investors to sell securities in other markets in order to raise cash in anticipation of greater redemptions. Also, if banks experience a marked deterioration in the quality of their loans to one country, these banks may attempt to reduce the overall risk of their loan portfolios by

[6] For a discussion of these financial linkages, see Goldfajn and Valdés (1997) and Van Rijckeghem and Weder (2001).
[7] For examples of this literature, see Valdés (1997) and Kaminsky, Lyons and Schmukler (2001).

reducing their exposure in other high-risk investments, which could include other emerging markets. These liquidity-driven types of behavior are more likely to occur among certain types of investors, including more leveraged investors (such as hedge funds), banks facing margin calls, and open-ended fund managers (who are more likely to need to raise liquidity in anticipation of future redemptions). Faced with liquidity problems, any of these investors are more likely to keep those assets whose prices have already collapsed and where secondary markets have become less liquid, causing them to sell other assets in their portfolios. This behavior can cause asset prices outside of the crisis region to fall, and the original disturbance can spread across different financial instruments, affecting a broad spectrum of markets and borrowers.

A second, and closely related, group of theories explaining how investors' behavior can cause contagion is based on incentive structures and changes in risk aversion.[8] A crisis in one emerging market may induce investors to sell their holdings in other emerging markets in order to maintain certain proportions of a country's or region's stock in their portfolios. Similarly, an increase in risk aversion (which could be caused by a crisis in one country or below-average returns) can cause investors to sell assets in which they are overweight in order to more closely track their benchmarks. If a large number of investors are evaluated based on similar benchmarks or have fixed country portfolio weights, this could lead to large price declines and currency depreciations. Value-at-Risk models, which have recently become more popular and are used by many commercial banks, can cause similar incentives and behavior patterns. These models can explain why banks and other investors may find it optimal to sell many higher-risk assets after a shock to one asset. While individually rational, this type of behavior can lead to adverse aggregate outcomes.

A third set of theories explaining how investors' behavior can cause contagion focuses on informational asymmetries and imperfect information. Investors often do not have a complete picture of the conditions in every country that can affect their portfolios' returns, partly due to the cost of gathering and processing information. In the absence of better information, a financial crisis in one country may lead investors to believe that other

[8] For examples of this literature, see Schinasi and Smith (2001) and Broner, Gelos and Reinhart (2004).

countries could face similar problems. As a result, investors could sell assets in other countries, especially those with similar conditions to those in the country where the crisis originated. This type of behavior can reflect rational as well as irrational behavior. If a crisis reveals weak fundamentals, investors may rationally conclude that similar countries could also face comparable problems, thereby causing contagion.

Further complicating this scenario, investors' behavior may be determined not only by their information (or lack thereof) on countries in their portfolio, but also by information on the actions of other investors.[9] Uninformed investors may find it less costly, and therefore more advantageous, to follow the investment patterns of other, informed investors, thereby generating additional effects from informational asymmetries on investor behavior. This type of herd behavior may not only be an outcome of optimal portfolio diversification, but may also become more common as: the fixed cost of gathering and processing country-specific information increases, the number of countries with investment opportunities grows, and the range of investors widens. Also, with more diverse investors, establishing individual reputations becomes more costly, making it more likely that investors will follow the herd. Herd behavior is likely to be more prevalent when investors, such as fund managers, are evaluated based on the performance of their portfolios relative to that of a specific index rather than absolute performance.

A fourth group of theories explaining contagion based on investors' behavior focuses on market coordination problems.[10] Investors' can modify their behavior based on self-fulfilling expectations that can generate multiple equilibria. More specifically, investors could suddenly withdraw from a country if they fear that they will otherwise be left with no claim on a limited pool of foreign exchange reserves, similar to what can occur during a bank run. Some analysts believe that these types of sudden shifts in market confidence and expectations are one of the most important factors causing contagion. In some cases, however, it is difficult to differentiate this cause of contagion from a fundamental cause of contagion, because a jump in investor expectations causing a shift between equilibria could

[9] For examples of this literature, see Calvo and Mendoza (1998) and Agénor and Aizenman (1998).
[10] For examples of this literature, see Jeanne (1997), Masson (1998), and Chang and Majnoni (2001).

be triggered by many factors, including fundamentals. It is worth noting that these changes in investor behavior based on market coordination problems involve behavior that is individually rational, but nevertheless increases financial volatility and can yield sub-optimal outcomes.

A final group of theories explaining how investors' behavior can cause contagion is based on investors' reassessment of the rules under which international financing takes place. This could reflect increased concern that countries might follow unilateral, confrontational policies regarding foreign private creditors. This could also reflect increased concern that international financial institutions are less likely to assist countries with financial difficulties, either due to a change in policy or a limited supply of funds. For example, if the international financial institutions lent to one country during a crisis, this could trigger a run on other countries based on the fear that there will be insufficient funds available to support these other countries during a crisis. A reassessment based on any of these factors could cause investors to sell a range of assets outside of the original crisis country, thereby causing contagion.

3. The Empirical Evidence on Contagion

The financial crises of the late 1990s prompted extensive empirical research on contagion. Some of this empirical research focuses on examining comovements in asset prices around the time of crises. Other research focuses on testing specific channels of contagion—such as through trade linkages or through changes in investor behavior. To simplify discussion, we divide this literature into five broad testing frameworks: asset price correlations, conditional probabilities of currency crises, changes in volatility, extreme moments, and tests for individual channels of contagion.[11]

[11] See Claessens, Dornbusch and Park (2001), Forbes and Rigobon (2001), and Moser (2003) for more complete surveys of this empirical literature.

One of the most popular frameworks to test for contagion is to examine changes in the correlation coefficients for interest rates, stock prices, and sovereign spreads across different economies.[12] Most of these tests define contagion as a significant increase in cross-market correlations, thereby focusing on the more narrow definition of "shift-contagion." Most studies using this framework find evidence of large comovements in a variety of asset returns around crisis periods, although there is less consensus on whether such comovements increase after a crisis. More specifically, this literature finds mixed evidence that asset market comovements increased in Latin America during the Mexican crisis in 1994. Other studies find that cross-country correlations among currencies and sovereign spreads of several Asian countries increased significantly during the East Asian crisis period (July 1997 to May 1998) when compared to other periods—indicating the presence of contagion.

An increase in cross-market correlations or comovements around crises, however, may not necessarily indicate contagion due to econometric problems with heteroskedasticity, omitted variables, and endogeneity.[13] More specifically, heteroskedasticity in asset price movements (which is likely because volatility tends to increase during crises) can cause estimated cross-market correlations to increase after a crisis, even though there is no increase in the underlying correlations. Similarly, changes in omitted variables (such as economic fundamentals, risk perception, and preferences) can cause an increase in asset price correlations, even when contagion is not present. It is also difficult to control for any endogeneity or feedback effects when estimating the effect of a crisis in one country on another. In order to adjust for these problems with heteroskedasticity, omitted variables and endogeneity in estimates of contagion, it is necessary to make more restrictive identifying assumptions. Different papers have used several different assumptions to resolve these problems. Their findings are mixed, with some finding almost no evidence of shift-contagion during recent crises, while others find some evidence of contagion. All of

[12] For an earlier example of this literature, see Baig and Goldfajn (1999). For a more recent and sophisticated application of this framework, see Bekaert and Harvey (2003).

[13] For more detailed discussions of these econometric problems and possible solutions, see Forbes and Rigobon (2002), Rigobon (2002), Boyer, Gibson and Loretan (1997), and Corsetti, Pericoli and Sbracia (2004).

these papers, however, find less evidence of contagion than in work that does not attempt to address these econometric issues.

A second, and closely related, approach to test for contagion is to control for the role of certain fundamentals when measuring market comovement or the probability of a crisis, thereby focusing on conditional correlations or probabilities rather than raw correlations.[14] The most common methodology for these tests is to examine whether the likelihood of a crisis in a given country is higher when there is another crisis in a "ground-zero" country or several countries. In other words, this methodology estimates the probability of a crisis conditional on information of the occurrence of a crisis elsewhere, taking into account fundamentals or other similarities. Results generally suggest that: the probability of a domestic currency crisis increases with a financial crisis elsewhere, contagion is more likely to spread through trade linkages than through macroeconomic similarities, and contagion tends to be regional rather than global (which is not surprising based on the earlier result on the importance of trade, since trade tends to be more intra-regional than inter-regional). These studies also suggest that the Mexican crisis was the least contagious of recent crises, while the Asian crisis was more contagious (and possibly as contagious as the 1980s debt crisis). These studies also suggest that both the composition of debt and exchange rate flexibility limit the extent of contagion, whereas capital controls do not appear to reduce it. Studies focusing on longer time horizons also find no solid evidence that contagion has been increasing over the past 120 years.

A third strategy of testing for contagion is to estimate spillovers in volatility, i.e., cross-market movements in the second moments of asset prices.[15] Studies using this approach have found evidence of contagion, but often from one specific country to another, and not as a general proposition. Most of these studies also do not adequately address problems with heteroskedasticity and omitted variable bias.

[14] For examples of this literature, see Eichengreen, Rose and Wyplosz (1996), Sachs, Tornell and Velasco (1996), Kaminsky and Reinhart (2000), Bordo and Murshid (2001), De Gregorio and Valdés (2001), Gelos and Sahay (2001) and Forbes (2002).
[15] For examples of this literature, see Edwards (1998) and Park and Song (2001).

A fourth strategy involves focusing on extreme moments in asset price data and measuring whether country comovements increase during these periods.[16] Extreme moments are periods when realizations of certain variables exceed a large threshold value. Only a few studies have used this approach, but they have generally found evidence of contagion during some of the crises of the 1990s, especially the Russian crisis. These studies also find more evidence of contagion during periods of extreme negative returns, as compared to periods of extreme positive returns. One shortcoming of this approach, however, is that the sample of extreme moments is very small.

A final method of testing for contagion is to focus on measuring the importance of individual channels through which contagion might occur, rather than focusing on changes in aggregate volatility or correlations. This strategy provides more insight on exactly why a crisis in one country affects other countries, and has recently been the most popular approach used in academic studies. Some of the most recent work in this area has also used firm-level data to examine the exact channels through which crises spread.[17] Since many cross-country linkages through trade and financial channels are highly correlated, focusing on microeconomic data permits a more concise identification of the various channels through which contagion can occur.

This series of papers focusing on the specific channels of contagion have yielded a variety of results. Several studies focus on the role of trade linkages and generally find strong evidence that direct trade and competition in third markets are important determinants of how crises spread.[18] Other studies have focused on capital flows through banks and portfolio investment.[19] These studies have also found evidence that direct financial linkages and competition for funds from common bank lenders (also called a common-

[16] For examples of this literature, see Chan-Lau, Mathieson, and Yao (2004) and Hartmann, Straetmans, and de Vries (2001).
[17] See Forbes (2004) for an example of this approach.
[18] For an example and more detailed overview of this literature, see Forbes (2002). For additional evidence, see Eichengreen, Wyplosz and Rose (1996) and Ito and Hashimoto (2002).
[19] For examples and more detailed overviews of this literature, see Peek and Rosengreen (1997), Van Rijckeghem and Weder (2001), and Caramazza, Ricci, and Salgado (2003). Also see Fratzscher (2002), which finds that financial interdependence and real integration are both important in explaining the transmission of crises.

creditor channel) can predict the incidence of contagion and crises. A closely related set of studies examines the role of investor behavior.[20] These papers have found strong evidence of investor trend following, as well as of contagion occurring through the actions of portfolio investors (especially emerging-market funds). Therefore, the empirical literature analyzing specific channels of contagion finds evidence that contagion has occurred through a wide variety of mechanisms during recent crises.

4. Minimal Contagion During Recent Crises

Although this extensive literature using a range of methodologies has found evidence of contagion during the financial crises of the 1990's, there is little evidence of contagion during recent crises. More specifically, the Argentine crisis in 2001/2002 and Turkish crisis in 2001 appear to have had little impact on other countries. The deterioration in Argentina in mid-2001 initially did have some effect on borrowing costs of neighboring countries, but these effects were relatively small and short-lived. The crisis in Argentina also had some effect on Uruguay, as Argentine citizens withdrew bank deposits from Uruguay's banking system, but spillovers to other countries in the region, and especially countries outside the region, were minimal. The crisis in Turkey had even less effect on other emerging markets.

There are several possible explanations for this reduction in contagion during recent crises. First, investors retrenched from many emerging markets after the series of crises in the late 1990s, causing significant changes in the countries' international financial structures. In particular, commercial banks substantially reduced their volume of short-term loans to emerging markets, reducing the risks from banks withdrawing their credit during future crises. Portfolio investors also substantially reduced their exposure to emerging markets, although this exposure has increased again over the past two years.

[20] For examples of this literature, see Froot, O'Connell and Seasholes (1999), Kaminsky and Schmukler (2001), and Broner, Gelos and Reinhart (2004).

Second, investors have learned from the series of crises in the 1990's, improving their approach to risk analysis and becoming more adept at differentiating amongst emerging markets. More specifically, investors appear to be better at discriminating between emerging markets based on individual country characteristics, instead of treating emerging markets as one comparable group or treating all countries in one region as a group. This ability to better discriminate amongst countries has been facilitated by improved information on countries and their policies. It is unclear, however, whether this improved discrimination will continue. Investors are often criticized for having "short-memories," a claim supported by the recent increases in correlations among emerging markets. Increased correlations, however, could also reflect the improvement in the global economic environment (such as strong global growth, high commodity prices, and low interest rates in developed economies), and not a reduction in investor discrimination.

A third explanation for the reduction in contagion during recent crises is that investors, international financial institutions and governments have become more adept at predicting which countries are likely to experience a crisis, and therefore less likely to be taken by surprise.[21] One of the key factors causing contagion may be if investors do not expect a crisis to occur, they are more likely to suddenly adjust behavior patterns and cause contagion—such as suddenly selling assets in other markets to cover losses or reassessing risks in similar countries. The Asian and Russian crises were generally viewed as a surprise, but the Argentine and Turkish crises were often considered as a matter of "when, not if". Several investment banks, the International Monetary Fund, and government agencies have invested in building "early-warning models" to better predict which countries are more likely to experience crises. Although these models are far from perfect and often tend to overpredict the occurrence of crises, simply developing these models and monitoring changes in model predictions may make investors more aware of risks in individual countries, and thereby less prone to the surprises that can generate contagion.

A final, but very important reason why there may have been less contagion during recent crises is that some emerging markets have undertaken reforms to improve their economic

[21] For discussions of the role of "surprise" in causing contagion, see Kaminsky, Reinhart and Vegh (2003) and Rigobon (2003).

fundamentals, thereby reducing their vulnerability to crises. More specifically, many emerging markets now have more flexible exchange rates, lower rates of inflation, more responsible fiscal policies, and higher reserve levels. Furthermore, many emerging markets have undertaken structural reforms, aimed in part at strengthening their financial and corporate sectors. This combination of policies has strengthened their economies and reduced their vulnerability to shocks originating elsewhere. Particularly important may be that many emerging markets now have current account surpluses—instead of deficits—so they are less reliant on external funding and therefore less affected by changes in investor sentiment. A series of studies have shown that countries with weak fundamentals are more likely to experience a financial crisis, and therefore it is not surprising that the improvement in economic fundamentals in many countries has made them less likely to experience a crisis that originates from problems elsewhere in the world.

5. Policy measures to deal with possible contagion

In spite of the reduction in contagion during recent crises, policymakers and government officials should not become complacent. Risks from contagion in international financial markets still remain, especially for developing countries. If a large country experiences a crisis, it will inevitably spill over to other countries through trade, financial markets, and the other cross-country linkages discussed above. As financial integration continues to increase around the world, this will tend to link countries closer together through periods of strength as well as weakness. Furthermore, even without crises, international financial markets will remain volatile. Therefore, government officials, investors, and policymakers should continue to take steps to strengthen individual economies and the international financial system in order to reduce the risks from contagion in the future. These steps can be classified into three broad categories: better country policies, improved investor strategies, and stronger global frameworks.

a. Better country policies

The most important means of reducing contagion and minimizing the effects of future financial crises is to strengthen individual country policies. Countries with stronger

macroeconomic frameworks, and especially with sustainable debt burdens, flexible exchange rates and labor markets, and strong financial systems, are less vulnerable to shocks originating in neighboring countries or the global economy. Recent empirical analysis also shows that stronger institutions reduce country vulnerability.[22] Over the past few years, important steps have been taken in many areas, although further improvement would still benefit most countries. Several country policies that have recently been emphasized and pursued in order to strengthen economies and reduce vulnerability to crises and contagion include: strengthening financial systems, improving fiscal and debt management, facilitating foreign investment (especially in financial systems), and improving prudential regulations on domestic investment. One policy that has less clear benefits, and potentially significant costs, is taxes on short-term capital inflows.

Weak financial systems were an important factor contributing to several crises in the 1990s. As a result, improving the regulation, supervision, and functioning of financial systems has received a substantial amount of attention since the crises of the 1990s. Global standards have developed in many areas. Many countries have undertaken significant steps to strengthen their financial systems. A review of the quality of financial systems is now a regular part of the international surveillance process, including through the joint World Bank-IMF Financial Sector Assessment Program (FSAP). This review includes "stress tests" to evaluate the ability of the financial system to withstand shocks originating in other countries. Moreover, part of strengthening financial systems involves strengthening the corporate sector and the ability of banks to collect on defaulted loans. Many countries have also taken important steps to improve their bankruptcy systems and corporate governance. This has included providing better information on corporate accounts, which in turn helps banks and investors make more informed decisions.

Better fiscal management, and especially better debt management, has also received substantial attention since the 1990's and can reduce the risk of contagion. Many countries have reduced their fiscal deficits and lengthened the maturity of their debt payments. Nonetheless, countries still face substantial challenges managing their debt burdens,

[22] For example, see Johnson, Boone Breach, and Friedman (2000).

especially as their ability to issue local currency debt remains limited and much debt still has floating interest rates and short maturities. As a result, debt burdens that appear to be manageable can quickly become unsustainable when market sentiment shifts (triggered through increased interest rates or currency movements). Countries should continue to attempt to manage debt burdens to levels that would be sustainable even in adverse economic scenarios as well as to reduce their reliance on foreign currency debt, floating interest rate debt, and exchange rate linked debt.

Another area in which many countries have made substantial progress in improving their ability to withstand shocks is by reducing restrictions on foreign investment, especially in the banking system. These steps have facilitated the entry of foreign banks, other financial institutions, and other forms of direct investment. In several Latin American and Central and Eastern European countries, foreign banks now represent more than half of the local banking system. Foreign banks help mitigate the effects of external shocks, since foreign banks are generally better capitalized, have improved risk management techniques, and have greater access to international financial markets during periods of stress. Investment by foreign multinationals has also been shown to reduce macroeconomic volatility, since multinational companies can borrow using internal financial markets and therefore can continue to expand investment during crises even when local companies tend to be financially constrained.[23] Due to these benefits, emerging markets should continue to welcome foreign investment in their economies, especially in their banking systems.

Closely related to reducing restrictions on foreign investment, many countries have also reduced restrictions and improved prudential and other regulations on investment by domestic citizens and investors. For example, several countries have allowed local pension funds to invest more freely abroad. Other countries have facilitated more private-to-private forms of risk sharing, including through removing regulatory barriers to allow a greater use of international risk management markets. All of these steps can reduce vulnerabilities to domestic events and strengthen the financial positions of domestic companies. Despite these benefits, substantial risks still remain for emerging markets, especially for those with

[23] See Desai, Foley and Forbes (2004).

weak institutional capacities. In these cases, it can be useful to maintain some prudential regulations, such as limiting foreign exchange exposures in the banking system to a certain fraction of capital. Similarly, due to the macroeconomic vulnerabilities from excessive foreign exchange borrowing by corporations, it may be useful to enact prudential regulations on corporate borrowing in offshore markets, and to review regulations such as the tax deductibility of interest payments on foreign exchange borrowings.

One closely related proposal is to impose a tax on short-term capital inflows, such as the *encaje* adopted by Chile from 1991-98. This policy has recently received fairly widespread support, so the evidence on the effectiveness of this policy merits some discussion here. In short, the effects of this policy are poorly understood and the empirical evidence available to date suggests that this type of capital control has yielded minimal benefits, but has substantial costs.

The Chilean *encaje* is generally viewed as the most successful application of this type of tax on capital inflows and there are a large number of studies—almost a whole literature—assessing the macroeconomic effects of this policy.[24] These studies use a range of strategies and reach several general conclusions (albeit some differences exist across papers). First, although the primary goal of the *encaje* was to moderate the appreciation of the Chilean peso in order to maintain competitive export prices, there is no evidence that the *encaje* affected the exchange rate. Second, there is little evidence that the capital controls protected Chile from the shocks emanating from other emerging markets during the Mexican, Asian, Russian, and Brazilian crises. Third, there is some evidence that the *encaje* did not significantly affect the total volume of capital inflows, but did shift the composition of capital inflows to longer maturities. Finally, there is some evidence that the *encaje* raised domestic interest rates by creating a wedge between domestic and foreign interest rates (although there is no agreement on whether this was a short- or long-run effect).

[24] For surveys of the empirical work on this subject, see Simone and Sorsa (1999) and Forbes (2003).

Of course, all of these results are subject to the caveat that it is extremely difficult to construct the counterfactual of what the Chilean exchange rate, capital inflows or interest rates would have been without the capital controls. But even ignoring this problem, these results suggest that—at best—the benefits of the *encaje* were to slightly raise interest rates and lengthen the maturity of capital inflows. There is little evidence that the *encaje* reduced Chile's vulnerability to crises or increased its growth rate. Although the period from 1991 to 1998 was a period of strong economic performance in Chile with no financial crises, this undoubtedly resulted from the package of sound economic policies enacted by the Chilean government—such as strengthening its banking system, liberalizing trade, supporting privatization, increasing exchange rate flexibility, maintaining low inflation rates, and running sound fiscal policies.

Moreover, there is evidence that the *encaje* had substantial costs and created a number of economic distortions for Chilean companies.[25] For example, immediately after the *encaje* was enacted, many firms chose to cross-list their stocks in the United States as ADRs (to avoid paying the tax). This may have slowed the development of the Chilean stock market. Potentially even more important, the *encaje* significantly increased financial constraints for smaller, publicly-traded companies (but not for larger firms). The *encaje* also forced firms to change their financial structures in other ways to avoid the tax. All of this behavior to avoid the tax on capital inflows created a deadweight loss, and this inefficient allocation of capital and resources undoubtedly reduced productivity and growth. Therefore, even the Chilean experience with taxes on short-term capital inflows—arguably the most successful case to-date—suggests that this tax had substantial costs, with minimal benefits. Countries considering enacting a similar type of tax should proceed cautiously, especially since the disproportionate burden of the tax appears to fall on smaller firms, and small and new firms are often important sources of job creation and economic growth in emerging markets.

[25] For a discussion of these costs, see Forbes (2003) and Gallego and Hernández (2003).

b. Improved market/investor strategies

As discussed briefly above, investors and international agencies have dedicated more resources to assessing risks in emerging markets. Investors are not only more aware of the risks, but have developed a number of new and more sophisticated methods of monitoring country vulnerabilities, such as the use of "early-warning system" (EWS) models. Although these models can only be expected to have limited success in predicting future crises—especially if future crises are caused by different factors than in the past—this increased monitoring and attention to emerging market statistics should reduce the chance of surprises in the future (albeit not eliminate it). Investors also appear to use increased information available on emerging markets to better differentiate risks across countries. Investors have become more sophisticated at managing risks, such as through the greater use of tools such as VAR modeling. Finally, improved capital adequacy among commercial banks in many lending countries has facilitated the ability of investors to absorb shocks and thereby reduced the risks of contagion.

Although all of these steps, and especially the increased use of new tools and risk-assessment models, can reduce risks for individual financial institutions, it is worth noting that they can also create new types of risks. More specifically, the use of similar models by a number of institutions can increase the risk of contagion by causing the institutions to all behave similarly after a crisis in one country. For example, a decline in asset values for one country may trigger sell-offs in other countries when many lenders adjust their portfolios simultaneously. Furthermore, as the complexity of international financial markets continues to increase, the risk of unexpected events triggered by complex and unforeseen interactions among market participants and between markets is more likely to occur. The risks of unknown interactions among cash, derivatives and other markets have already increased interests by policy makers in assuring more robust settlement and counterpart systems, especially across borders. It is unclear if the steps taken to date are comprehensive enough, and further analysis of these sorts of risks is underway, but some caution would be useful.

c. Stronger global frameworks

Although individual countries and investors have taken steps to reduce the risks from contagion, or at least to make the risks more transparent, the risks still remain and further action at the international level is important. In particular, steps at the global level could involve four areas: improved information on countries' policies and institutional environment, enhanced risk management and better forms of private risk sharing, changes to international financing facilities, and an improved framework for sovereign-debt restructuring.

The first area in which steps could be taken at the global level to reduce contagion is better information on countries' policies and institutional environments. Granted, significant progress has already been made in improving information, especially in terms of ex-ante measures. For example, closer coordination between international agencies has generated better information on countries' macroeconomic policies, external debt situations, and financial policies. In particular, assessments of countries' structural policies have substantially improved under the World Bank and International Monetary Fund's FSAPs and other Reports on Standards and Codes (ROSCs). IMF surveillance has improved its assessment of vulnerabilities in various dimensions (such as the banking system, debt sustainability, and corporate sector). Augmenting these improvements is the increased frankness of discussions and the greater public disclosure of related documents. Publications such as the IMF's Global Financial Stability Report have also improved public information.

Despite these substantial improvements in information and data availability, the international financial institutions can still have difficulty disclosing some information and expressing negative views on individual country's risks. The international institutions, by their very cooperative nature, cannot release certain documents publicly without country approval. One possible step to alleviate this problem and to further improve information availability is to require that all country analyses performed by the international financial institutions are released publicly. At the very least, this should be required for standard country reviews, such as the Article IV evaluation performed by the IMF annually for each country. Granted, required disclosure of country analyses may make countries more

reluctant to share certain information. Moreover, a negative report by the international institutions could, in some scenarios, raise investor concern and prompt selling that in turn causes a crisis. History shows, however, that this information tends to become public at some point regardless, and early disclosure could therefore be more likely to lessen the impact of a crisis and generate steps to reduce a country's vulnerability before a crisis occurs.

A second area in which the global community could reduce the chance of contagion is through improved risk management tools.[26] For developed countries and creditworthy financial institutions and corporations, risk management tools have been available for several decades to deal with a variety of scenarios. The introduction of many new derivatives over the past two decades has further improved the spectrum of risk management tools and their ease of use. Moreover, developed countries have the ability to use monetary and fiscal policy in order to smooth shocks and reduce output fluctuations. In contrast, risk management tools are much more limited for most developing countries, largely because the supply of tools specifically designed for their situations is inadequate. Moreover, most emerging markets are unable to effectively use monetary or fiscal policy to smooth shocks and reduce output fluctuations. Instead, emerging markets and developing countries are often forced to rely on borrowing and lending in international markets to attempt to smooth fluctuations. High external debt burdens and the procyclical pattern of capital flows to emerging markets, however, often limits the ability of countries to borrow during periods of large adverse shocks (and possibly makes it too easy to borrow during periods of favorable shocks).

Emerging markets have attempted to address this problem and develop risk management tools, but they have had limited success. For example, some countries have established contingent credit lines from private sector commercial banks and other financial institutions. The amount of financing available through these channels remains limited, however, and the availability of the resources during a crisis is not assured since the credit lines generally include contingencies (such as force majeure). Countries have also tried to

[26] See Claessens (2004) for a more in-depth discussion of the issues concerning risk management by developing countries.

use existing hedging instruments (such as short-dated futures and options, and collateralized swaps), which should not raise concerns about credit risk and should, in principle, be available to countries of all credit-standings. These instruments, however, have limited hedging potential since their maturities are shorter and they require the ability to raise cash on short notice. Some countries have also used commodity hedging, but these often are not available with the appropriate price index.

Moreover, a number of characteristics of emerging markets have limited the development and attractiveness of these different hedging mechanisms. Since the market for most hedging instruments for emerging markets is undeveloped and relatively illiquid, this raises the cost of the mechanisms and investors often require collateral and additional commitment fees, all of which reduce their attractiveness. Also, when emerging markets use any of these hedging tools, they can sometimes be interpreted as sending adverse signals on the creditworthiness of the country—especially if data is limited or of poor quality. Moreover, the lack of mechanisms to enforce claims and the absence of formal seniority and bankruptcy rules at the sovereign level limits the ability and willingness of international financial markets to provide the right forms of external financing, including risk management tools. This concern is particularly important in hindering the development of longer-dated derivatives instruments, which can also be more tailored to the specific circumstances of countries (such as swaps and other OTC products).

On a more positive note, there has recently been increased interest in some specific types of hedging instruments—especially those related to catastrophes, weather fluctuations and growth. The World Bank has recently supported the development of "cat" (catastrophe) bonds. A few countries and states, including California and Japan, have issued earthquake bonds. Instruments indexed to rainfall and temperature have been used on a small scale. There have recently been a number of more exotic suggestions to expand hedging based on a range of variables (such as the Shiller macro-type hedges or the Merton country swaps), although these have not been adopted yet, even in developed countries.

The risk management instrument which has recently received the most attention is a proposal to link payments on sovereign debt to an issuing country's rate of GDP growth (or possibly industrial production growth) through "growth-indexed bonds" (GIBs).[27] Although growth-indexed bonds and related instruments have been discussed intermittently for years, they have recently received increased attention, such as in the declaration of the Summit of the Americas, in the "Cuzco Proposals" of the Rio Group of Latin American countries, and in a G-7 working group. Argentina is also considering offering a bond with payments linked to growth as part of its current debt restructuring. Growth-indexed bonds would reduce aggregate economic volatility and stabilize government resources, reducing the need for spending cuts when growth is slow and restraining new spending when growth is rapid. By stabilizing debt payments, growth-indexed bonds could reduce the chance of crises. Growth-indexed bonds would also be particularly advantageous for emerging markets since they could address a number of diverse risks that affect growth—from natural disasters, to falling prices for key commodity exports, to slower growth in major export markets—without having to hedge against each risk individually.

Despite this recent interest in growth-indexed bonds, the development of this hedging instrument has been limited due a number of coordination and technical issues. For example, there is concern about the timeliness and reliability of growth statistics, as well as the difficulty of starting a liquid market for any new financial instrument. Nonetheless, several smaller countries have issued a variant of growth-indexed bonds, such as Costa Rica, Bulgaria, and Bosnia and Herzegovina. The specific structure of these bonds, however, was not carefully thought out and had a number of problems. For example, the Bulgarian bonds were callable—so that when growth exceeded the threshold to generate additional payments, the government simply recalled the bonds rather than pay the additional fee. Furthermore, the bonds did not clearly specify what measure of GDP should be used to calculate the threshold—not even noting whether nominal or real GDP should be used.

[27] For more information on growth-indexed bonds, see Borensztein and Mauro (2004) and Council of Economic Advisers (2004).

The lack of technical rigor in drafting these previous growth-indexed bond contracts, as well as the other hurdles to issuing these instruments, suggests a role for the international community in supporting the issuance of growth-indexed bonds. Different countries, organizations and institutions could take a number of steps. For example, they could draft a sample bond contract to clarify exactly how certain concerns could be addressed and to help establish consistent legal standards to facilitate bond pricing. They could provide concrete alternatives to ensure reliable and accurate GDP statistics, such as strategies for handling data revisions and possibilities for external monitoring to avoid data manipulation. They could explore options to help jump-start a liquid market for growth-indexed bonds, such as addressing any national regulatory barriers and coordinating the issuance of these bonds by a number of countries simultaneously. The international financial institutions could also play a role by providing technical assistance to address concerns with data reliability. Multilateral institutions, such as the World Bank or Inter-American Development Bank, could even explore purchasing growth-indexed bonds from many countries in a well-diversified portfolio—thereby guaranteeing an initial source of demand and helping jump-start a more liquid market.[28] Moreover, many of these steps that could be undertaken by the international community to support the issuance and acceptance of growth-indexed bonds could also be used to support the development of additional hedging and risk-management instruments to reduce the vulnerability of emerging markets to crises and contagion.

A third area in which the global community could take steps to reduce the chance of contagion is through adjustments to the forms of international official financing. The most common form by which the international community helps emerging markets and developing countries during liquidity crises and other periods of financial distress is through official financing facilities. The official financing instruments available, however, could be expanded to directly address concerns with contagion. For example, the IMF could revisit and improve its earlier facility for a contingent-credit lending (CCL) facility.

[28] The International Monetary Fund is currently restricted from purchasing instruments such as growth-indexed bonds.

The CCL was designed to provide a credit line to countries that followed sound policies but were affected by external shocks. The CCL was never used and was recently ended, partially since countries believed that the criteria and conditionality to receive the CCL were too stringent. The IMF could reconsider a revised CCL and consider ways to increase participation in the facility, while still maintaining its initial goals.

Another way in which the IMF could improve its alternatives for official financing is to introduce non-borrowing programs. The IMF is currently discussing these types of programs. Non-borrowing programs would set specific targets for participating countries and include regular reviews and monitoring, similar to (or slightly less than) a standard IMF program. In return, the specific targets would give government officials the incentive to undertake needed reforms, and the regular IMF reviews would help improve investor confidence in the country. Discussions in the IMF and international community on starting a non-borrowing program, as well as on extending the CCL, have, however, been difficult and protracted. The challenges in implementing these new lending facilities shows the difficulty in balancing the signaling effects of access to ex-ante financing tools, with the problems of adverse selection and moral hazard. One potential avenue for future work is to explore mechanisms in which the private sector plays a greater role in country selection and qualification, possibly through some type of co-financing mechanism.

A final broad area in which the global community could take steps to reduce the chance and impact of contagion is through improvements to sovereign-debt restructuring mechanisms.[29] Although some countries have recently managed to restructure their debts in a timely and effective manner, in other cases debt restructurings have been prolonged and disorderly (such as in the current Argentine debt restructuring). Simplifying and clarifying the mechanisms by which an insolvent country can restructure its debt could greatly reduce the losses to investors and to countries, and even avoid prolonged and costly debt defaults. By reducing these risks, there should be less contagion from a crisis or default in one country on debt prices in other countries with high debt burdens. Although

[29] See Roubini and Setser (2004) for a much more extensive and thorough discussion of issues related to sovereign debt restructuring.

some measures have been undertaken to improve debt restructuring, and other steps are currently ongoing, more can be done in the international community.

One area in which the institutional environment for debt restructurings has already improved significantly is in the more widespread adoption of collective-action clauses (or CACs) in bond contracts issued under New York law. CACs put in place a mechanism to deal with some of the inefficiencies caused by intra-creditor coordination problems. Potentially even more important, in some cases CACs have been extended to cover not only coordination between individual bond tranches, but also between more aggregate debt classes. For example, Uruguay recently included this broader form of CACs in their recent debt restructuring. Since CACs are only included in new or restructured debt for many countries, it will take time for them to apply to all outstanding debt. In the future, however, the more widespread use of CACs should facilitate bond restructurings by allowing restructurings to take place with an absolute majority, rather than unanimity, and reducing the problem of holdouts hindering a restructuring.

In addition to supporting the widespread use of CACs, the international community is currently in the process of developing a "Code of Conduct to Guide Future Debt Workouts." This Code is intended to be a set of principles for the collaborative resolution of sovereign external debt crises and for taking concerted action in pre-crisis situations. The Code was discussed in international private and official circles over the last few years, and the proposal currently being discussed was drafted in 2004 by a small group of developing countries and private sector groups.

Additional work needs to be done to gain support for the Code from a sufficient range of governments and private sector organizations, in addition to the actual drafting committee. Some private market participants believe the Code is too strong and could lead to litigation, while others believe it is not sufficiently strong and could be difficult to enforce. There are also a number of unresolved questions with the Code. For example, what is its legal standing? How does adherence to the Code affect IMF conditionality? Who reviews the Code, discusses revisions, and monitors compliance? Once a Code has fairly

widespread support, it will be important for individual governments and creditor organizations (or creditors directly) to pledge to follow the Code when crises erupt or are on the verge of occurring. In the end, even if the Code is not adopted by a large number of participants, this discussion is still important, as it should help clarify the processes that should be followed during crises and debt restructurings.

In addition to the introduction of CACs and the development of a Code of Conduct, there have recently been a number of additional proposals to improve the institutional framework for ex-post restructuring. The Sovereign Debt Restructuring Mechanism (SDRM) proposed by the IMF has been the most visible of these initiatives. Others include the Universal Debt Rollover Option with a Penalty (UDROP), which would attach an automatic rollover option to all foreign currency liabilities. None of these proposals, however, has received sufficient international support for a variety of conceptual and political economy reasons. For example, creditors are concerned that new mechanisms could make default too easy, so that countries would be tempted to default rather than repay their debts or undertake difficult economic reforms. Borrowing countries are concerned that any of these options could make creditors more reluctant to lend and thereby increase the cost of borrowing. Even for mechanisms that most agree are desirable—such as CACs—borrowing countries were reluctant to be the first to adopt the new mechanism, since it could be interpreted as a signal that debt restructuring is likely to occur in that country in the future.

One of the fundamental points of disagreement in the current discussion of what steps should be taken to improve sovereign debt restructuring in the future is the role of the official community. Some analysts believe that market forces, rather than new international mechanisms, are sufficient to resolve the existing problems with sovereign debt restructurings.[30] These analysts argue that the speed at which recent changes have been implemented—such as the introduction of CACs and the active discussion on a Code of Conduct—reflects the ability of financial markets to innovate to address current problems.

[30] For example, see Roubini and Setser (2004).

This view, however, overlooks that fact that although CACs were discussed for years and even included in bonds issued under British law, they were not introduced in bonds issued under New York law until recently. Some skeptics even argue that CACs would never have been accepted except to prevent more extreme changes—such as the SDRM. For a large number of reasons, markets may not necessarily reach the first-best outcome and the international financial institutions or the international policy community should be encouraged to engage in the progress. More generally, the process of financial innovation is haphazard and is often the response to major financial crises or the (threat) of regulatory actions—rather than a long-term plan to improve the functioning of international financial markets. Therefore, the international community should continue to explore different mechanisms to improve sovereign debt restructurings in the future.[31]

6. Conclusions

Contagion can occur through widespread and diverse channels—from fundamental linkages through global shocks, trade and financial linkages, to changes in investor behavior driven by incentive problems, informational asymmetries, market coordination problems, or investor reassessment. Empirical analyses of contagion have used a variety of strategies and techniques, but at least some papers find a role for each of these factors in the transmission of the crises in the 1990's to countries around the world.

During the most recent financial crises in Argentina and Turkey, however, contagion was much less. This partially reflects better policies by many emerging markets—especially in adopting more flexible exchange rates, more responsible fiscal policies, higher reserve levels, and better oversight of financial systems. It also reflects improvements in the investment community, such as the development of better tools to assess, manage and discriminate between the risks in different emerging markets. Moreover, it also reflects improvements by the international financial institutions, such as enhanced monitoring, data quality and information, and especially more sophisticated assessments of vulnerabilities in

[31] See Claessens and Underhill (2004) for further discussion of the difficulties in making changes to the international financial architecture.

debt structures and financial systems. All of these factors have helped reduce vulnerabilities in emerging markets, and in particular, reduced the "surprise" factor during recent crises.

It is unlikely, however, that these improvements have ended the risks from contagion in the future. The crises in Argentina and Turkey were largely foreseen, slow to occur, and in countries with relatively weak linkages to most other economies. If a crisis occurred in a large economy, it would undoubtedly affect other nations through trade and financial linkages, as well as possibly through changes in investor behavior. Moreover, a number of unknowns still exist. It is difficult to predict the potential scale of private outflows from groups of countries or regions in the event of a major crisis. In this era of increased financial integration and evolving financial markets, it is difficult to predict the size of official resources that could be required temporarily to stabilize countries during a liquidity crisis. Many of the steps that have recently been undertaken—such as the more widespread use of CACs and VAR-type models—have not yet been tested during a crisis in a large country. Moreover, none of these reforms could be expected to address all of the possible channels through which contagion and crises can occur.

Therefore, individual countries, investors, and the international community should still continue to take steps to reduce the buildup of vulnerabilities in emerging markets, thereby reducing the risks of crises and the spread of crises across borders. In particular, the global community should improve information on countries' policies and institutional environments, enhance risk management (such as through the use of growth-indexed bonds), adopt new forms of international financing facilities, and strengthen the framework for sovereign debt restructuring. Although there is no way to fully insulate countries from crises that occur elsewhere, these steps would make a substantial contribution toward reducing the likelihood and intensity of any contagion in the future.

References

Agénor, Pierre-Richard and Joshua Aizenman (1998). "Contagion and Volatility with Imperfect Credit Markets." *IMF Staff Papers*, 45(2):207-235.

Baig, Taimur, and Ilan Goldfajn (1999). "Financial Market Contagion in the Asian Crisis." *IMF Staff Papers* 46: 167-95.

Bekaert, Geert and Campbell Harvey (2003). "Market Integration and Contagion." NBER Working Paper #9510.

Bordo, Michael and Antu Murshid (2001). "Are Financial Crises Becoming More Contagious?: What is the Historical Evidence on Contagion?" In Stijn Claessens and Kristin Forbes (Eds.), *International Financial Contagion.* Boston: Kluwer Academic Publishers, pgs. 367-404.

Borensztein, Eduardo and Paolo Mauro (2004). "The Case for GDP-indexed Bonds." *Economic Policy*, April: 165-216.

Boyer, Brian, Michael Gibson and Mico Loretan (1997). "Pitfalls in Tests for Changes in Correlations." Federal Reserve Board, International Finance Discussion Paper #597.

Broner, Fernando, R. Gaston Gelos, and Carmen Reinhart (2004). "When in Peril, Retrench: Testing the Portfolio Theory of Contagion." IMF Working Paper #04/131.

Calvo, Guillermo, Leonardo Leiderman, and Carmen Reinhart (1996). "Inflows of Capital to Developing Countries in the 1990s'." *Journal of Economic Perspectives* 10:123-139.

Calvo, Guillermo and Enrique Mendoza (1998). "Rational Herd Behavior and the Globalization of Securities Market," mimeo, University of Maryland.

Caramazza, Francesco, Luca Ricci and Ranil Salgado (2003). "International Financial Contagion in Currency Crises." *Journal of International Money and Finance*, forthcoming.

Chang, Roberto and Giovanni Majnoni (2001). "International Contagion: Implications for Policy." In Stijn Claessens and Kristin Forbes (Eds.), *International Financial Contagion.* Boston: Kluwer Academic Publishers, pgs. 407-30.

Chan-Lau, Jorge, Donald Mathieson, and James Yao (2004). "Extreme Contagion in Equity Markets." *IMF Staff Papers* 51(2): 386-408.

Claessens, Stijn (2004). "Taking Stock of Risk Management Techniques for Sovereigns." Mimeo, University of Amsterdam.

Claessens, Stijn, Rudiger Dornbusch, and Yung-Chul Park (2001). "Contagion: Why Crises Spread and How This Can Be Stopped." In Stijn Claessens and Kristin Forbes

(Eds.), *International Financial Contagion.* Boston: Kluwer Academic Publishers, pgs.19-41.

Claessens, Stijn and Kristin Forbes (Eds.) (2001). *International Financial Contagion*. Norwell: MA: Kluwer Academic Publishers.

Claessens, Stijn and Geoffrey Underhill (2004). "The Need for Institutional Changes in the Global Financial System: An Analytical Framework with Application to the Debt Sustainability of Low-Income Countries." Mimeo, University of Amsterdam.

Corsetti, Giancarlo, Marcello Pericoli and Massimo Sbracia (2004). " 'Some Contagion, Some Interdependence: More Pitfalls in Tests of Financial Contagion." *Journal of International Money and Finance,* forthcoming.

Corsetti, Giancarlo, Paolo Pesenti, and Cédric Tille (2000). "Competitive Devaluations: Toward a Welfare-Based Approach." *Journal of International Economics* 51:217-41.

Council of Economic Advisers (2004). "Growth-Indexed Bonds: A Primer." Council of Economic Advisers White Paper.

Desai, Mihir, Fritz Foley, and Kristin Forbes (2004). "Financial Constraints and Growth: Multinational and Local Firm Responses to Currency Crises." NBER Working Paper #10545.

Edwards. Sebastian (1998). "Interest Rate Volatility, Capital Controls, and Contagion," NBER Working Paper 6756.

Eichengreen, Barry, Andrew Rose and Charles Wyplosz (1996). "Contagious Currency Crises." *Scandinavian Economic Review* 98:463-84.

Forbes, Kristin (2004). "The Asian Flu and Russian Virus: The International Transmission of Crises in Firm-Level Data." *Journal of International Economics* 63(1): 59-92.

Forbes, Kristin (2003). "One Cost of the Chilean Capital Controls: Increased Financial Constraints for Smaller Traded Firms." NBER Working Paper #9777.

Forbes, Kristin (2002) "Are Trade Linkages Important Determinants of Country Vulnerability to Crises?" In Sebastian Edwards, and Jeffrey Frankel (Eds.), *Preventing Currency Crises in Emerging Markets*. Chicago: University of Chicago Press, pgs.77-124.

Forbes, Kristin and Roberto Rigobon (2002). "No Contagion, Only Interdependence: Measuring Stock Market Comovements." *Journal of Finance* 57: 2223-61.

Forbes, Kristin and Roberto Rigobon (2001). "Measuring Contagion: Conceptual and Empirical Issues." In Stijn Claessens and Kristin Forbes (Eds.), *International Financial Contagion.* Boston: Kluwer Academic Publishers, pgs. 43-66.

Fratzscher, Marcel (2002). "On Currency Crises and Contagion." ECB Working Paper # 139.

Froot, Kenneth, Paul G. J. O'Connell, Mark S. Seasholes (2001). "The Portfolio Flows of International Investors, I." *Journal of Financial Economics* 59, 151-93.

Gallego, Francisco and Leonardo Hernández (2003). "Microeconomic Effects of Capital Controls: The Chilean Experience During the 1990s." *International Journal of Finance and Economics* 8(3): 225-253.

Gelos, Gaston and Ratna Sahay (2001). "Financial Market Spillovers: How Different are the Transition Economies?" In Stijn Claessens and Kristin Forbes (Eds.), *International Financial Contagion.* Boston: Kluwer Academic Publishers, pgs. 329-66.

Gerlach, Stefan and Frank Smets (1995). "Contagious Speculative Attack," *European Journal of Political Economy* 11:5-63.

Glick, Reuven and Andrew Rose (1999). "Contagion and Trade: Why are Currency Crises Regional?" *Journal of International Money and Finance* 18:603-17.

Goldfajn, Ilan and Rodrigo Valdés (1997). "Capital Flows and Twin Crises: The Role of Liquidity." IMF Working Paper No. 97/87.

Gregorio, José de and Rodrigo Valdés (2001). "Crisis Transmission: Evidence from the Debt, Tequila and Asian Flu Crises." In Stijn Claessens and Kristin Forbes (Eds.), *International Financial Contagion.* Boston: Kluwer Academic Publishers, pgs. 99-128.

Hartmann, Philipp, Stefan Straetmans, and Casper de Vries (2001). "Asset Market Linkages in Crisis Periods." ECB Working Paper #71.

Ito, Takatoshi and Yuko Hashimoto (2002). "High Frequency Contagion of Currency Crises in Asia." NBER Working Paper #9376.

Jeanne, Olivier (1997). "Are Currency Crisis Self Fulfilling?" *Journal of International Economics* 43:263-286.

Johnson, Simon, Peter Boone, A. Breach, and E. Friedman (2000). "Corporate Governance in the Asian Financial Crisis." *Journal of Financial Economics* 58:141-86.

Kaminsky, Graciela, Richard Lyons, and Sergio Schmukler (2001). "Mutual Fund Investment in Emerging Markets: An Overview." In Stijn Claessens and Kristin Forbes (Eds.), *International Financial Contagion.* Boston: Kluwer Academic Publishers, pgs. 158-85.

Kaminsky, Graciela and Carmen Reinhart (2000). "On Crises, Contagion and Confusion." *Journal of International Economics* 51:145-68.

Kaminsky, Graciela, Carmen Reinhart, and Carlos Vegh (2003). "The Unholy Trinity of Financial Contagion." NBER Working Paper #10061.

Masson, Paul (1998). "Contagion: Monsoonal Effects, Spillovers, and Jumps Between Multiple Equilibria," *IMF Working Paper* #98/142.

Moser, Thomas (2003). "What is International Financial Contagion?" *International Finance* 6(2): 157-178.

Park, Yung Chul and Chi-Young Song (2001). "Financial Contagion in the East Asian Crisis: With Special Reference to the Republic of Korea." In Stijn Claessens and Kristin Forbes (Eds.), *International Financial Contagion.* Boston: Kluwer Academic Publishers, pgs. 241-266.

Peek, Joe and Eric Rosengreen (1997). "The International Transmission of Financial Shocks: The Case of Japan." *American Economic Review* 87:495-505.

Rigobon, Roberto (2003). "Contagion, News, and Anticipation." MIT Working Paper.

Rigobon, Roberto (2002). "Contagion: How to Measure It?" In Sebastian Edwards, and Jeffrey Frankel (Eds.), *Preventing Currency Crises in Emerging Markets.* Chicago: University of Chicago Press, pgs. 269-334.

Roubini, Nouriel and Brad Setser (2004). *Bailouts or Bail-ins? Responding to Financial Crises in Emerging Economies.* Washington, DC: Institute of International Economics.

Sachs, Jeffrey, Aaron Tornell and Andres Velasco (1996). "Financial Crises in Emerging Markets: The Lessons from 1995," *Brooking Papers on Economic Activity* 1:147-215.

Schinasi, Garry and Todd Smith (2001). "Portfolio Diversification, Leverage, and Financial Contagion." In Stijn Claessens and Kristin Forbes (Eds.), *International Financial Contagion.* Boston: Kluwer Academic Publishers, pgs. 187-223.

Simone, Francisco Nadal De and Piritta Sorsa. (1999). "A Review of Capital Account Restrictions in Chile in the 1990s." IMF Working Paper #99/52.

Valdés, Rodrigo, (1997). "Emerging Markets Contagion: Evidence and Theory." Central Bank of Chile Working Paper #7.

Van Rijckeghem, Caroline and Beatrice Weder (2001). "Sources of Contagion: Is it Finance or Trade?" *Journal of International Economics* 54: 293-308.