

# The Role of the Banking System in the International Transmission of Shocks

*Massimo Sbracia\* and Andrea Zaghini\*\**  
*Bank of Italy, Research Department*

February 2001

## **Abstract**

The paper analyzes the role of the banking system in the international transmission of financial shocks. A channel of transmission is defined as a mechanism through which a financial crisis in one country brings about a financial crisis in another country. Channels involving the banking sector operate through changes in the value of collateral and capital adequacy ratios, through bank runs and bank panics, and through moral hazard. Some stylized facts related to these channels are presented. In particular, the importance of the exposure to a common source of funding and the irrelevance of bank runs as causes of financial distress and contagion are also confirmed by many recent empirical studies. By contrast, according to empirical analyses, the presence of public guarantees as a source of vulnerability to financial shocks is still very controversial. Hence, vulnerability to the common lender channel during the Mexican, Asian and Russian crises is assessed. The indexes proposed in the paper show that the risks stemming from this channel have sharply declined in the years following each crisis for almost all the countries in our sample.

*JEL classification:* F42, G21, G28.

*Keywords:* Financial crisis, Bank run, Contagion, Regulation.

\* Tel.: +39-06-4792-3860, fax: +39-06-4792-4118, e-mail: m.sbracia@flashnet.it

\*\* Tel.: +39-06-4792-2061, fax: +39-06-4792-4118, e-mail: a.zaghini@poboxes.com

# 1 Introduction<sup>1</sup>

Analysis of banking and currency crises from a unified perspective is a very recent development. The literature on ‘twin crises’ has revealed the important complementarities between bank insolvency and currency instability, stressing that causation may run in either direction. In the last few years, empirical studies have focused on the relevance of imbalances in the banking sector at the root of currency devaluations. At the same time, the literature on currency crises has examined the tendency of financial crises originating in one country to spread internationally. This line of research, usually referred to as ‘contagion’ studies, has just started to disentangle the specific role of banks in the international transmission of shocks. A seminal contribution by Miller (1998) provides examples of domestic banking crises causing financial distress abroad, and currency crises abroad provoking domestic bank runs.

A *channel of transmission* can be defined as a mechanism through which a financial crisis in a country A brings about a financial crisis in a country B. For example, a currency crisis in A might cause a sharp decline in its imports from B that, in turn, could bring B’s exchange rate under pressure. Eventually, B too faces a currency crisis (the so called trade channel). In this paper we are concerned with channels operating through the banking system, which may be in A, in B or in a third country C. We focus on channels in which banks are involved because we believe that the banking system has specific characteristics which have to be taken into account when designing policies aimed at containing systemic risks. Unlike other authors, we do not distinguish between crises due to the *normal interdependence* between countries A and B, and crises occurring because of some *discontinuity in the transmission mechanism*, since we are simply interested in the *role of banks*.<sup>2</sup> Moreover, we neglect transmission channels based on optimal portfolio rules even if the banking sector is directly involved. In today’s globally integrated world, banks invest in international financial markets and, like other institutional investors, can transmit shocks through portfolio rebalancing decisions. However, this channel is not bank specific. Here, we analyze transmission

---

<sup>1</sup>We are very grateful to Chiara Bentivogli, Paola Caselli, Giancarlo Corsetti, Giorgio Gobbi, Aviram Levy, Roberto Rinaldi and participants at the meeting “Marrying the Macro- and Micro-Prudential Dimensions of Financial Stability” held at the Bank for International Settlements (October 2000) for useful suggestions and helpful discussions. We also thank Antonio Covelli and Giovanna Poggi for valuable research assistance. This paper does not necessarily reflect the views of the Bank of Italy.

<sup>2</sup>In two related papers, Corsetti et al. (2000 and 2001) provide a theoretical appraisal of studies on contagion and interdependence and an empirical analysis of the occurrence of contagion during the Asian crisis.

mechanisms deriving from changes in the value of collateral and capital adequacy ratios, from bank runs and bank panics, and from moral hazard.

The first channel stems from the specific lending function of banks. Loan contracts typically require the borrower to provide *collateral*. If a currency crisis reduces the market value of stocks in a country, each economy that has been backing its liabilities with those stocks as collateral has to ‘mark to market’; otherwise, it may face a reduction in its credit lines from the banking system. Moreover, if a bank has been lending to firms in the crisis country, the resulting rise in non-performing loans worsens its ‘value at risk’. The result is that the bank, in order to comply with binding *capital adequacy constraints*, will have to withdraw capital from other countries, creating a credit crunch. The larger the number of countries for which the lender is an important source of funding, the higher the probability of a wide diffusion of the crisis (*common lender channel*).

The second channel of transmission relates to the function of transforming maturities. Banks provide a transformation of instruments with short maturities, offered to depositors, into instruments with long maturities that other agents desire. This ‘transformation’ service leaves banks vulnerable to runs that can potentially be transmitted to the whole domestic banking system (*bank panics*). In models with multiple equilibria, as in the seminal paper by Diamond and Dybvig (1983), contagion through this channel occurs because a crisis in a foreign country modifies *the information set* available to all agents. On the other hand, in models where the multiplicity of equilibria disappears, the probability of a bank run can be related to the *structure of the economy*.

In order to reduce the risk of runs, public authorities may offer guarantees on deposits. *Moral hazard* resulting from implicit or explicit government guarantees, confidence in international rescue packages or the belief that some borrowers are ‘too big to fail’ can generate excessive capital inflows that banks may channel towards risky or unprofitable plans. Such over-borrowing, in turn, can translate into unsustainable imbalances that make the economy vulnerable to international shocks and to a sudden reversal of capital flows.

Among the channels discussed in the paper, we regard the presence of a common lender as the most important source of vulnerability. This view is induced by a growing empirical literature on the topic, which show significant effects of this channel on the probability of a financial crisis, while mitigating the role of bank runs and being inconclusive about moral hazard. Thus, we propose some indexes of vulnerability to the common lender channel, which take into account both the borrower’s dependence and the lender’s exposure.

In the next section, we examine at a theoretical level the channels that

favor the transmission of financial shocks through the banking system. In section 3, we present some stylized facts related to these channels. Notable points here are: the concentration of loans and the presence of a common lender in the regions involved in the major crises of the second half of the 1990s; the apparent irrelevance of episodes of bank panics during the last twenty years; the recent widespread diffusion of explicit deposit insurance. In Section 4 we discuss the relevance of the different channels of transmission, in the light of recent empirical studies. Section 5 proposes some indexes of vulnerability to contagion stemming from the concentration of loans from the same lender. Section 6 concludes.

## **2 Channels of transmission: Theory**

### **2.1 Common lenders and the value of collateral**

In the current scenario of growing cross-border integration among banks, a common lender can be the main source of funds for several countries. But, competition for funds from the same bank might become a problem. When a common lender is highly exposed to a crisis country, adjustments to restore capital adequacy or reduce risk exposure can lead to sudden cuts of credit lines in other economies. In fact, if a bank faces a rise in non-performing loans in one country, it is likely to reduce its overall value at risk, by choice or for regulation reasons. In practice, it may shift away from lending and increase its holding of government bonds, so that other countries that had been borrowing from it become vulnerable to a retrenchment of their credit line. Moreover, if these countries' liabilities have a short maturity and the bank's rebalancing needs are large, the crisis can trigger large capital outflows from other countries. For instance, consider the case in which the firms from two countries A and B borrow from the same banking system (say, country C). When a crisis hits A, banks from C may face defaults on loans to A. To restore capital adequacy ratios, country C can provoke a credit crunch in country B by calling in the loans. Thus, the productive sector of country B comes under pressure and eventually the whole country may face a crisis. Note that even if B's economy is not directly linked to A's, the presence of a third party C makes the crisis spread from one country to the other.

When borrowers are heavily dependent on the bank and do not have easy access to alternative sources of financing, the credit crunch can also cause a crisis in other economies, independently of the state of fundamentals. However, three conditions must be fulfilled for this channel of transmission to operate:

- the bank's exposure in the country initially affected by a financial crisis must be large, implying potential substantial losses and, in turn, the need to restore capital asset ratios or to readjust risk exposure;
- the same bank must be an important source of credit for other countries;
- the potentially affected countries must not have other sources of funding readily available.

Note that the third condition relies on some form of market imperfection. If the common lender does not roll over its loans in countries with sound fundamentals, other lenders could intervene in its place. However, the common lender might have had a better knowledge of the borrowers' economies, given their past relationship or because of geographical proximity. Since potential lenders may not be able to perform efficient monitoring of borrowers, owing, for instance, to larger early costs, they might refrain from replacing the common lender.

A similar pattern of contagion is also at work through changes in the value of collateral (e.g. stocks or government bonds) provided by borrowers. If the value of these assets falls after a financial crisis, banks demand the value of collateral to be restored. When firms in country B provide collateral from country A and a crisis hits the latter, the banking system (now in country B) requires them to adjust the value of collateral; otherwise banks have to reduce the amount of their outstanding loans. As before, a credit crunch in country B and the transmission of the crisis (from A to B) are the likely outcomes.

Emerging economies, that require substantial foreign resources to finance productive activities, are particularly vulnerable to changes in the value of collateral. In fact, weak international financial links, reflected in inadequate provision of international collateral, place limits on a country's ability to acquire external financing (Caballero and Krishnamuthy, 1999). For instance, consider a region that is economically open but has an underdeveloped bank-based financial market, and suppose that an economy in this region backs its funding by asset holdings in a neighboring country. When a crisis hit the 'collateral' economy, the lender will require a sounder backing of its claims. If this is impossible, the lender will downgrade the borrower and reduce the amount of credit issued, ceasing to roll over existing loans or calling in its credits. Consequently, during financial crises the country's international collateral may prove insufficient to finance its productive activity. Domestic firms requiring foreign funds might trade domestic assets for international collateral at prices below those warranted by the fundamentals of the country, exacerbating the initial shock.

## 2.2 Bank runs and bank panics

### 2.2.1 Informational bank runs

The traditional explanation for a bank run is that depositors seeing large withdrawals from their bank might fear that a bankruptcy is imminent. Since bank assets are allocated on a *first-come first-served* basis, when depositors expect a run, they respond by rushing to withdraw, in the attempt of preceding the others. Withdrawals in excess of banks' current expected demand for liquidity can cause bankruptcy. In fact, banks typically *transform* liquid liabilities into illiquid assets. This service – which allows better risk sharing among people with different consumption horizons (and provides the rationale for the existence of banks) – makes banks vulnerable to runs. Bank run models, as in Diamond and Dybvig (1983), exhibit multiple equilibria: a 'good' equilibrium, which entails optimal risk sharing, and a 'bank run' equilibrium, which makes all agents worse off with respect to the allocation that they would have achieved without bank intermediation (i.e., by trading in a competitive market).

An apparent inconsistency of the standard model is that bank runs should not be observed in equilibrium, because no one would deposit when a bank run is expected. However, the equilibrium could be selected contingently on a publicly observable random variable, provided that the probability of a run is small. As Diamond and Dybvig put it:

‘this [variable] could be a bad earnings report, a commonly observed run at some other bank, a negative government forecast, or even a sunspot. It need not be anything fundamental about the bank's condition’.

Bank runs have drawn the attention of economists and regulators because a run on an 'illiquid' but solvent bank entails an *inefficient equilibrium*. Different classes of models provide different explanations for the causes of this market failure and prescribe different optimal policies for preventing the problem. In the framework of Diamond and Dybvig, bank runs arise because of a *coordination problem*: depositors withdraw simply because they expect other depositors to withdraw and, by doing so, they determine a (self-fulfilling) bankruptcy. In this model, the optimal public policy is the implementation of a deposit insurance scheme financed with money creation. In other models (e.g. Chari and Jagannathan, 1988) the inefficiency is due to the presence of *informational asymmetries*: depositors are afraid that banks are insolvent, because they do not know the real state of banks' claims (and banks cannot credibly reveal it). Hence, a public policy should aim at reducing the informational asymmetries. In this perspective, Gorton (1985a)

shows that a temporary ‘suspension of convertibility’ (of the demand deposit into cash) could give banks the possibility of informing depositors that continuation of investments is mutually beneficial.<sup>3</sup>

Bank run models highlight several possible causes of the international transmission of financial shocks. First, a currency or a banking crisis in one country may represent the *sunspot variable* that triggers a bank run (or an extensive bank panic) in another country. While this channel is very clear at a theoretical level, it is very hard – if not impossible – to test on empirical grounds. The crucial issue is that multiple-equilibria models of bank runs and contagion are not reproducible, and there exists no econometric methodology to test them.

Second, the *revision of beliefs* following a crisis in another country may be another cause of the transmission. If agents observe widespread episodes of bankruptcy, they may interpret these as a signal of difficulties affecting the world economy. The resulting Bayesian update of the quality of banks’ assets can trigger a sequence of withdrawals and failures. Even if the transmission of shocks through this channel is more closely related to the fundamentals, it does not always lead to efficient outcomes. In particular, Chari and Jaganathan (1988) show that agents can (mis)interpret liquidity withdrawals, considering them as generated by pessimistic information about banks’ assets, and their reaction can cause a bank panic.

Finally, contagious bank runs can occur in the presence of *asymmetric information*. In a recent model of bank panics, Chen (1999) modifies Diamond and Dybvig’s standard framework by assuming that some depositors are better informed about the value of the bank’s assets. Informed depositors enjoy an advantage, since they can withdraw earlier in bad states in which the bank cannot fully repay all depositors. Uninformed depositors therefore have an incentive to respond to other sources of information, before the value of the bank’s assets is revealed. Failures of other banks, interpreted as a signal of worldwide (or regional) difficulties, can be one such source of information. Even if information contained in bank failures is very noisy, uninformed depositors may still respond to it and withdraw. Moreover, informed agents, knowing that uninformed depositors withdraw early, can be forced to withdraw early too, even before they receive more precise signals about the assets. In this way, a single bankruptcy can easily trigger a contagious bank panic.

---

<sup>3</sup>Other authors consider as excessive ‘the anxiety’ of bank executives and regulators for this phenomenon and for its implications in terms of systemic risk. Hence – also in light of past experiences in Scotland and New England (the Suffolk System) – they claim that banks should not be regulated at all (see, for instance, the discussions in Fama, 1980; Gorton, 1985b; Kaufman, 1994; Calomiris and Kahn, 1996).

### 2.2.2 Structural bank runs

The literature on bank runs has produced interesting developments of the original model of Diamond and Dybvig in which a unique equilibrium emerges. In particular, Postlewaite and Vives (1987) have presented a framework in which there is a unique equilibrium that entails a positive probability of a bank run. In their model there is no exogenous event on which agents condition their behavior and, at the same time, there are *no* equilibria without the possibility of bank runs. An important feature of this kind of model is the possibility of making some comparative statics, relating the probability of a run to the characteristics of the economy.

Building on a variation of the model of Postlewaite and Vives, Goldfajn and Valdes (1997) focus on the role of banks as intermediaries between foreign investors and domestic enterprises. The banking system typically offers foreign investors assets with shorter maturity, which attract *large capital inflows*. This intermediation has two main consequences: it results in larger capital movements and, at the same time, it increases the risk of sudden reversals of flows. In fact, the effects of internal or external shocks are amplified by the action of the domestic banking system and propagated to the rest of the economy. When a shock hits the economy (e.g., a negative productivity shock or a rise in the international interest rates), risk-averse foreign investors, holding shorter-term assets, withdraw their funds. In this framework the banking system clearly increases the vulnerability of the country to contagion: shocks (such as a currency crisis abroad), that without intermediation would have resulted only in relatively small capital outflows, can set on a disruptive financial crisis. Moreover, assets with shorter maturity imply larger capital inflows and, in turn, a higher probability of a run.<sup>4</sup>

Goldfajn and Valdes extend their analysis by including in the model a central bank and the possibility of a *currency mismatch* between assets and liabilities of the domestic banking system. If domestic banks find it optimal to offer (liquid) foreign-currency-denominated assets, the mismatch with their (illiquid) domestic-currency-denominated investments translates into a higher probability of runs. When a run on domestic banks occurs, the impact of capital outflows on official reserves increases the probability of a currency devaluation. Hence, not only does the model provide an explanation for the recurrent ‘boom-bust’ cycles of capital flows observed in many emerging markets, but it also presents a consistent framework in which banking and

---

<sup>4</sup>In a similar context, Chang and Velasco (1998) have proved that larger capital inflows increase the level of indebtedness of the banking system and hence the vulnerability of the country to a bank run triggered by a refusal of creditors to roll over their loans.

currency crises occur together.<sup>5</sup>

More recently, Goldstein and Pauzner (2000) have ‘solved’ the coordination problem of Diamond and Dybvig by introducing some incomplete private information. In their ‘global game’, a unique probability of a bank run emerges as a function of the characteristics of the demand deposit contract. Goldstein and Pauzner find that offering a higher *short-term interest rate* (i.e. offering a higher return to agents demanding early withdrawal) makes the bank more vulnerable to a run. Hence, internal or external shocks that have an impact on short-term interest rates make the occurrence of a financial crisis more likely.

Finally, contagion may be due to the presence of an *international interbank market*. To the extent that interbank loans are neither collateralized nor insured, a bank failure can generate a chain of subsequent failures. On the one hand, an international interbank market as well as national interbank markets promotes efficient financial management,<sup>6</sup> and makes it possible to limit an individual bank’s troubles. For instance, when a bank is affected by an idiosyncratic liquidity shock, the interbank market provides liquidity support. On the other hand, the existence of this market increases the fragility of the whole banking system, since it cannot provide enough liquidity when the entire sector comes under pressure.

Freixas et al. (1999b) consider banks facing uncertain liquidity needs. Long-term investment opportunities make it costly for banks to maintain liquid reserves. Thus, an interbank credit market where banks can obtain liquidity reduces the opportunity cost of maintaining liquid reserves. However, in the presence of illiquid investments, international interbank linkages expose the system to the possibility of a coordination failure, even if all banks are solvent. For instance, a liquidity shock in a foreign country can lead home depositors to believe that home banks will provide their liquidity to that country; the best response to this belief is to withdraw home deposits, thereby generating a bank run at home. In a related paper, Allen and Gale (2000) show that contagion due to liquidity shocks depends on the degrees of completeness of the interbank linkages. When a region of the world is hit by a liquidity shock and world demand for liquidity exceeds world supply, international interbank linkages can propagate the shock to other regions. The consequences of such contagion turn out to be very strong if the interbank market is *incomplete* (i.e. each region is connected only with a few other regions) and are mitigated if the market is *complete* (each region is

---

<sup>5</sup>For an extensive empirical analysis on the ‘twin crises’ see Kaminsky and Reinhart (1999).

<sup>6</sup>In particular, the decentralized operation of interbank lending facilitates *peer monitoring* (Rochet and Tirole, 1996).

connected with all the other regions). Finally, Kiyotaki and Moore (1997) developed a theoretical model of ‘credit chains’ in which shocks are amplified and transmitted through a network of firms that borrow from and lend to each other. In such a network, temporary liquidity shocks to some firms can cause a chain reaction, propelling other firms into financial difficulties.

### 2.3 Moral hazard

In order to reduce the risk of bank runs, many countries have implemented explicit deposit insurance schemes. Even in the absence of explicit insurance, international investors may believe that their deposits and loans in some emerging economies enjoy *de facto* public insurance. As stressed by Diaz-Alejandro (1985), in many cases the public expects policy-makers to intervene and save depositors and other creditors from losses when financial intermediaries run into trouble. Warnings that such interventions will not be provided may simply appear to be not believable, as expectations of a bail-out are strengthened by past episodes of capital injections into the banking system.

Like any form of insurance, public guarantees on deposits create moral hazard. Moral hazard arises when the provision of guarantees modifies the incentive for the insured party to take preventive actions, increasing the probability that the event being insured against occurs. In particular, moral hazard modifies both the behavior of international investors (*creditor moral hazard* or *moral hazard play*) and the decisions of bank managers (*debtor moral hazard*). Creditor moral hazard is related to the large capital inflows and the reduced incentives for an effective monitoring on banks’ lending activity induced by the existence of explicit or implicit insurance on deposits and loans. Debtor moral hazard is connected with the additional risks taken by bank managers and shareholders both in their borrowing (overborrowing) and their lending activity. It may also produce an additional negative effect in case of a financial crisis: if a negative shock hits the economy and reduces investment profitability, bank managers might not become more cautious in planning their investments. On the contrary, they could well begin to finance very risky projects in an attempt to recover their losses (*gambling for redemption*).

Corsetti et al. (1999) propose a model to explain the role of moral hazard in the unfolding of the Asian financial crisis. Their work focuses on moral hazard as the common source of over-investment, excessive external borrowing and current account deficit.<sup>7</sup> Financial intermediation played a

---

<sup>7</sup>For an explanation of the ‘over-borrowing syndrome’ see Giannetti (2000).

key role in channeling funds towards projects that were quite unprofitable from a social point of view. Because of moral hazard, national banks borrowed excessively from abroad and lent excessively at home. The production plans and strategies of the corporate sector largely overlooked costs and risks of investment projects. Underlying this over-lending syndrome was the presumption that short-term interbank cross-border liabilities were effectively guaranteed by either a direct government intervention in favor of international debtors or an indirect bail-out through IMF programs. To the extent that foreign creditors were willing to lend against future implicit bail-out revenue, unprofitable projects and cash shortfalls were re-financed through external borrowing. This process, known as *evergreening*, translated into an unsustainable path of current account deficits, leading to overall systemic fragility and a significant vulnerability to shocks.

While Corsetti, Pesenti and Roubini provide a theoretical framework consistent with the events observed in each Asian country hit by the crisis, their model does not explain why all the countries were hit at the same time. One possible explanation is that behaviors that arise because of moral hazard can be highly contagious. Moral hazard is, in fact, inherently forward-looking: a particular episode can create moral hazard only to the extent that it influences expectations of how a similar situation will be dealt with in the future. Hence, if foreign creditors suffer losses in a country where public authorities were supposed to grant deposits and loans, they may also refrain from investing in countries with a similar financial system. Recall that the effects of moral hazard on bank managers and shareholders are likely to be negligible in countries with a well-designed and effective system of prudential regulation and supervision. If a banking crisis in an emerging-market economy reveals information about the weakness of banking supervision in other countries, banking and currency crises in the latter countries are likely to occur.

### 3 Some stylized facts

In this section we provide some stylized facts describing the recent evolution of borrowing and lending flows, the occurrence of bank runs and bank panics, and the worldwide diffusion of deposit insurance schemes.

**(1) The United States, Japan and Germany – the main international lenders – tend to concentrate their loans into specific regions of the world. Moreover, countries belonging to the same region tend to borrow from the same lender.**

Developing countries rely heavily on foreign funds to finance their eco-

conomic activity. The United States, Japan and Germany provide most of the foreign loans these countries demand. Data from the Bank for International Settlements (BIS) show that at the beginning of the 1990s loans from these three lenders amounted to over half (53 per cent) of the total liabilities of developing countries vis-à-vis BIS reporting countries.<sup>8</sup> At the end of the decade, this share was still close to 45 per cent, despite the contraction in Japanese lending.

Following the recent Asian crisis, total loans from advanced economies to developing countries diminished somewhat. Yet, foreign loans of the United States, Japan and Germany remained highly specialized, concentrating into Latin America, Asia and Eastern Europe, respectively. In 1990, about 60 per cent of US bank loans to developing countries was directed towards Latin America; at the beginning of 2000, despite the decrease in US total funds to developing countries which followed the Asian crisis, this share was almost unchanged (57 per cent). A similar pattern characterizes the Japanese banking sector. Loans of Japanese banks to developing countries decreased sharply after the Asian crisis: in three years they halved from the peak reached in Q2 1997. Japanese bank loans to Asian and Pacific countries, approximately equal to 50 per cent of their loans to developing countries in 1990, rose to over 75 per cent in 1994 and remained on that level until 2000.

Unlike the other main lenders, the exposure of Germany to developing countries increased to some extent after 1997. Over the decade, the weight of East European countries remained constant, at around 40 per cent of total bank loans to developing countries.

A second feature of bank loans is that developing countries in the same area tend to share the same borrower. Table 1 shows the shares of indebtedness of Latin America, Asia Pacific and Eastern Europe vis-à-vis the United States, Japan and Germany in the quarter preceding the Mexican, Asian and Russian crises and in last available quarter.<sup>9</sup>

At the end of 1994, most Latin American countries liabilities vis-à-vis the United States were at least 30 per cent of their total external indebtedness (32 per cent for whole area). After the Mexican crisis, the weight of loans from US banks declined. At the end of June 2000, the region was still highly indebted to the US: on average, liabilities to the common lender accounted

---

<sup>8</sup>In the paper, we follow the BIS definition of developing countries and we use BIS ‘consolidated’ data set.

<sup>9</sup>Each entry is the amount owed by that region to the lender, divided by that region’s total debt to BIS reporting countries (Grand Total). For the quarter preceding the Mexican, Asian and Russian crises we refer, respectively, to Q4 1994, Q2 1997 and Q2 1998. Data for the Q2 1994 (which is effectively the closest available before the beginning of the Mexican crisis) do not differ significantly from Q4 1994.

for almost  $\frac{1}{4}$  of the total. Analogously, at the end of the second quarter of 1997, more than 35 per cent of total external liabilities of the Asia Pacific region were due to Japanese banks. After the crisis, the weight of external liabilities to Japan declined quickly but, in the second quarter of 2000, it was still significant at 24 per cent. Finally, Eastern Europe increased its dependence on German banking loans even after 1998 Russian crisis. The share of loans from the common lender raised to almost 40 per cent in mid 2000.

**(2) The number of banking crises has escalated in the last 20 years with respect to the 1970s. However, episodes of bank runs and bank panics have not been frequent.**

While there seems to be a large consensus on the theoretical definitions of sound and unsound banking systems, the empirical identification of a banking crisis is not a simple task. Studies are strongly conditioned by the availability and the quality of data, especially for developing countries, by the difficulties in finding homogenous sources of data at the firm level, and by the lack of high-frequency data, which complicates the task of promptly detecting crises. Most empirical works have defined a banking crisis by considering one or more of the following factors: the ratio of non-performing assets to total assets in the banking system; the closure or failure of important banking institutions; the occurrence of major bail-outs, conducted by the government or the private sector (e.g., through mergers or take-overs); the occurrence of large-scale nationalizations of banks; the cost of rescue operations; the occurrence of extensive bank runs; a fall in the prices of bank shares.

Owing in part to those data-related problems, few studies have compared the frequency of banking crises over long horizons. The relevance of the phenomenon in the last 20 years is acknowledged in Lindgren et al. (1996), which provides one of the most extensive studies on banking crises. The authors surveyed all the IMF member countries, from 1980 to 1995. During that period 133 among the over 180 member countries of the IMF experienced *crises* or *significant problems* in the banking sector.<sup>10</sup> Developing and industrial countries alike were affected, as well as all economies in transition. Despite the large number of crises, episodes of bank runs and bank panics have not been frequent. The analysis of a sub-sample of 34 countries that have experienced crises or significant problems in the banking sector provides

---

<sup>10</sup>A *crisis* is defined as a situation in which a sizable group of financial institutions has liabilities exceeding the market value of their assets, the economy experiences bank runs or other portfolio shifts, collapse of some financial firms and government intervention. Extensive unsoundness of the banking sector, short of a crisis, is termed a *significant problem*.

a large set of information on both the causes and the consequences of the crises.<sup>11</sup> The sample includes only 7 bank panics and ‘sporadic’ bank runs to individual institutions in just a few other episodes. Moreover, in only 2 cases (Argentina in 1995 and the Philippines in the first half of the 1980s) can the bank panic be considered as the main cause of the failure or closure of some institutions.

The current situation, characterized by relatively infrequent episodes of bank runs, contrasts with the picture prevailing before widespread resort to deposit insurance. For instance in the United States, the so called Free Banking Era (1837-1863) and National Banking Era (1863-1914) were punctuated by recurrent nationwide bank panics. Since federal deposit insurance was introduced in 1934, there have been no widespread episodes of bank panic. The empirical relevance of bank runs as a cause of banking crises is, however, still an open question. According to some authors, both in recent and in past periods, runs have only been a symptom of the banks’ weaknesses, rather than the cause. Most banking problems have been due to a deterioration in the asset quality, rather than to bank runs (liability side of the balance sheet).

**(3) The number of countries with explicit deposit insurance schemes has increased sharply since 1980. The characteristics of these schemes have been adjusted in recent years, in order to reduce the risks due to moral hazard and other agency problems.**

The IMF has recently conducted an extensive survey of 72 countries with different systems of deposit protection (see Garcia, 1999). An explicit deposit insurance scheme for national banks did not exist in the United States before 1934 and other countries did not follow this suit until the 1960s.<sup>12</sup> In April 1999, of the 72 systems reviewed by the IMF, 68 were explicitly defined in law or regulation. Interestingly, only 18 schemes were adopted before 1980. As the incidence of banking crises escalated, 50 new formal schemes were implemented: 19 during the 1980s and 31 during the 1990s.

The acceleration in the implementation of formal deposit insurance schemes was particularly pronounced in Europe and Africa. The European Union Directive on Deposit Guarantees in 1994 – which requires countries to set up a deposit insurance scheme to which banks are forced to adhere – has induced many countries to revise or to establish systems of deposit protection. In

---

<sup>11</sup>The sample comprises 19 developing economies, 8 transition economies and 7 industrial countries: 36 cases of banking sector problems are singled out (for one country, Argentina, 3 different episodes are considered).

<sup>12</sup>Some states within the United States started deposit insurance earlier; so did Czechoslovakia.

countries that are, or aspire to be, members of the European Union, standardization of certain criteria (e.g. the compulsory or voluntary nature of membership and the coverage limits) has been enhanced. In Africa, the implementation of formal schemes did not quicken until 1999, when 6 countries (Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea and Gabon) ratified a Treaty establishing a common central bank and setting the rules of an explicit deposit insurance scheme.

The most important trend in deposit insurance seems to be the shift from an implicit to an explicit scheme. Many countries now with explicit guarantees have, in fact, reformed their pre-existing implicit insurance. Of the four countries reported in Garcia (1999) that do not maintain formal guarantees on deposits, only Kuwait has never considered implementing explicit schemes. In Bolivia and Costa Rica explicit schemes are under discussion or being prepared; in Honduras, the current banking law refers to the adoption of a deposit insurance law, but, in April 1999, the bill had still to be presented to the Parliament.<sup>13</sup>

Revisions of explicit guarantees have tended towards making it compulsory for banks to be members of the deposit insurance. These reforms – aimed at reducing adverse selection problems – have occurred not only in Europe as a result of the 1994 Directive on Deposit Guarantees, but also in the Middle East and in the Americas.<sup>14</sup>

Generally, deposit insurance covers only retail deposits and only up to a certain amount. In order to reduce the room for moral hazard, the coverage limit should be low enough to encourage large depositors and sophisticated creditors (such as foreign creditors and other banks) to monitor the bank's investment activity closely; on the other hand, the limit should also be sufficiently high to guarantee small depositors, typically unable to engage in effective monitoring of banking institutions. As a rule of thumb, the IMF suggests that deposits should be guaranteed up to a limit not exceeding two times per capita GDP. In the IMF sample the average coverage limit is 3 times per capita GDP, with the highest average in Africa and the lowest in Europe. However, some countries offer a full coverage to all deposits and also to other liabilities.<sup>15</sup> Most of these countries began to offer full coverage when they declared a financial emergency, intending to shift to limited

---

<sup>13</sup>Dermirguc-Kunt and Detragiache (2000) consider a different sample, where 23 other economies – mainly Asian and African countries – still maintain an implicit scheme.

<sup>14</sup>Recall that a deposit insurance scheme that is voluntary and charges a fixed premium is likely to attract weaker institutions and repel stronger ones.

<sup>15</sup>These countries are Colombia, Ecuador, Indonesia, Japan, Korea, Malaysia, Mexico, Thailand and Turkey. Kuwait – which has an implicit scheme – is also supposed to cover all deposits.

coverage once the conditions of the banking system were sounder. For instance, the current insurance scheme in Japan – which covers all depositors and creditors – is planned to end in March 2002 (see Freixas et al., 1999a). Sweden and Finland have already retracted the full coverage offered during their banking crises and have replaced it with limited coverage.

Finally, almost all countries with an explicit deposit insurance have shifted to a system of coverage per depositor rather than per deposit, in order to lower the effective coverage ratio and to discourage attempts to circumvent the limits.

## 4 Hints from the empirical literature

The stylized facts presented above show that the presence of a common lender characterizes many developing countries. Moreover, banking crises in these countries – especially in recent years – have not been associated with bank runs, maybe as a result of the widespread diffusion of explicit deposit insurance schemes. The importance of the exposure to a common source of funding and the irrelevance of bank runs as causes of financial distress and of crisis transmission across borders are confirmed by empirical studies. By contrast, according to empirical analyses, the presence of public guarantees as a source of vulnerability to financial shocks is still very controversial.

The role of indebtedness to a common creditor as a cause of currency crises during the last 30 years has been examined by Kaminsky and Reinhart (2000). The authors divide their sample of 20 industrial and developing countries into 3 different partitions, dictated by *geographical closeness*, *trade linkages* (bilateral and third-party) and *source of funding*. Their model shows two important findings: i) the probability of a currency crisis increases non-linearly with the number of crisis economies in the same cluster; ii) knowing that there is a crisis in a country belonging to the same common lender group has a higher predictive power than knowing that the country belongs to the same trade cluster or to the same geographical cluster.

Van Rijckeghem and Weder (1999) identify a common lender in all recent international financial crises: the United States for Latin America in 1994-95, Japan for South-East Asia in 1997 and a small group of European countries (Germany in particular) for Transition economies during the 1998 Russian crisis. For all crisis episodes, they label ‘ground zero country’ the economy where a financial shock first occurred and then study the similarity in the financial structure of crisis economies with respect to that country. The three ground zero economies are Mexico, Thailand and Russia. The model shows that the structure of indebtedness is the most important fac-

tor in transmitting financial shocks across countries. All the economies that experienced financial turmoil after the collapse of the ground zero country had a structure of liabilities similar to that of the first country experiencing turmoil, suggesting that competition for funds is significantly associated with the probability of contagion.

Similar conclusions are also drawn by Caramazza et al. (2000) through a panel probit model in which one explanatory variable takes into account the source of financing. This variable is built as the product of the importance of the common creditor for the borrowing country – where the common creditor is identified as the country that lent the most to the ‘ground zero’ country – and the importance of the borrowing country for the common creditor. On average, the weight of the common lender in the liabilities of a crisis country is about 5 percentage points higher than its weight in the liabilities of unaffected economies, whereas the weight of a crisis economy in the assets of the common lender is about 10 percentage points higher than the weight of unaffected countries. As a result, the explanatory variable is significantly higher in crisis economies than in non-crisis ones.

As concerns the importance of bank panics, our stylized facts highlight that in the last thirty years, besides from a few anecdotal episodes, panics have always been only a symptom of weaknesses in the financial system rather than the cause. Although there is not yet universal consensus on the causes of banking crises, in most countries episodes of financial turmoil took place following ‘asset-related’ problems, such as rising shares of non-performing loans. For instance, Lindgren et al. (1996) find that banking crises are mainly related to the fluctuations in the conditions of the real sector due to the business cycle. In fact, in the onset of a banking crisis, many countries experienced a recession, large shifts in terms of trade and other economic shocks, or important non-economic events with an adverse economic impact. Generally, these macroeconomic factors contributed to a further deterioration of an already weak financial system, characterized by low profitability, high debt, low levels of cash and capital relative to assets, and high responsiveness to changes in domestic and foreign interests rates.

While in the most recent years the unimportance of bank runs might be due to the worldwide diffusion of deposit insurance schemes (see Section 3), according to many authors, even at the beginning of the century, most banking panics did not show the characteristics of random events, such as equilibria caused by agents’ self-fulfilling beliefs. Serious problems on the liability side of banks’ balance sheets (e.g. large declines in total deposits) occurred rarely in the US and were mainly concentrated in two periods: 1893 and 1930-33. However, such problems were often accompanied by a deteriorating macroeconomic outlook, which complicates the task of assessing

the direction of causality.

An influential study by Gorton (1988) examines the seven crises that occurred during the US National Banking Era (1863-1914), before deposit insurance was adopted by the United States. The results of his analysis are consistent with the view that such panics were systematic responses by depositors to a changing perception of risk, usually based on the arrival of new information, rather than random events. Kaufman (1994), in his review of the episodes of bank contagion, also argues that strong shocks at one bank or group of banks did not spill over randomly to other banks. With only rare exceptions, empirical studies focusing on equity returns on banks in the United States from 1970 to 1990 report strong evidence that contagion occurred only for the banks which were financially interconnected with the initially affected bank. For instance, after the failure of the ‘perceived’ state-insured thrift institutions in Ohio and Maryland in 1985, depositors were able to differentiate not only between federally insured and federally non-insured institutions, but also correctly tell apart ‘perceived’ insured from ‘perceived’ uninsured institutions.

The relationship between bank stability and moral hazard arising from the adoption of deposit insurance schemes is still very controversial. Dermirguc-Kunt and Detragiache (1999 and 2000) argue that explicit deposit insurance increases the probability of a banking crisis and that its impact tends to be stronger when the coverage offered to depositors is large and the scheme is funded and run by the government. However, Eichengreen and Arteta (2000), with a sample covering a longer time period and a larger number of developing countries, show the opposite result: deposit insurance reduces the probability of a banking crisis. Other estimations including also data of OECD countries provide, instead, non-significant coefficients.

Summarizing, the presence of a common lender appears as the most relevant channel of transmission. Indeed, empirical studies on banking crises find that vulnerability to contagion increases substantially when countries heavily borrow from single source of funding. Thus, a set of indicators of financial system’s weaknesses should take into account the level of indebtedness vis-à-vis the same lender. Some potential indicators – proposed in the next Section – suggest that vulnerability to contagion through the common-lender channel has sharply decreased after the Mexican, the Asian and the Russian crises.

## 5 Vulnerability to the common lender channel

In this section we provide an assessment of the vulnerability to contagion due to the presence of a common lender. Our analysis focuses on the three main areas involved in recent episodes of financial distress: Latin America, Asia Pacific and East Europe. As discussed above, for each of these three regions it is easy to identify a common lender: the United States, Japan and Germany, respectively.

### 5.1 Borrowers' dependence and lenders' exposure

The theoretical survey presented in the paper (Section 2) suggests that vulnerability from a common lender depends on both the levels of the borrower's liabilities and of the lender's exposure. For instance, a situation in which many countries heavily borrow from the same lender is not necessarily risky, provided that the lender's exposure vis-à-vis each country is not large. Consider the Mexican crisis. If the share of US external loans vis-à-vis all Latin American countries had been negligible in 1994, the risk of a sudden reversal of the US funds following a default in one of these countries would have been small. Instead, US banks were highly exposed to these countries; Mexico alone accounted for almost  $\frac{1}{4}$  of US external banking loans to developing countries.

For each emerging country in our set, Tables 2 to 4 report two measures of dependence from the common lender in the crisis year and in the second quarter of 2000: the 'relative dependence' ( $rd$ ) and the 'absolute dependence' ( $ad$ ). For each country  $i$ , the former is the ratio between the amount owed to the common lender and country  $i$  total liabilities vis-à-vis BIS reporting countries. The latter is the ratio between the amount owed to the lender and country  $i$  GDP. Analytically:

$$rd_{CL}^i = \frac{L_{CL}^i}{\sum_{j \in REP} L_j^i};$$
$$ad_{CL}^i = \frac{L_{CL}^i}{GDP_i};$$

where  $CL$  stands for common lender,  $REP$  is the set of BIS reporting countries,  $DC$  is the set of developing countries,  $L_j^i$  are the liabilities of country  $i$  vis-à-vis country  $j$ .

Tables 2 to 4 show that in 1994 Peru and Paraguay were the only Latin American countries with a 'low' relative dependence on US bank loans. All

the other Latin American countries were receiving no less than 30 per cent of their banking funding from the United States. Analogously, in 1997 many economies of the Asian and Pacific region were highly dependent on Japanese banks and in 1998 most East European countries were largely borrowing from Germany. The most important exception to this geographical pattern is represented by the Philippines. Unlike the other Asian countries, both in December 1997 and in June 2000 the Philippines were mainly exposed vis-à-vis the United States, as most Latin American countries.<sup>16</sup> At the end of June 2000, the relative dependence of Latin American and Asian and Pacific countries had strongly reduced, as these countries have increased the share of liabilities vis-à-vis other industrial countries (especially Germany and Spain). On the contrary, for East European countries, loans from Germany have increased in relative terms, despite the (small) decline in the flows of funds in absolute terms. In Q2 2000, six out of nine East European countries in our sample have raised their dependence on the common lender; for Russia and Ukraine, the weight of their external liabilities vis-à-vis Germany peaked to over 50 per cent.

Absolute dependence show a somewhat different picture. For the major Latin American countries, liabilities vis-à-vis US banks in the crisis year were not particularly large given the dimension of their economy (as measured by the GDP). Liabilities vis-à-vis the main lender were, instead, very important for Thailand, Indonesia, Malaysia, Russia and Hungary – the ratio between total external liabilities and GDP being larger than 10 per cent. In June 2000, absolute dependence was still low in Latin America and had strongly decreased in the Asian and Pacific region. In East Europe, it had increased for most countries, and was still above 10 per cent for Russia and Hungary.

Claims of the common lender vis-à-vis the economies of each area are shown in Tables 5 to 7. The first measure, the ‘relative exposure’ ( $re$ ), is ratio between the common lender’s assets vis-à-vis country  $i$  and its total claims vis-à-vis developing countries. The second, the ‘absolute exposure’ ( $ae$ ), is the ratio between the common lender assets vis-à-vis country  $i$  and the common lender own funds (capital and reserves;  $K_{CL}$ ). Analytically:

$$re_i^{CL} = \frac{A_i^{CL}}{\sum_{j \in DC} A_j^{CL}};$$

$$ae_i^{CL} = \frac{A_i^{CL}}{K_{CL}}.$$

where  $A_i^j$  denotes the claims of country  $j$  vis-à-vis country  $i$  and, of course,

---

<sup>16</sup>Taiwan is also an exception as in Q2 1997 it had a well distributed liabilities’ structure, the weights of its loans vis-à-vis the three main lenders being all equal to 12 per cent.

$A_i^j = L_j^i$ . In the crisis year, the relative exposure of the common lender was a two-digit number for Argentina, Brazil, Mexico, China, Indonesia, South Korea, Thailand and Russia. Interestingly, this set of countries includes the three economies that were first affected by financial distress in each episode. In particular, in the crisis year, the share of loans received by Mexico and Thailand, respectively from US and Japanese banks, both amounted to 23 per cent of the claims of these lenders vis-à-vis developing countries; in Q2 1998, the share of German banks' claims vis-à-vis developing countries received by Russia was only slightly lower (19 per cent).

As for the absolute exposure, the picture in the crisis year was again much worse for the Asian and Pacific region with respect to Latin America and East Europe. For Indonesia, South Korea, Thailand and Taiwan the exposure of the lender was a two-digit number; in Latin America there was no country for which the weight of claims from US were so large and, in East Europe, only claims vis-à-vis Russia were a large share in German banks' assets.

## 5.2 Indexes of vulnerability

Starting from the measures of borrower's dependence and lender's exposure illustrated above, one can construct different indexes of vulnerability to the common lender channel. For instance, Caramazza et al. (2000) multiply the relative dependence of the borrower by the relative exposure of the main lender vis-à-vis that borrower (Index CRS). For each emerging country  $i$ , this index can be formally described as:

$$I_i^{CRS} = rd_{CL}^i re_i^{CL}. \quad (1)$$

This index suffers from two major inconveniencies. A first weakness arises from the fact that it is only based on relative flows. Note that the borrower's relative dependence is high when all its liabilities are due to a single country; however, if these flows are negligible with respect to the magnitude of the borrower's economy, the dependence on the lender should be regarded as negligible as well. Thus a possible refinement of Index CRS consists in using the absolute dependence instead of the relative dependence of the borrower vis-à-vis the common lender. A similar reasoning applies to the common lender's exposure. For instance, it might well happen that the lender's exposure remains unchanged in relative terms, whilst absolute flows increase significantly. Of course the latter case entails a higher risk for contagion, since it implies a larger expected loss for the lender in case of a crisis in  $i$  and, in turn, a higher probability that capital adequacy requirements force the lender to a retrenchment of its credit lines.

The second drawback of Index CRS is due to the fact that it partially disregards the exposure of the main lenders vis-à-vis the *crisis economy*. Note that in the Index CRS, the crisis economy is used only in order to identify the common lender, which is defined as the country that lent the most to the first economy experiencing financial turmoils. However, recall that theory suggests that the common-lender channel is active if two hypotheses hold: the exposure of the lender vis-à-vis the *crisis economy* is large enough to imply an adjustment in its credit lines; the same lender is an important source of funding for many economies. While the latter is taken into account by the measure of dependence, the former is neglected in the Index CRS. Indeed, if the common lender holds a low share of claims vis-à-vis country  $i$ , Index CRS tends to be low (as the second factor in the right hand side of equation (1) is small); nevertheless, a situation in which the common lender is highly exposed vis-à-vis a third country  $h$  entails a high degree of vulnerability to contagion also for country  $i$ : when asset prices collapse in  $h$ , the common lender is likely to withdraw funds also from country  $i$ .

An index that fully takes into account the two sources of vulnerability can be devised as:

$$I_i^1 = ad_{CL}^i ae_{crisis}^{CL},$$

where,  $ae_{crisis}^{CL}$  is the absolute exposure of the common lender vis-à-vis the first country that experienced the crisis.

Index 1 is composed of two factors: the first one differs among all developing countries (the borrower's dependence), the other varies among the main lenders. Hence, the comparison of countries belonging to the same common lender cluster and of countries belonging to different clusters is straightforward. Within clusters, differences are due only to the borrowers' different level of dependence on the common lender; across clusters, they are also due to the different concentration of common lenders' assets.

Since the magnitude of the retrenchment of the credit lines from the common lender depends also on the size of the likely rebalancing, a third factor could be introduced in the index of vulnerability. A first rough measure can be devised as:

$$reb_i^{CL} = \frac{A_i^{CL}}{\sum_{j \in DC} A_j^{CL} - A_{crisis}^{CL}}; \text{ for } i \neq crisis. \quad (2)$$

This factor takes into account the fact that the amount of funds that will be cut from country  $i$  is an increasing function in the amount of funds that the common lender provides to this country and to the crisis country. Therefore,

an index of vulnerability for country  $i$  that includes also a measure of the likely rebalancing can be written as:

$$I_i^2 = ad_{CL}^i ae_{crisis}^{CL} reb_i^{CL}.$$

A final consideration: Index CRS (as well as Index 1 and 2 here proposed) is a measure that requires the knowledge of the ‘ground zero’ country. Then, it can be constructed only *ex-post*; namely, after the crisis has already erupted. In order to obtain an *ex-ante* indicator, the factors in Index 1 and 2 that refer to the crisis economy may be referred to the country for which the exposure of the common lender is the highest. The risk of transmission is, in fact, maximum when the country that first experiences the financial turmoil is the most important debtor of the common lender. In this case, the probability that the crisis forces the lender to re-adjust its lines of credit is large, and thus the probability that the common lender channel of contagion is enabled is high. Analytically, the *ex-ante* version of Index 1 and 2 become:

$$\begin{aligned} I_i^1 &= ad_{CL}^i AE_i^{CL}; \\ I_i^2 &= ad_{CL}^i AE_i^{CL} REB_i^{CL}; \end{aligned}$$

where

$$\begin{aligned} AE_i^{CL} &= \left\{ \max_{h \neq i} \frac{A_h^{CL}}{\sum_{j \in DC} A_j^{CL}} \right\}; \\ REB_i^{CL} &= \frac{A_i^{CL}}{\sum_{j \in DC} A_j^{CL} - \max_{h \neq i} A_h^{CL}}. \end{aligned}$$

Index 1 and 2 would probably overestimate the risks of contagion since they refer to the worst scenario (the ground zero economy is the most “dangerous” for the diffusion of the crisis) but, for the same reason, they could also be more useful for a prudential assessment of the phenomenon.

Tables 8 to 10 report the values of our *ex-ante* indexes and Index CRS for Latin American, Asia Pacific and East European countries, in the crisis year and in Q2 2000. Overall, results are somewhat different on both the magnitude and the ranking of countries’ vulnerability. In particular, note that the introduction of a measure of absolute dependence in Index 1 reduces the level of vulnerability to contagion for countries like Brazil, China and Russia, whose weight of external loans is small with respect to GDP; vulnerability increases, instead, for countries like Bolivia, Philippines, Malaysia and many East Europe countries, which heavily rely on external funds.

In spite of the heterogeneity of the results, some main findings can be singled out. First, all indexes suggest that, in the crisis year, vulnerability was much higher in the Asian and Pacific region than in the other two areas. In particular, note that all indexes take the highest value for Thailand in 1997, denoting the extreme vulnerability of the banking system in this country to a withdrawal of funds from Japan. Second, it is interesting to note that in 1997, when the intensity of the contagion following the devaluation of the Thai baht was most evident, indexes take very large values for four of the five countries mainly involved in the crisis. Here, the Philippines are an exception, since liabilities of the banking system vis-à-vis Japan were low, as the country was mainly indebted to the United States. Finally, according to all indexes, vulnerability to this channel of contagion has sharply declined in Q2 2000 with respect to the crisis year for almost all the countries in our sample. This is probably due to both a more even distribution of liabilities on the part of developing countries and a higher degree of diversification in bank investments of the three main lending countries. Nevertheless, the decline in vulnerability was particularly large for Asian countries – as a result of the sharp reduction of funds from Japan – and somewhat smaller for East European countries.

## 6 Conclusions

The paper identifies three main channels for the international transmission of financial shocks through the banking system. The first channel hinges on the specific lending activity of banks, and is connected with the value of collateral and capital adequacy requirements. When the same institution is the main source of funding for several countries, the increase of non-performing loans following a financial crisis in one of the borrowing economies may induce the common lender to require early repayment of its outstanding credits elsewhere. Similarly, the collapse of the value of debtors' collateral may worsen their creditworthiness and negatively affect the confidence of international lenders.

The second channel of transmission is connected with the function of maturity transformation, which leaves banks vulnerable to *runs*. The indeterminacy of equilibria in bank run models gives rise to two different classes of runs. First, the change in the *information set* due to a crisis in a foreign country may induce depositors in other countries to switch from a good to a bad equilibrium (sunspot) or to update their beliefs about the quality of other banks' assets (wake-up call). Second, the probability of a bank run can be related to the *structure of the economy*. In particular, the probability of a

banking crisis increases with the share of foreign-currency-denominated debt and the level of domestic and international interest rates, and decreases with the maturity of capital inflows. Moreover, in globally integrated financial markets, banks from different economies may form a network of firms (credit chain) through which problems affecting a specific bank of a single country can be transmitted internationally.

Financial shocks can also spread because of moral hazard. The presence of implicit or explicit insurance schemes, confidence in international rescue packages or, simply, the belief that some borrowers are ‘too big to fail’ can provoke excessive capital inflows that banks eventually channel towards risky or unprofitable plans. A banking crisis in a country characterized by such a system of guarantees can undermine the confidence of international investors in the reliability of similar systems, triggering large capital outflows and, eventually, a financial crisis in other countries.

The experience of the most recent crisis episodes suggests that, among others, the presence of a common source of funding strongly favors the transmission of financial shocks. The paper proposes some indexes which measure the degrees of vulnerability to this channel. Such measures do not require the knowledge of the country first affected by a negative shock (‘ground zero’ country), allowing a useful ex-ante risk assessment. In addition, they facilitate both cross-country and over-time comparisons. Focusing on the Mexican, Asian and Russian crises, our analysis shows that the values of the indexes have sharply decreased following each crisis in the three areas involved, reflecting a higher degree of diversification of the sources of funding of developing countries and a lower level of concentration of loans of the main lenders (the US, Japan and Germany).

A statistical analysis of the predictive power of this kind of indicators and their contribution to more traditional sets of variables signaling the fragility of the financial system was beyond the scope of the present work. The empirical evidence reported so far is, however, promising. Preliminary econometric studies reviewed in our work agree on the finding that the probability of a currency crisis increases significantly in the presence of a common lender. Thus, a set of indicators of vulnerability of the financial system should take into account the level of indebtedness vis-à-vis the same lender.

## References

- [1] Allen F., Gale D. (2000), "Financial Contagion", *Journal of Political Economy*, Vol. 108, pp. 1-33.
- [2] Caballero R.J., Krishnamuthy A. (1999), "Emerging Markets Crisis: an Asset Markets Perspective", *IMF Working Paper*, N. 129.
- [3] Calomiris C.W., Kahn C.M. (1996), "The Efficiency of Self-Regulated Payment Systems: Learning from the Suffolk System", *Journal of Money, Credit and Banking*, Vol. 28, 766-797.
- [4] Caramazza F., Ricci L., Salgado R. (2000), "Trade and Financial Contagion in Currency Crises", *IMF Working Paper*, No. 55.
- [5] Chang R., Velasco A. (1998), "Financial Crises in Emerging Markets: a Canonical Model", *NBER Working Paper*, No.6469.
- [6] Chari V.V., Jagannathan R. (1988), "Banking Panics, Information, and Rational Expectations Equilibrium", *Journal of Finance*, Vol. 43, pp. 749-763.
- [7] Chen Y. (1999), "Banking Panics: The Role of the First-Come First-Served Rule and Information Externalities", *Journal of Political Economy*, Vol. 107, pp. 947-968.
- [8] Corsetti G., Pericoli M., Sbracia M. (2000), "The International Transmission of Financial Shocks", Bank of Italy, mimeo.
- [9] Corsetti G., Pericoli M., Sbracia M. (2001), "Correlation Analysis of Financial Contagion: What You Should Know before Running a Test", Bank of Italy, mimeo.
- [10] Corsetti G., Pesenti P., Roubini N. (1999), "Paper Tigers? A Model of the Asian Crisis", *European Economic Review*, Vol.43, pp.1211-1236.
- [11] Demirguc-Kunt A., Detragiache E. (1998), "The Determinants of Banking Crises in Developing and Developed Countries", *IMF Staff Paper*, Vol.45, pp.81-109.
- [12] Demirguc-Kunt A., Detragiache E. (2000), "Does Deposit Insurance Increase Banking System Stability?", *IMF Working Paper*, No.3.
- [13] Diamond D., Dybvig P. (1983), "Bank Runs, Liquidity, and Deposit Insurance", *Journal of Political Economy*, Vol. 91, pp. 401-419.

- [14] Diaz-Alejandro C. (1985), "Good-Bye Financial Repression, Hello Financial Crash", *Journal of Development Economics*, Vol. 19, pp.1-24.
- [15] Eichengreen B., Arteta C. (2000), "Banking Crises in Emerging Markets: Presumptions and Evidence", Center for International and Development Economic Research Working Paper, No.115, University of California, Berkeley.
- [16] Fama E.F. (1980), "Banking in the Theory of Finance", *Journal of Monetary Economics*, Vol. 6, pp. 39-57.
- [17] Freixas X., Giannini C., Hoggarth G., Soussa F. (1999a), "Lender of Last Resort: A Review of the Literature", *Financial Stability Review*, Bank of England, November.
- [18] Freixas X., Parigi B., Rochet J.C. (1999b), "Systemic Risk, Interbank Relations and Liquidity Provision by the Central Bank", *CEPR Discussion Paper*, No.2325.
- [19] Garcia G. (1999), "Deposit Insurance: a Survey of Actual and Best Practices", *IMF Working Paper*, No. 54.
- [20] Giannetti M. (2000), "Banking System, International Investors and Central Bank Policy in Emerging Markets", *Bank of Italy, Temi di Discussione*, No.369.
- [21] Goldfajn I., Valdés R.O. (1997), "Capital Flows and the Twin Crises: The Role of Liquidity", *IMF Working Paper*, No. 87.
- [22] Goldstein I., Pauzner A. (2000), "Endogenous Probability of Bank Runs in a Rational Expectations Model", mimeo.
- [23] Gorton G. (1985a), "Bank Suspension of Convertibility", *Journal of Monetary Economics*, Vol. 15, pp. 177-193.
- [24] Gorton G. (1985b), "Banking Theory and Free Banking History. A Review Essay", *Journal of Monetary Economics*, Vol. 16, pp. 267-276.
- [25] Gorton G. (1988), "Banking Panics and the Business Cycles", *Oxford Economic Papers*, Vol. 40, pp. 751-781.
- [26] Kaminsky G., Reinhart C.M. (1999), "The Twin Crises: the Causes of Banking and Balance of Payment Crises", *American Economic Review*, Vol.89, pp.473-500.

- [27] Kaminsky G., Reinhart C.M. (2000), "On Crises, Contagion, and Confusion", *Journal of International Economics*, forthcoming.
- [28] Kaufman G.G. (1994), "Bank Contagion: A Review of the Theory and Evidence", *Journal of Financial services Research*, Vol. 8, pp. 123-150.
- [29] Kiyotaki N., Moore J. (1997), "Credit Chains", mimeo.
- [30] Lindgren C.J., Garcia G., Saal M.I. (1996), *Bank Soundness and Macroeconomic Policy*, International Monetary Fund, Washington D.C.
- [31] Miller V. (1998), "The Double Drain with a Cross-Border Twist: more on the Relationship between Banking and Currency Crises", *American Economic Review Papers and Proceedings*, Vol. 88, No. 2, pp.439-443.
- [32] Postlewaite A., Vives X. (1987), "Bank Runs as an Equilibrium Phenomenon", *Journal of Political Economy*, Vol. 95, pp. 485-491.
- [33] Rochet J.C., Tirole J. (1996), "Interbank Lending and Systemic Risk", *Journal of Money Credit and Banking*, Vol. 28, No. 2, pp. 733-762.
- [34] Sbracia M., Zaghini A. (2001), "Crises and Contagion: the Role of the Banking System", in *Marrying the Macro- and Micro-Prudential Dimensions of Financial Stability*, Bank for International Settlements, Basel.
- [35] Van Rijckeghem C., Weder B. (1999), "Sources of Contagion: Finance or Trade?", *IMF Working Paper*, N. 146.

## Tables

Table 1. Shares of indebtedness to the US, Japan and Germany

<b>Region:</b>	<b>United States</b>		<b>Japan</b>		<b>Germany</b>	
	<b>Q4 94</b>	<b>Q2 00</b>	<b>Q2 97</b>	<b>Q2 00</b>	<b>Q2 98</b>	<b>Q2 00</b>
<i>Latin America</i>	32.2	24.1	6.0	3.9	13.7	13.2
<i>Asia Pacific</i>	12.4	10.5	35.7	24.3	12.5	15.8
<i>East Europe</i>	3.3	6.8	4.0	2.3	37.6	39.5

Table 2. Relative and absolute dependence: Latin America

<b>Country</b>	<b>Q4 94</b>	<b>Q2 00</b>	<b>Q4 94</b>	<b>Q2 00</b>
	<u>Relative</u>		<u>Absolute</u>	
<i>Argentina</i>	30.7	18.6	4.24	4.44
<i>Bolivia</i>	35.4	22.1	2.12	5.07
<i>Brazil</i>	29.6	26.4	2.73	2.76
<i>Chile</i>	31.6	20.4	7.69	5.92
<i>Colombia</i>	29.8	21.8	3.75	3.18
<i>Mexico</i>	38.5	29.6	5.92	3.05
<i>Peru</i>	16.5	14.8	1.01	3.24
<i>Paraguay</i>	13.0	10.5	1.30	1.16
<i>Uruguay</i>	36.5	25.1	7.28	5.65
<i>Venezuela</i>	33.9	27.3	7.94	3.61

Table 3. Relative and absolute dependence: Asia Pacific

<b>Country</b>	<b>Q2 97</b>	<b>Q2 00</b>	<b>Q2 97</b>	<b>Q2 00</b>
	<u>Relative</u>		<u>Absolute</u>	
<i>China</i>	36.0	21.9	2.30	1.25
<i>Indonesia</i>	41.7	29.2	11.3	6.24
<i>India</i>	22.8	15.6	1.03	0.65
<i>Malaysia</i>	37.5	34.3	10.8	7.05
<i>Philippines</i>	15.7	20.9	2.61	4.19
<i>South Korea</i>	33.4	24.1	7.30	3.00
<i>Thailand</i>	55.8	39.8	25.8	8.09
<i>Taiwan</i>	13.0	18.6	1.13	1.18

Table 4. Relative and absolute dependence: East Europe

<b>Country</b>	<b>Q2 98</b>	<b>Q2 00</b>	<b>Q2 98</b>	<b>Q2 00</b>
	<u>Relative</u>		<u>Absolute</u>	
<i>Bulgaria</i>	33.2	25.7	3.79	2.46
<i>Czech Rep.</i>	43.4	44.5	8.78	8.23
<i>Hungary</i>	43.4	44.4	13.6	14.1
<i>Poland</i>	26.5	35.6	2.05	3.65
<i>Romania</i>	32.6	25.8	2.50	2.54
<i>Russia</i>	43.4	54.4	11.8	11.6
<i>Slovak Rep.</i>	27.5	25.9	7.53	6.12
<i>Turkey</i>	26.8	30.8	4.63	6.01
<i>Ukraine</i>	44.8	50.3	1.31	1.73

Table 5. US exposure vis-à-vis Latin America

Country	Q4 94	Q2 00	Q4 94	Q2 00
	Relative		Absolute	
Argentina	10.1	10.6	3.52	2.71
Bolivia	0.12	0.37	0.04	0.09
Brazil	13.8	14.7	4.80	3.75
Chile	3.62	3.78	1.26	0.96
Colombia	2.77	2.25	0.96	0.57
Mexico	23.0	14.6	8.01	3.73
Peru	0.47	1.61	0.16	0.41
Paraguay	0.09	0.07	0.03	0.02
Uruguay	1.18	1.08	0.41	0.28
Venezuela	4.29	3.23	1.49	0.82

Table 6. Japanese exposure vis-à-vis Asia Pacific

Country	Q2 97	Q2 00	Q2 97	Q2 00
	Relative		Absolute	
China	12.4	14.9	12.9	4.61
Indonesia	14.6	13.1	15.2	4.05
India	2.55	3.62	2.66	1.12
Malaysia	6.42	6.68	6.70	2.06
Philippines	1.41	3.61	1.47	1.11
South Korea	20.7	16.4	21.6	5.05
Thailand	23.0	12.9	24.0	3.97
Taiwan	1.94	4.00	2.03	1.23

Table 7. German exposure vis-à-vis East Europe

Country	Q2 98	Q2 00	Q2 98	Q2 00
	Relative		Absolute	
Bulgaria	0.26	0.19	0.26	0.19
Czech Rep.	2.78	2.41	2.78	2.41
Hungary	3.65	4.14	3.65	4.14
Poland	1.86	3.58	1.86	3.58
Romania	0.59	0.40	0.59	0.40
Russia	18.7	13.9	18.7	13.9
Slovak Rep.	0.87	0.73	0.87	0.73
Turkey	5.22	7.54	5.22	7.54
Ukraine	0.38	0.28	0.38	0.28

Table 8. Indexes of vulnerability: Latin America

<b>Country</b>	<b>Q4 94</b>	<b>Q2 00</b>	<b>Q4 94</b>	<b>Q2 00</b>	<b>Q4 94</b>	<b>Q2 00</b>
	<u>Index CRS</u>		<u>Index 1</u>		<u>Index 2</u>	
<i>Argentina</i>	311	198	33.9	16.6	4.46	2.07
<i>Bolivia</i>	4.2	8.1	17.0	19.0	0.03	0.08
<i>Brazil</i>	408	389	21.9	10.3	3.92	1.77
<i>Chile</i>	114	77	61.6	22.2	2.90	0.98
<i>Colombia</i>	82	49	30.0	11.9	1.08	0.31
<i>Mexico</i>	887	433	28.4	11.4	7.59	1.96
<i>Peru</i>	7.7	24	8.1	12.1	0.49	0.23
<i>Paraguay</i>	1.2	0.8	10.4	4.3	0.01	0.01
<i>Uruguay</i>	43	27	58.3	21.2	0.89	0.27
<i>Venezuela</i>	146	88	63.6	13.5	3.54	0.51

Table 9. Indexes of vulnerability: Asia Pacific

<b>Country</b>	<b>Q2 97</b>	<b>Q2 00</b>	<b>Q2 97</b>	<b>Q2 00</b>	<b>Q2 97</b>	<b>Q2 00</b>
	<u>Index CRS</u>		<u>Index 1</u>		<u>Index 2</u>	
<i>China</i>	444	327	55	6.3	8.85	1.13
<i>Indonesia</i>	607	383	272	32	51.5	4.94
<i>India</i>	58	56	25	3.3	0.82	0.14
<i>Malaysia</i>	240	229	258	36	21.6	2.84
<i>Philippines</i>	22	75	63	21	1.14	0.91
<i>South Korea</i>	689	393	175	14	47.0	2.66
<i>Thailand</i>	1282	511	556	41	161	6.27
<i>Taiwan</i>	25	74	27	6.0	0.68	0.29

Table 10. Indexes of vulnerability: East Europe

<b>Country</b>	<b>Q2 98</b>	<b>Q2 00</b>	<b>Q2 98</b>	<b>Q2 00</b>	<b>Q2 98</b>	<b>Q2 00</b>
	<u>Index CRS</u>		<u>Index 1</u>		<u>Index 2</u>	
<i>Bulgaria</i>	8.8	4.8	65	30	0.21	0.07
<i>Czech Rep.</i>	121	107	150	100	5.12	2.78
<i>Hungary</i>	158	184	231	171	10.4	8.23
<i>Poland</i>	49	127	35	44	0.80	1.83
<i>Romania</i>	19	10	43	31	0.31	0.14
<i>Russia</i>	811	757	56	76	11.1	11.4
<i>Slovak Rep.</i>	24	19	128	74	1.38	0.62
<i>Turkey</i>	140	232	79	73	5.06	6.37
<i>Ukraine</i>	17	14	22	21	0.11	0.07