

International Journal of Finance and Economics

*Int. J. Fin. Econ.* 4: 313-323 (1999)

## Twin Crises and the Intermediary Role of Banks

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Banking and balance of payments crises often happen simultaneously. We show that the impact of a devaluation on the net worth of commercial banks with a short open foreign exchange position speeds up the timing of a balance of payments crisis. In an asymmetric information framework, domestic commercial banks have to pay a positive risk premium on the international capital market which is determined by their net worth. Some stylized facts from selected crises episodes are presented in order to gauge the empirical relevance of the effects that have been stressed in the model. Copyright © 1999 John Wiley & Sons, Ltd.

**KEY WORDS:** Asia; balance of payment crises; banking crises; Mexico; speculative attack; transition economies

### SUMMARY

Simultaneous banking and balance of payments crises, i.e. twin crises, have occurred in many developing and transition economies. This paper shows that twin crises can arise if banks' net worth is determined endogenously by the balance of payments situation. More specifically, an expected devaluation lowers the net worth of commercial banks with a short open foreign exchange position. If banks' net worth declines, the borrowing capacity of banks falls, and a balance of payments crisis is speeded up. In addition, a negative shock to the return on commercial banks' domestic lending would raise the risk premium that banks have to pay on international markets and reduce

the time until the collapse of a fixed exchange rate regime.

There are thus two ways of viewing the links between banking and balance of payments crises. As in the traditional literature, pegged exchange rates which are inconsistent with domestic fundamentals can cause twin crises. Yet, twin crises can also ensue in the absence of macroeconomic disequilibria if a negative shock reduces the net worth of domestic financial institutions. Such a negative shock could be an increase in non-performing loans of commercial banks, a sudden decline in asset prices, or the withdrawal of a government guarantee to bail out distressed commercial banks. The resulting decline in the expected return on domestic lending would reduce the net worth of commercial banks, increase the risk premium, and lead to a decline in foreign borrowing. This, in turn, would speed up the collapse of a fixed exchange rate regime.

Apart from the need to make external financial liberalization an integral part of a consistent reform package, the most important policy

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JEL Code: F31; F36.

CCC 1076-9307/99/040313-11\$17.50

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conclusion is to monitor the short open foreign exchange position of banks. One way to reduce feedback effects between banking and balance of payments crises could be to restrict cross-border capital movements. However, this would have the adverse effects of shielding domestic commercial banks from foreign competition and of restricting investment to domestic savings. Likewise, our results lead us to caution against the introduction of minimum reserve requirements on foreign borrowing because these may speed up rather than delay a foreign exchange crisis. A similar argument would apply to other regulations which raise the costs of borrowing from abroad. Hence, the potential positive welfare implications of such regulations must outweigh their negative implications for the timing of a foreign exchange crisis.

The empirical evidence reviewed in the paper shows that commercial banks' short open foreign exchange position has widened prior to the currency crises analysed and that reduced foreign lending during balance of payments crises has come mainly through reduced foreign loans to commercial banks. Recently, foreign borrowing of commercial banks has increased particularly in some transition economies of Central and Eastern Europe. Should a new balance of payments crisis strike in these economies, it has thus grown more likely that it would feed back into their banking systems. In fact, the severe financial and economic crisis that has beleaguered Russia since August 1998 has closely followed the pattern described in this paper.

## INTRODUCTION

Simultaneous banking and balance of payments crises, i.e. twin crises, have occurred in many developing and transition economies (Kaminsky and Reinhard, 1996). The theoretical literature offers a number of insights into the possible common causes of these crises. Papers modeling causality that runs from banking crises to balance of payments crises assume usually that banks are covered by automatic deposit insurance.<sup>1</sup> In these papers, a banking crisis feeds through to the balance of payments as a bail-out of ailing banks is financed by money creation which undermines the exchange rate peg (Velasco, 1987; Calvo, 1995).

Yet, these models are unable to account for episodes such as the recent crises in Asia, where the monetization of fiscal deficits on the eve of the crises was uncommon, and where large-scale bail-outs, if any, occurred only after the currencies had been attacked. Krugman (1998) accounts for this by arguing that balance of payments crises were triggered as governments reneged on their implicit promises to bail out ailing financial institutions and as investors took flight. Obstfeld (1994) models causality running from balance of payments to banking crises by arguing that a speculative attack on the currency can cause bank insolvencies if banks finance their operations domestically and are unable to pass along interest rate hikes fully to their customers.

The present paper contributes to this literature in three ways. It allows for causality to run both ways and for the two types of crises to reinforce each other. Moreover, it demonstrates how a banking crisis can feed through to the balance of payments without the banks being bailed out by the government. Finally, the model highlights the major role banks have been playing as importers of capital in the run-up to many twin crises.

The paper shows that twin crises can arise if banks' net worth is determined endogenously by the balance of payments situation. More specifically, an expected devaluation lowers the net worth of commercial banks with a short open foreign exchange position. If banks' net worth declines, the borrowing capacity of banks falls, and a balance of payments crisis is speeded up. In addition, a negative shock to the return on commercial banks' domestic lending would raise the risk premium that banks have to pay on international markets and reduce the time until the collapse of a fixed exchange rate regime. The results of this paper caution against the introduction of minimum reserve requirements on foreign loans as these may speed up the collapse of a fixed exchange rate regime rather than enhancing its sustainability.

A similar argument is applied in Miller (1998) to spillovers of currency crises in one country into a banking crisis abroad.<sup>2</sup> Moreover, Goldfajn and Valdés (1997) have a model where causality can run both ways, where a banking crisis can feed through to the balance of payments without a government bail-out, and where banks are

modeled as importers of capital. However, while Goldfajn and Valdés stress the feedback effect that uncertainty about liquidity needs can have for the balance of payments, this paper stresses the solvency problem of commercial banks.

The following second section of the paper introduces the model and derives the analytical results. The next section confronts the findings of the model with some stylized facts from selected crisis episodes in order to gauge the empirical relevance of the effects that have been stressed in the model. The final section concludes.

## A MODEL OF TWIN CRISES

In the following, balance of payments crises are modeled as speculative attacks which lead to a loss of foreign exchange reserves and end in forced currency devaluations. Banking crises are modeled as sharp declines in the net worth of the commercial banking system.

The model has six types of financial assets: domestic and foreign cash, domestic government bonds, foreign bonds, foreign loans to domestic banks, and domestic bank loans to domestic enterprises.<sup>3</sup> The government finances its exogenous primary deficit  $\dot{D}_t = \mu$  by issuing bonds bought up by the central bank. In the initial period,  $n$  identical domestic commercial banks raise foreign currency loans of infinite maturity by the amount of  $nF/\bar{s}$  from abroad. Subsequently, they exchange the foreign for domestic currency at the central bank's fixed exchange rate  $\bar{s}$ . Domestic money supply is the sum of the stock of foreign reserves  $R_t$  and of the accumulated government deficits  $D_t$ .<sup>4</sup>

$$M_t^s = D_t + R_t, \quad (1)$$

where  $R_0 = nF$ .

Banks use the domestic cash they obtain from the central bank in the initial period to extend domestic currency loans of infinite maturity to domestic enterprises. Domestic households diversify their portfolios between domestic cash and foreign assets.<sup>5</sup> Their demand for domestic cash depends linearly on the opportunity cost of holding foreign assets  $i^* + \dot{s}_t^e/s_t$ , where  $i^*$  is the exogenous foreign interest rate and  $\dot{s}_t^e/s_t$  is the expected rate of depreciation of the domestic currency.

Thus, assuming absolute purchasing power parity and normalizing the foreign price level to unity, real money demand of domestic enterprises and households is:

$$\frac{M_t^D}{s_t} = a_0 - a_1 \left( i_t^* + \frac{\dot{s}_t^e}{s_t} \right) + \frac{nF}{s_t} \quad a_0, a_1 > 0. \quad (2)$$

As long as the fixed exchange rate regime is credible, real money demand remains constant. Hence, money market equilibrium requires that the constant increase  $\mu$  in the domestic component of money supply must be compensated in every period by a corresponding decline in foreign reserves. As reserves are depleted, the fixed exchange rate regime collapses eventually under a speculative attack, and the exchange rate adjusts to its floating rate equilibrium level. By imposing a smooth-pasting condition as in Flood and Garber (1984), the point in time when the fixed exchange rate regime collapses can be derived as:

$$\bar{t} = \frac{nF}{\mu} - \frac{a_1}{\alpha}, \quad (3)$$

where  $\alpha = a_0 - a_1 i^*$ . As is readily seen, the time period until a speculative attack occurs and until the fixed exchange rate collapses is decreasing in the rate of monetary expansion, i.e. in the amount of deficit financing through the monetary authorities, and in the interest sensitivity of money demand. It is increasing in the volume of foreign reserves of the central bank, which in turn depends positively on the amount of bank borrowing abroad.

So far, the inflow of foreign capital has been treated as exogenous. Now, the intermediary role of domestic banks is taken into account explicitly, and their decision to borrow from abroad and to lend at home is modeled.<sup>6</sup> Due to asymmetries of information, domestic enterprises can access the international capital market only through commercial banks. Interest on both foreign and domestic loans is payable at rates fixed in the initial period. In addition to the foreign interest rate, the domestic currency cost of the foreign loan depends also on the rate of exchange rate depreciation and on a risk premium,  $rp$ . The risk premium reflects the fact that the return on domestic lending is stochastic, and that

foreign lenders face a positive probability of receiving less than their contractually agreed return.

The representative bank's net worth equals the present value of its expected profit:

$$\begin{aligned}
 E[\Pi] = & F(i_L - i^* - rp) \int_0^{\bar{t}} e^{-i^*t} dt \\
 & + Fi_L e^{-i^*\bar{t}} \int_{\bar{t}}^{\infty} e^{-\int_{\bar{t}}^t i^* + \frac{s_j}{s} dj} dt \\
 & - F(i^* + rp) e^{-i^*\bar{t}} \int_{\bar{t}}^{\infty} \frac{s_t}{s} e^{-\int_{\bar{t}}^t i^* + \frac{s_j}{s} dj} dt - K,
 \end{aligned} \tag{4}$$

where  $i_L = i_L(F)$  is the expected return on domestic lending,  $K$  is a fixed cost of financial intermediation such as information costs, and the exponential integrals reflect the fact that the discount factor varies with changes in the expected rate of devaluation. The risk premium that the bank has to pay on the international market is assumed to be related negatively to its net worth and thus to expected profits<sup>7</sup>  $\partial rp/\partial E(\Pi) = rp' < 0$ . We thus follow Bernanke *et al.* (1994) who argue that in the presence of asymmetric information about the quality of borrowers, the net worth of a (financial) firm is an important determinant of its borrowing capacity. A negative shock and (expectations of) an exchange rate depreciation have a negative impact on the net worth of banks and thus on their ability to borrow abroad.

Domestic commercial banks behave as Cournot oligopolists, charging a mark-up over their costs. In the initial period, the representative bank forms expectations about the future path of the exchange rate and about the collapse time. Because the loans it extends are denominated in domestic currency, the bank incurs a short open foreign exchange position. If the exchange rate depreciates, the profit of the bank declines, and, all banks being identical, a banking crisis may ensue.<sup>8</sup> The bank maximizes profits by choosing appropriately the volume of its activities  $F$ , taking the foreign interest rate and the responses of other banks as given. Assuming for simplicity that the individual bank ignores the effect of its decisions on the timing of the collapse and on the exchange rate that prevails after the collapse, first and second order conditions for a profit maximum are:

$$\begin{aligned}
 \frac{\partial E[\Pi]}{\partial F} = & \left( i_L + F \frac{\partial i_L}{\partial F} - i^* - rp \right) \int_0^{\bar{t}} e^{-i^*t} dt \\
 & + e^{-i^*\bar{t}} \left[ \left( i_L + F \frac{\partial i_L}{\partial F} \right) \int_{\bar{t}}^{\infty} e^{-A_t} dt \right. \\
 & \left. - \frac{i^* + rp}{s} \int_{\bar{t}}^{\infty} s_t e^{-A_t} dt \right] = 0, \\
 \frac{\partial^2 E[\Pi]}{\partial F^2} < & 0,
 \end{aligned} \tag{5}$$

where

$$A_t = \int_{\bar{t}}^t i^* + \frac{s_j}{s} dj.$$

The following comparative static analysis focuses on the effect of a decline in the expected return on domestic lending and on its negative effect on the balance of payments. Essentially, the same comparative static effect would obtain if foreign lenders raised the risk premium because they lost confidence in a government bail-out of domestic banks or because they learned new information about the true net indebtedness of domestic banks. The response  $\partial F^*/\partial i_L$  in the optimal amount of foreign borrowing to a decline in the expected return is determined by:

$$\begin{aligned}
 E[\Pi]_{Fi_L} = & \left( \int_0^{\bar{t}} e^{-i^*t} dt + e^{-i^*\bar{t}} \int_{\bar{t}}^{\infty} e^{-A_t} dt \right) \\
 & \cdot \left[ 1 - rp'F \left( \int_0^{\bar{t}} e^{-i^*t} dt + \frac{e^{-i^*\bar{t}}}{s} \int_{\bar{t}}^{\infty} s_t e^{-A_t} dt \right) \right] > 0.
 \end{aligned} \tag{6}$$

From (3) we know that a decline in foreign borrowing speeds up the collapse:

$$\frac{\partial \bar{t}}{\partial i_L} = \frac{\partial \bar{t}}{\partial F} \frac{\partial F}{\partial i_L} > 0. \tag{7}$$

Hence, an exogenous fall in the expected return on domestic lending speeds up the collapse of the fixed exchange rate even in the absence of a bank bail-out which would fuel money supply.<sup>9</sup> If the fall in expected domestic returns is interpreted as a fall in asset prices as in Krugman (1998), it can thus be shown how such a negative exogenous shock to the domestic banking system can trigger a balance of payments crisis.<sup>10</sup>

One policy option to cut the link between banking and balance of payments crises would be a





(non-interest bearing) minimum reserve requirement  $r$  on foreign loans. The bank's profit function (4) and the first order condition (5) would then become:

$$E[\Pi] = F \cdot \left[ (i_L(1-r) - i^* - rp) \int_0^{\bar{t}} e^{-i^*t} dt + e^{-i^*\bar{t}} \left( i_L(1-r) \int_{\bar{t}}^{\infty} e^{-A_t} dt - \frac{i^* + rp}{s} \int_{\bar{t}}^{\infty} s_t e^{-A_t} dt \right) \right] - K \quad (4.1)$$

and

$$\frac{\partial E[\Pi]}{\partial F} = \left[ \left( i_L + F \frac{\partial i_L}{\partial F} \right) (1-r) - i^* - rp \right] \int_0^{\bar{t}} e^{-i^*t} dt + e^{-i^*\bar{t}} \left[ \left( i_L + F \frac{\partial i_L}{\partial F} \right) (1-r) \int_{\bar{t}}^{\infty} e^{-A_t} dt - \frac{i^* + rp}{s} \int_{\bar{t}}^{\infty} s_t e^{-A_t} dt \right] = 0. \quad (5.1)$$

The response  $\partial F^*/\partial r$  of the optimal demand for foreign loans to an increase in the reserve requirement is determined by:

$$E[\Pi]_{Fr} = -i_L \left[ \left( 1 + \frac{1}{\varepsilon(L, i_L)} \right) - rp \left( \int_0^{\bar{t}} e^{-i^*t} dt + \frac{e^{-i^*\bar{t}}}{s} \int_{\bar{t}}^{\infty} s_t e^{-A_t} dt \right) \right] \times \left( \int_0^{\bar{t}} e^{-i^*t} dt + e^{-i^*\bar{t}} \int_{\bar{t}}^{\infty} e^{-A_t} dt \right) - \frac{\partial rp}{\partial r} \left( \int_0^{\bar{t}} e^{-i^*t} dt + \frac{e^{-i^*\bar{t}}}{s} \int_{\bar{t}}^{\infty} s_t e^{-A_t} dt \right), \quad (8)$$

with the first term of (8) being negative if, at the bank's optimal loan supply, the demand for loans is interest elastic  $\varepsilon(L, i_L) < -1$ ,<sup>11</sup> and the second term being positive if the risk premium declines when the reserve requirement increases. Hence, introducing a reserve requirement has two opposing effects on the amount of foreign borrowing (and thus on the collapse time). On the one hand, the return on domestic lending would decline, causing a reduction in borrowing. On the other hand, the risk premium would decline, causing an increase in borrowing. Assuming that the first effect dominates, it can thus not be ruled out that the introduction of a reserve requirement would

speed up the collapse of a foreign exchange regime, rather than enhancing its sustainability. Hence, if the case for such regulations is made in a framework which—unlike ours—assumes market imperfections, the positive welfare implications of regulations must outweigh their potential negative implications for the timing of a foreign exchange crisis.<sup>12</sup>

## CASE STUDIES

This section assesses the empirical relevance of the feedback effects between banking and balance of payments crises that have been highlighted above. Selected evidence from three crises episodes in Asia, Mexico, and Central and Eastern Europe is presented. According to the theoretical framework, the negative impact of a devaluation on the net worth of commercial banks which have a short open foreign exchange position speeds up the timing of a balance of payments crisis. This feedback effect will be particularly important in countries where the banking system has had a sizable open foreign exchange position and where the banking system has played an important role as an importer of foreign capital.

Changes in the net worth of commercial banks cannot be observed and related to developments in the balance of payments directly. Indirect evidence on the share of commercial banks in foreign borrowing, on changes in commercial banks' foreign liabilities during crises episodes, and on the exposure of banks to foreign exchange rate risk is thus being presented in the following. The analysis draws on data on the foreign liabilities *vis-à-vis* commercial banks in the reporting area of the Bank of International Settlements (BIS). When analysing these data, the following caveats should be borne in mind. *First*, data on foreign direct investment, on portfolio investment in the banking sector, and on liabilities towards non-banks are not included. However, this restriction seems justified because the above model has focused on private capital flows, because borrowing of banks from non-banks is of minor importance, and because inflows of FDI and of portfolio capital are to some extent determined by factors other than those determining inflows of foreign loans. *Second*, flows have to be calculated on the basis of changes

in stocks, and data on net foreign liabilities are not available. *Third*, in order to determine the total effect of changes in banks' net worth on the borrowing capacity of an economy, it would be necessary to take into account the liabilities that commercial banks assume indirectly by guaranteeing loans of the corporate sector. However, data on such guarantees have not been available.

While the share of banks in total foreign liabilities gives an idea of the effects running from banking to balance of payments crises, looking at the foreign exchange exposure of banks allows an analysis of the reverse feedback channel. Hence, the data on the structure of foreign liabilities are supplemented by information on net foreign assets of commercial banks as provided in the International Financial Statistics of the International Monetary Fund. Net foreign assets are defined as the difference between total foreign currency assets and foreign currency liabilities, expressed in domestic currency terms. If assets exceed liabilities, a bank has a long open position in foreign currency: a devaluation of the domestic currency raises the value of its net foreign assets. Conversely, a devaluation raises net liabilities if a bank has a short open position. Note that these aggregated data give an incomplete picture of the foreign exchange exposure of commercial banks because the maturity structure and the currency structure of foreign assets and liabilities are not considered. Also, the data do not show whether banks have hedged their foreign currency risk through, for example, forward contracts.

### Asia

The recent crisis episodes of Asia are prime examples of twin crises. In 1997, exchange rate pegs *vis-à-vis* the US-dollar had to be given up, and the currencies of Indonesia, Korea, and Thailand lost about 50% of their value in nominal terms. Central bank reserves shrank by 35% on average in Thailand and Korea and by 9% in Indonesia (International Monetary Fund (IMF), 1998). These balance of payments crises have been accompanied by severe problems in the commercial banking systems: nonperforming loans are estimated at about 35% of gross domestic product (GDP) in Indonesia and Korea and

60% in Thailand, which puts the interest costs of bank recapitalization alone at about 5% of GDP (Deutsche Bank Research, 1998: 3). Consequently, ratings of banks in the countries under review were revised downward (Table 1), which has worsened the terms under which Asian banks can raise funds from abroad.

Net foreign assets of Asian commercial banks had declined substantially prior to the balance of payments crisis of 1997 (Table 2).<sup>13</sup> Foreign borrowing of Asian commercial banks has also been reflected in their high share in foreign loans. At the end of 1997, Asian banks held a 44% share in total foreign liabilities of the region as a whole, which was substantially higher than the share of Latin American banks (24%) but less than that of banks in the advanced transition economies of Eastern Europe (53%) (BIS, 1998). This suggests a potentially strong feedback effect between banking and balance of payments problems at least for the transition and the Asian economies.

Table 3 looks at the developments in foreign borrowing around crises episodes in more detail. For Asia, the sample has been split into two periods, the first ending in mid-1997, and the contribution of banks to *changes* in total liabilities has then been calculated. Before the crises, 46% of the increase in Asia's liabilities were loans raised by banks. Overall, total capital inflows into the Asian economies intermediated by the banking systems have been estimated at more than 4% of GDP for the years 1995 and 1996 (Chote, 1998: 7). Yet, these aggregated data cloud significant differences between countries. Borrowing of commercial banks was more important in South Korea (67.3%) than in Thailand (39.9%) and in Indonesia (21.1%). During the crises, however, changes in foreign liabilities of commercial banks played a decisive role throughout the region as the fall in foreign liabilities in the second half of 1997 has been caused mainly by a decline in loans to banks. The withdrawal of funds from Asian banks as a result of increased uncertainty about the soundness of the banking system was even accompanied by increased lending to non-banks (BIS, 1998). At least in Thailand, capital imports through commercial banks already declined prior to the crisis when the country was still a net capital importer (Buch and Heinrich, 1998).

Table 1. Credit ratings of banks before and after the twin crises of 1997

	Number of banks					
	March 1997			March 1998		
	Total	Rated BB or worse	Negative outlook <sup>a</sup>	Total	Rated BB or worse	Negative outlook <sup>a</sup>
Czech Republic <sup>b</sup>	3	0	0 (3)	3	0	3 (3)
Indonesia						
National currency	16	11	0 (4)	15	15	5 (5)
Foreign currency	3	3	0 (4)	6	5	5 (5)
Korea						
National currency	7	0	3 (6)	11	5	5 (7)
Foreign currency	9	0	3 (9)	9	9	0 (9)
Thailand						
National currency	9	1	0 (5)	10	3	5 (5)
Foreign currency	7	1	0 (6)	6	1	6 (6)

A BB-rating has been chosen as a cut-off criterion because Standard & Poor's regards obligors rated BB, B, CCC, and CC as having significant speculative characteristics (see <http://www.ratings.com/corporates/index.htm>). For the Asian countries, double counting occurs because some banks are assigned a rating both in national and in foreign currency.

<sup>a</sup> Banks assigned 'negative' or 'watch negative' (in brackets: total number of banks assigned a rating outlook).

<sup>b</sup> National and foreign currency.

Source: Standard & Poor (1997, 1998); authors' calculations.

### Mexico

Just as the Asian financial crises, the Mexican currency crisis of 1995 had been preceded and accompanied by a loss in profitability of the banking system and by an increase in non-performing loans (OECD, 1997; Ortiz Martinez, 1998: 8). In addition, Mexican banks had raised quite substantial amounts of foreign loans from abroad. Prior to the crisis, Mexican banks accounted for 77.3% of the increase in total foreign liabilities. During and after the crisis, Mexican banks were important exporters of capital. In the immediate aftermath of the crisis in the first half of 1995, foreign loans to Mexico declined by 5.4 billion US-dollar, and

about two thirds of this decline was the result of reduced lending to Mexican banks (BIS, 1996: 5).

At first sight, it may look as if the exposure of Mexican banks to foreign exchange risks had been fairly small and unchanged prior to the crisis of 1995 (Table 2). Yet, as Mishkin (1997) argues, commercial banks' net worth was affected negatively by the depreciation of the peso. The devaluation increased sharply the value of foreign liabilities of commercial banks. Even if the banks had matching foreign currency assets, they were often not hedged against exchange rate risk because of the credit risk involved. Also, banks with short-term liabilities and long-term assets were exposed to liquidity risk.

Table 2. Net foreign assets of commercial banks 1989–1997 (end of period, in percent of total assets)

	1989	1990	1991	1992	1993	1994	1995	1996	1997
Czech Republic	—	—	—	—	4.8	2.5	-3.7	-3.5	3.2
Hungary	0.2	2.1	2.4	2.2	1.8	-0.8	-2.1	—	—
Indonesia	9.0	-0.8	-0.6	-2.0	-4.8	-5.3	-3.5	-2.6	—
Korea	-1.3	-0.4	-1.7	-0.9	0.6	-0.1	-1.1	-2.6	2.1
Mexico	2.4	-0.5	-3.3	-2.5	-3.2	-3.4	-1.4	-1.1	-0.6
Thailand	-1.1	-3.1	-2.5	-3.7	-6.5	-15.9	-19.4	-19.9	-20.7

Net foreign assets = (foreign assets - foreign liabilities)/total assets.

Source: IMF (1998); authors' calculations.

Table 3. Change in foreign liabilities during twin crises (billion US-dollar)

	Before crisis <sup>a</sup>	During and after crisis <sup>b</sup>
<b>Asia</b>		
Change in total liabilities	279.4	-9.5
Change in banks' liabilities	128.7	-17.1
Share of banks (%)	46.0	180.5
<b>South Korea</b>		
Change in total liabilities	73.3	-9.9
Change in banks' liabilities	49.3	-12.0
Share of banks (%)	67.3	121.4
<b>Indonesia</b>		
Change in total liabilities	58.7	-0.30
Change in banks' liabilities	12.4	-0.6
Share of banks (%)	21.1	215.8
<b>Thailand</b>		
Change in total liabilities	52.6	-10.6
Change in banks' liabilities	21.0	-8.3
Share of banks (%)	39.9	78.6
<b>Czech Republic</b>		
Change in total liabilities	11.4	-0.6
Change in banks' liabilities	7.3	-1.0
Share of banks (%)	63.6	171.6
<b>Mexico</b>		
Change in total liabilities	12.4	-2.8
Change in banks' liabilities	9.6	-3.1
Share of banks (%)	77.3	112.0

<sup>a</sup> 1991:6-1997:6 for Asia and the Czech Republic, 1991:6-1994:12 for Mexico.

<sup>b</sup> 1997:6-1997:12 for Asia and the Czech Republic, 1994:12-1997:12 for Mexico.

Source: BIS (various issues); BIS (1998); authors' calculations.

### Central Europe

Both the currency crises of Asia and of Mexico have spilled over into the emerging market economies of Central and Eastern Europe. In the aftermath of the Mexican crisis of 1995, Hungary experienced balance of payments problems which led to a 20% devaluation of the forint. This crisis had been preceded by substantial problems in the domestic banking system which necessitated three rounds of bank recapitalization in the years 1993 through 1994 (Buch, 1996). In the Czech Republic, the banking sector has been recapitalized partially since 1991 but continues to suffer from sizable non-performing loans. These weaknesses in the banking system as well as in corporate governance have contributed to the infection of the Czech

economy with the Asian flu in 1997. In May 1997, following substantial losses of currency reserves, the central bank was forced to abandon the exchange rate target which had been in place since the beginning of reforms in 1991 (Buch and Heinrich, 1997).

Following the opening up to foreign capital during the past decade, commercial banks in transition economies have become important channels of foreign loans. As has been noted above, the share of commercial banks in foreign liabilities exceeded values observed in Asia or Latin America at the end of 1997. The intermediary role of commercial banks for foreign loans has been particularly important in the Czech Republic. Net foreign assets of Czech commercial banks had declined continuously in the years prior to the currency crises of 1997 (Table 3). As in Korea, they rebounded at the end of 1997, being driven mainly by an increase in gross foreign assets. Likewise, net foreign assets of Hungarian banks had turned negative prior to the 1995-crisis.

As has been the case during earlier crises episodes, capital imports through commercial banks declined during the twin crisis in the Czech Republic (Table 3), as credit ratings of commercial banks were adjusted downwards (Table 1). Overall, the decline in foreign liabilities in the second half of 1997 was more than accounted for by reduced lending to commercial banks. Moreover, balance of payments data show that net capital exports of Czech commercial banks preceded the currency crisis of May 1997.

In summary, the empirical evidence lends support to the hypotheses of our model. Balance of payments problems of Asian countries have been accompanied by a decline in lending to commercial banks. Similar observations could be made for Mexico and Hungary in 1995 and for the Czech Republic in 1997. While the decline in lending to commercial banks seems to have preceded balance of payments problems, the available evidence does not allow to draw strong conclusions about the sequence of events.

### CONCLUSIONS

This paper has given one explanation for the empirical observation that banking and balance of



payments crises often occur simultaneously. It has focused on the fact that the net worth of domestic banks which borrow internationally and lend domestically is affected negatively by exchange rate changes. A decline in banks' net worth, in turn, raises the risk premium that banks have to pay on the international capital market and lowers the amount of foreign borrowing. Hence, the collapse of a fixed exchange rate regime is speeded up. Adverse shocks to domestic fundamentals such as a decline in the expected return on domestic lending, an increase in non-performing loans, or an increase in the government deficit could lead to a foreign exchange crisis.

There are two ways of viewing the links between banking and balance of payments crises. As in the traditional literature, pegged exchange rates which are inconsistent with domestic fundamentals can cause twin crises, even more so because they may induce banks not to take exchange rate risks into account and thus to borrow excessively. Yet, twin crises can also ensue in the absence of macroeconomic disequilibria if a negative shock reduces the net worth of domestic financial institutions. Such a negative shock could be an increase in non-performing loans of commercial banks, a sudden decline in asset prices, or the withdrawal of a government guarantee to bail out distressed commercial banks. The resulting decline in the expected return on domestic lending would reduce the net worth of commercial banks, increase the risk premium, and lead to a decline in foreign borrowing. This, in turn, would speed up the collapse of a fixed exchange rate regime. The results thus stress the need to make external financial liberalization an integral part of a consistent domestic reform package.

The most important policy conclusion is the crucial need to monitor the short open foreign exchange position of banks. One way to reduce feedback effects between banking and balance of payments crises could be to restrict cross-border capital movements. However, this would have the adverse effects of shielding domestic commercial banks from foreign competition and of restricting investment to domestic savings. Likewise, our results lead us to caution against the introduction of minimum reserve requirements on foreign borrowing because these may have the unwanted effect of speeding up rather than delaying a for-

eign exchange crisis. A similar argument would apply to other regulations which effectively raise the costs of borrowing from abroad. Hence, if the case for such regulations is made in a framework which assumes market imperfections, the positive welfare implications of regulations must outweigh their potential negative implications for the timing of a foreign exchange crisis.

The empirical part has been restricted to the analysis of banks' share in foreign borrowing and of changes in net foreign assets of commercial banks. The evidence lends support to the argument that commercial banks' short open foreign exchange position has widened prior to the currency crises analysed and that reduced foreign lending during balance of payments crises has come mainly through reduced foreign loans to commercial banks. Recently, foreign borrowing of commercial banks has increased particularly in some transition economies of Central and Eastern Europe. Should a new balance of payments crisis strike in these economies, it has thus grown more likely that it would feed back into their banking systems. In fact, the severe financial and economic crisis that has beleaguered Russia since August 1998 has closely followed the pattern described in this paper.

## ACKNOWLEDGEMENTS

This paper has been written in the context of a research project on the integration of the reform states in Central and Eastern Europe into the international capital market. Financial support from the Volkswagen-Foundation is gratefully acknowledged. The authors would like to thank Markus Diehl, Laszlo Halpern, Christian Pierdzioch, and an anonymous referee for most helpful comments on an earlier draft. Of course, we remain solely responsible for all remaining errors and inaccuracies.

## NOTES

1. McKinnon and Pill (1995) show that the presence of deposit insurance can lead to overborrowing.
2. Miller (1996) shows the links between a speculative attack and the reserve constraints of commercial

- banks. In this model, a worsening balance of payments position may trigger a banking crisis which, in turn, *lengthens* the time until a speculative attack occurs.
3. The following model is based on Krugman (1979) and Flood and Garber (1984). We thus abstract from the possibility of multiple equilibria. For a more detailed discussion see Obstfeld (1986). The literature on speculative attacks is surveyed comprehensively by Agénor *et al.* (1992).
  4. This assumes that the government neither pays interest on its accumulated deficit nor receives interest payments on international reserves.
  5. To the extent that direct loans to firms from abroad are often guaranteed by commercial banks, the results of our analysis would not change if we allowed for direct borrowing. If domestic firms raise non-guaranteed loans and have assets in domestic currency only, a similar link between enterprise net worth and balance of payments crises could be analysed. Allowing households to hold deposits at domestic banks in addition to cash and foreign assets slightly complicates the exposition but does not affect the results qualitatively.
  6. This assumption that the central bank cannot borrow from abroad is relaxed in Obstfeld (1986) and Buiter (1987). Our results would remain the same, however, if we looked at the consolidated accounts of the domestic banking system, i.e. of the central bank and of commercial banks.
  7. A similar point is made by Mishkin (1997) who argues that a devaluation of the domestic currency worsens the net worth of firms and aggravates problems in the domestic economy linked to asymmetries in information. However, Mishkin does not directly link this incipient decline in net worth to developments of the balance of payments.
  8. A recent empirical study seems to have an opposite result. Demirgüç-Kunt and Detragiache (1997) find that banking crises are unrelated to exchange rate changes. However, crises are related to a deterioration in the balance of payments position and to the open foreign exchange position of commercial banks. Unfortunately, the authors do not report evidence on the possible correlation between these variables and the exchange rate.
  9. Notice that  $E[\Pi] > 0$  implies that the end-period equity of domestic banks is positive. If domestic households hold this equity, the induced positive effect on net wealth would raise money demand. A fall in banks' net wealth would thus not only have a negative direct impact on the collapse time but also a negative indirect impact through the decline in money demand. Because both effects run in the same direction, we have neglected the second channel.
  10. By the same token, the impact of a devaluation on banks' net worth magnifies the familiar detrimental effect of an exogenous increase in the government deficit on the fixed exchange rate system.
  11. Under our assumption of imperfect competition on the loan market, this condition indeed holds.
  12. Chile's currency has come under pressure recently as a result of the financial crisis in Asia to which Chile is exposed heavily due to its large exports to that region. In response, the government has reduced substantially the mandatory non-interest bearing deposit which had been imposed on short-term capital inflows in 1991. The intention is to attract more capital in order to support the currency and to prevent a further devaluation which would hurt firms with net foreign exchange liabilities (Banco Central de Chile, 1998).
  13. In the case of Thailand, the sharp decline in net foreign assets is also due to the fact that an offshore banking center had been established in 1993 (BIS, 1997; Dekle and Pradhan, 1997). Hence, former domestic interbank loans from foreign parent banks to their Thai subsidiaries may now have been booked as short-term loans from abroad, thus leading to a reported increase in the foreign liabilities of Thai banks.

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