BALANCE OF PAYMENT CRISIS AND CAPITAL FLOWS:
THE ROLE OF LIQUIDITY

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Resumen
El trabajo desarrolla un modelo de crisis externas enfocado a la interacción entre la creación de liquidez por parte de intermediarios financieros y colapsos cambiarios. Se muestra que el rol de transformar madureces por parte de los intermediarios resulta en mayores movimientos de capital y mayor probabilidad de crisis. Este tipo de ciclo es el observado en la realidad: grandes influjos, crisis y una corrida abrupta desde el país. El modelo muestra como shocks negativos de productividad o alzas en la tasa de interés internacional pueden ser magnificados por el comportamiento de los inversionistas que están interrelacionados a través de sus depósitos en agentes intermediadores. Un colapso eventual del tipo de cambio puede interrelacionar aún más el comportamiento de los inversionistas.

Abstract
A model of external crises is developed focusing on the interaction between liquidity creation by financial intermediaries and foreign exchange collapses. The intermediaries' role of transforming maturities is shown to result in larger movements of capital and a higher probability of crises. This resembles the observed cycle in capital flows: large inflows, crises and abrupt outflows. The model highlights how adverse productivity and international interest rate shocks can be magnified by the behavior of individual foreign investors linked together through their deposits in the intermediaries. An eventual collapse of the exchange rate can link investors' behavior even further.

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1 Introduction

The Mexican external crisis of December 1994 brought into question our basic understanding of this type of events. The collapse of the Peso was prompted by an initial devaluation and was characterized by a severe run against the foreign reserves caused by a sudden outflow of capital. The immediate preoccupation of the Mexican government (and several policy makers in the US) was to solve the very short run problem of rolling over the debt and avoiding the major step of announcing their default. The run against Mexican assets gave the impression that there was a strong component of a liquidity crisis involved which is more similar to the models of the Bank Run literature than to the traditional models of balance of payment crises.\(^1\)

Other balance of payment crises, in particular the severe ones, such as in Chile (1982), Finland (1992) and Mexico (1982), share with Mexico (1994) the above phenomenon as well as three other interesting features. First, they all experienced a capital inflow surge in the years preceding the crises. Second, this capital inflow was intermediated, at least in part, by the domestic financial sector which, in addition, increased its proportion of short term liabilities. Finally, the external collapses were accompanied by severe banking crises.\(^2\)

The capital cycles of surges and sudden outflows have been documented extensively in the literature\(^3\) and have been a major issue of concern to policy makers who are caught in the dilemma of introducing capital controls.\(^4\) In their analysis of the Mexican crisis, Sachs, Tornell and Velasco (1995) argue that the volatility of capital flows (and the inadequate response of Mexican authorities) played a major role in the crisis. Figure 1 shows the capital inflows in the years preceding the crises for the countries cited above.

The composition of capital inflows is also interesting. Table 1 presents the figures for the countries in the study of Schadler et al. (1993) which focuses on capital inflow surges. The main conclusion from this table is that Foreign Direct Investment is not the driving force. Other capital—which is more associated with intermediation—explains the bulk of the inflows. This includes bonds, direct borrowing, and other

\(^1\)See, e.g., Sachs (1995).
\(^2\)For a description of these 4 crises see Dornbusch, Goldfajn and Valdés (1995).
\(^3\)See Calvo et al (1993) and Schandler et al. (1993).
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short and long run fixed income instruments.

Less emphasized is the fact that capital inflows are usually accompanied by increased intermediation and, sometimes, shortening of maturities. The idea that higher capital inflows are related to increasing intermediation is a phenomenon that has a strong counterpart in the real world. For instance, if we analyze the episodes of capital inflow surges studied in Schadler, et al. (1993), there is evidence that financial intermediation increased significantly during the time of the surges. Figure 2 presents real claims of the financial sector on the private sector during these episodes (Chile, Egypt, Mexico, Spain, and Thailand). The surge starts in quarter 0. It is clear from the figure that in all five countries financial intermediation increased during the surges.

Less attention is given to the fact that when capital flows are abruptly reversed, often a banking crisis emerges as an additional strain. In all the four cases highlighted above, banking crisis was indeed an important consideration to policy makers. In fact, the study by Kaminsky and Reinhart (1995) concludes that there is a strong link between banking and balance of payment crises for a large number of episodes.\(^5\)

\(^5\)Their goal is more ambitious. They aim to establish a causal link between the twin crises. See
Table 1: Composition of Some Capital Inflow Surges
First Year of Surge minus Previous Year, US$ mill.

<table>
<thead>
<tr>
<th></th>
<th>Years of Surge</th>
<th>Direct Invest.</th>
<th>Port. Invest.</th>
<th>Other Long/T.</th>
<th>Other Short/T</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile</td>
<td>1990–93</td>
<td>-697</td>
<td>272</td>
<td>2053</td>
<td>212</td>
<td>1840</td>
</tr>
<tr>
<td>Egypt</td>
<td>1991–92</td>
<td>-531</td>
<td>6</td>
<td>7758</td>
<td>-900</td>
<td>6333</td>
</tr>
<tr>
<td>Mexico</td>
<td>1989–93</td>
<td>774</td>
<td>177</td>
<td>6411</td>
<td>-1757</td>
<td>5605</td>
</tr>
<tr>
<td>Spain</td>
<td>1987–91</td>
<td>752</td>
<td>2571</td>
<td>7601</td>
<td>4946</td>
<td>15870</td>
</tr>
<tr>
<td>Thailand</td>
<td>1988–92</td>
<td>899</td>
<td>184</td>
<td>-341</td>
<td>2035</td>
<td>2777</td>
</tr>
</tbody>
</table>

Source: IFS.

Note: The countries are those studied in Schadler et al. (1993). Colombia was left out because of lack of intermediation data.

Figure 2: Real Financial Claims on the Private Sector
It is difficult to explain major external crises in a context where all agents—investors, intermediaries and policy makers—are rational given the magnitude of the currency crises and the relatively small size of the underlying shocks (internal or external). Usually, it is assumed that policy makers are following an inconsistent policy. Surprisingly, it is easier to explain major crises in association with the observed capital swings and banking crises. The latter provides the magnification and propagation effects needed for a complete explanation.

The traditional theoretical framework on balance of payment crises is based on the large literature on speculative attacks that followed the seminal article by Krugman (1979). The key starting point of this literature is that the government follows an inconsistent policy combined with a fixed exchange rate regime, which would eventually have to collapse. The major contribution, then, is to use rational investors to define exactly when and how the collapse occurs.  

The main candidate for government inconsistency is its fiscal policy. The Mexican, Finish and Chilean experiences, however, do not support this contention (although it is a good explanation in several other cases). The normal measures of fiscal budget indicated that Mexico was running budget surpluses up to the year of the crisis. Equivalently, credit creation by the central bank was relatively stable up to 1994.

This paper departs from the Krugman tradition and does not assume an inconsistency in policy making. The crises arise as a result of an internal or external shock that is amplified and propagated to the rest of the economy by liquidity creating financial intermediaries who generate more than proportional capital flows. The model is able to replicate the observed cycles in capital flows: large inflows, crises and abrupt outflows. This is done in a context where both investors and financial intermediaries are fully rational and anticipate the possibility of crisis.

The paper focuses on the interaction between liquidity, capital flows and exchange rate collapses. Liquidity considerations arise only in a world where there are intermediaries transforming maturities, offering liquid assets to their customers and, im-

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also the papers on banking crises in Latin America by Gavin and Hausman (1995) and Rojas-Suarez and Weisbord (1995).


7As of September of 1994 the fiscal budget surplus-GDP ratio figures are as follows: 1.6% in 1992, 1.0% in 1993, and –0.5% in 1994.

8Although an inconsistent policy is completely compatible with the model and would reinforce our results.
plicitly, allowing the possibility of runs on their assets. Thus, the introduction of intermediaries in the model is a synonym for liquidity creation and all its side effects.

The model below highlights the fact that there is an asymmetry between the time needed for investment to mature and the timing of investors. The latter are short sighted by necessity. They may need the money in the short run for their consumption or want to have liquid assets in order to have the flexibility to invest in other places in the short run. The intermediaries offer these assets to investors in order to attract them. On the other side they invest in production which needs time to mature (early interruptions are not profitable). In other words, they transform their illiquid assets into liquid ones in order to attract capital. It is precisely this transformation that brings more capital to the economy but it is also the one that introduces the possibility of runs. Ex-post, the good outcome is the one in which the intermediary offers liquid assets, there are no runs and (more) investment is realized. However, the possibility of runs and massive disruption does exist.

Intermediation, therefore, produces two main effects. On one hand, it can increase the capital inflows to the economy. By allowing more flexibility, offering more liquid assets, intermediaries improve the attractiveness of the economy in the eyes of the foreign investors. On the other hand, they may generate runs and large capital outflows, amplifying initial shocks that otherwise would not have generated crises.

Intermediation, together with its creation of liquid assets, allows for the possibility of runs and crises but it does not generate crises by itself. Throughout the paper, we analyze two types of shocks: productivity and international interest rates. For each type of shock, there will be a cutoff point that determines a region where runs against the intermediary are the equilibrium outcome. This region is determined by the foreign investors, who decide whether to accelerate the timing of their withdrawals. With this region defined we can explicitly determine the probability of crises. In this sense we depart from the standard “bank run” literature in which the outcome of the models are multiple self-fulfilling equilibria whose likelihood is not determined endogenously.

The interaction between exchange rate collapses and runs against the intermediaries is especially interesting. The effects work in both directions. The existence of runs against the intermediaries generates a sudden demand for reserves that may force a devaluation of the currency, independently of the fiscal policy followed by the
government. On the other hand, an expected devaluation of the currency will change the return profile of the investment, increasing the benefits of early withdrawals, and, therefore, increasing the chances of a collapse.

This paper is organized as follows. In section 2 we set up the simplest possible model with its basic components: foreign investors, intermediaries, technology and the central bank. As a useful benchmark, we initially solve the model for the capital flow pattern that would exist in the absence of intermediation. Then, we introduce intermediation, solve for the optimal early withdrawal policy, and identify the endogenous probability of runs. We show that this probability is strictly positive and does not decrease when intermediaries offer more liquidity. In section 2.2.2, we verify that runs effectively increase the capital outflows and in section 2.2.3 we propose that, under certain conditions, capital inflows may actually increase with intermediation. In section 3 we give a closed-form solution of the model using a Constant Relative Risk Aversion (CRRA) utility function and a Bernoulli distribution of the shocks. In several simulations, we show that capital inflows effectively increase with intermediation and we look at some comparative statics.

The relationship between runs on intermediaries and exchange rate collapses is explored in section 4. First, we verify that runs increase the probability of an exchange rate collapse. Then, we show that the possibility of a devaluation increases the region where runs against intermediaries are the unique equilibria. Finally, we analyze the interactions of two intermediaries with imperfectly correlated investment pools, showing that runs against an otherwise liquid intermediary can occur if there is a run against the other intermediary. This effect increases both the size and probability of the collapse.

Once the main contributions of the chapter are completed, we explore an extension. In section 5 we demonstrate how all the effects can still go through when the nature of the initial shock is changed. We explore the interesting case where the impulse is the international interest rate. Finally, section 6 concludes.

## 2 The Basic Model

International Investors are risk averse agents that maximize their expected utility of wealth, choosing their optimal portfolio allocation between a safe international asset