'Systemic' flight to quality from emerging economies, and *enabled* international credit lines

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Comments are most welcome.

Abstract

This paper builds a simple but new model to highlight a puzzle. Commercial banks routinely extend credit lines to firms, which need to be effectively backed by some reserves. In contrast, international credit lines for emerging economies to take care of flight to quality hardly need to be backed by reserves. This is because the so-called systemic outflow from emerging economies is accompanied by inflow into developed economies. So funding liquidity need not be a problem even if reserves are small. This suggests that ceteris paribus the market for credit lines to take care of flight to quality ought to exist more easily than the market for usual credit lines for business investments. It is actually the opposite. Why? One explanation can lie in the *dual agency perspective* (Tirole, 2002). Central banks and the IMF can then act as mediators and provide enabling conditions. We also discuss possible extensions of the model to analyse some related issues.

Key words: International capital flows, flight to quality, credit line, reserves, emerging economies.

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1 Introduction

Though the costs of sudden and large outflow of capital from emerging economies were well recognized in the literature already, they received renewed attention in the aftermath of the East Asian Financial crisis in 1997-98.[2] The early writings included Bhagwati (1998) and Rodrik (1998). Both these influential papers were very pessimistic about the net benefits of free international capital flows, given that a costly outflow can occur suddenly. There have been suggestions to impose capital controls in various forms. However, these writings did not consider an international credit line (CL) as a safeguard in this context. Following Fischer (2002) and some others, we will analyse the use of international CL in this paper. In an important respect, we will carry the analysis forward. This paper suggests that the argument for capital controls is exaggerated if an international CL is in place.

It is interesting that the so-called systemic flight to actual or perceived quality (or sudden outflow of capital) from emerging economies is typically associated with a situation in which investors would like to shift from emerging economies to developed countries. So while there is a problem in one part of the world economy (the emerging economies), there is often no such problem in another part of the world (the developed countries). A good example of this is the East Asian Financial Crisis of 1997-98 (in the absence of an international CL for emerging economies). In this crisis, it was primarily the emerging economies (and these too in some parts of the world) that faced a flight to quality. The developed world did not face serious problems then.[3] So while the so-called systemic flight out of most or all emerging economies is indeed systemic within the world of emerging economies, it is

[2] 'The reversal reached 12 percent and 6 percent of GDP in Mexico in 1981-3 and 1993-95, respectively, 20 percent in Argentina in 1982-83, and 7 percent in Chile in 1981-83. In Indonesia, Korea, Malaysia, Philippines, and Thailand, the combined difference between the 1997 outflows and the 1996 inflows equalled $ 85 bn, or about 10 percent of these countries' GDPs.' (p. 8-9, Tirole, 2002)

[3] The financial crisis in and around 2008 was different. This was primarily in the developed world. There is a debate on whether or not even this was truly global. Even so, we will consider a truly global flight to quality later. See section 5.

often not systemic in the context of the global economy that consists of not only emerging economies but also the developed countries.

In the case of a flight to quality from emerging economies, not only is there no problem of capital outflow from one part of the world i.e. the developed world, there is actually, in a sense, a potential solution in the developed world. The capital outflow from emerging economies is nothing but capital inflow into developed countries. At a time when there is a liquidity crunch in emerging economies, there is, what we may call liquidity abundance in the developed countries. We will formally show how this very liquidity abundance in developed countries can be used to take care of the liquidity crunch in emerging economies. Given this framework, neither the number of emerging economies nor the size of the outflow matters. In this context, there is hardly any problem of *funding liquidity* (Brunnermeier and Pedersen, 2009).

It is true that when there is a sudden outflow of funds from an emerging economy, then it is usually difficult for banks or even governments there to borrow in the international market to meet the redemption requirements of existing investors. In this context, it helps to have an ex-ante international CL (an option to borrow) in place.

A simple corollary of the above analysis is that there is less need for foreign exchange reserves with emerging economies to deal with sudden capital outflow than is usually believed, given that a CL is in place. The CL mechanism used here is somewhat similar to the mechanism that is used in Gatev and Strahan (2006) though the context is quite different. In both cases, there is little need for reserves (more on the later).[4]

In practice, the IMF offers a CL facility. This has so far been bought by Columbia, Poland, Mexico and Romania. Other countries such as India have not bought this facility (for more on this, see Singh (2011)). However, if more countries buy a CL from the IMF, then the latter, it is often argued, is unlikely to be able to handle this, given that it has limited capital and

[4]The CL used here is quite different from that in Gangopadhyay and Singh (2003). There a bank has a CL from some financial institution which hoards the cash. In contrast, in this paper, there is much less need to hoard cash.

it cannot issue its own currency (Eichengreen, et al., 2006). This argument is clearly exaggerated in the light of the above analysis. There is little need for funding from the IMF, given that there is hardly any systemic outflow at the global level. It is true that there can be other difficulties in extending CLs (see also Aizenman, et al., 2010). Indeed one objective of this paper is to explore in depth the nature of possible market failure involved in international CLs.

If we compare an international CL to take care of sudden outflow of funds from emerging economies to a more familiar CL from a bank to a firm that is routinely used for completion of projects or to exploit new and 'perishable' business opportunities, then we have a puzzle. To see this, observe that the familiar credit lines for business effectively need to be backed by some reserves. We have argued above that this need for reserves to deal with the situation of sudden outflow of funds from portfolio investments in emerging economies is much less. This suggests that the market for international CLs to take care of sudden outflows could be on more firm grounds than the market for credit lines for usual business. In practice, it is the opposite. We will present a simple model to highlight this aspect.

It is true that lending to emerging economies is not just a matter of financial risks but there can also be difficulties due to the international aspect associated with the required CL. When both parties to a contract are in and one the same country, then they are bound by the same laws, there is one government that is involved in the enforcement of contracts, and they have one and the same currency. So it is not difficult to operate. It is true that there are the usual agency costs in financial contracts. However, there are no significant additional private costs in this context. However, when one party to a contract is in one country and another party is in another country, then there are two sets of laws and two governments that are potentially involved. There are issues of contract enforcement. There is concern for sovereignty in each country. Exchange rate risk too is involved. This includes not only the risk due to market fluctuations but also the risk due to the sudden and excessive creation of base money by the public authorities in an emerging economy in the absence of an increased public demand for the same. All

this leads to additional 'agency costs'.

Tirole (2002) has developed a *dual agency perspective* of finance in the international context. This is in contrast to the single agency perspective in the context of a closed economy, which is what usually textbooks deal with (see, for example, Tirole, 2006). The problem of additional agency costs can fall on the shoulders of market participants in the international context.[5] In the national context, additional problems are either absent or they are taken care of by the national governments. The total costs in this case are low, given that these costs need not be incurred by market participants repeatedly in each separate transaction in view of the fact that the government provides public goods and services that all agents can rely on. All this may explain why there is such a small market for private international CLs in practice even while CLs are routinely used within an economy.

It is well known that an important role of the government is to provide a legal framework that provides an enabling environment in which voluntary contracts can materialize. This kind of an enabling environment is often missing at the international level (Tirole, 2002). We will see how, in this context, the IMF and the central banks can help. They can play an important role as mediators between sellers and buyers of international CLs. They can help to enhance the credibility of and reduce the cost of international CLs. Their role then is not to provide the funds in our model.[6] The role of central banks and the IMF in our model is to act as (second best) substitutes for an international government that is able and willing to avoid the additional agency costs involved in international contracts. The central

[5]This problem does not arise in equal measure for trade in goods, for FDI, or for demandable financial flows. In case of trade, there are mechanisms in place that more or less ensure that payments for goods and services go hand in hand with receipt of goods and services. In case of FDI, it helps to have direct control over the project. In case of demandable financial flows, there is an obvious exit route for foreign investors if they see or perceive a problem. Moreover, an ex-ante credible threat of quick withdrawal can act as a check on moral hazard by users of demandable financial flows (Diamond and Rajan, 2001). These kinds of mechanisms are often missing in case of long term financial flows that are involved in CL contracts.

[6]For funding liquidity, we can have *inside liquidity* instead of *outside liquidity* in this context (see Holmstrom and Tirole, 2011).

banks and the IMF can provide an enabling environment for international CLs. We will refer to CLs that materialize in an enabling environment provided by the central banks and the IMF as *enabled* international CLs. (CLs within an economy are enabled anyway, given the presence of a national government.)

The formal model in this paper deals with the case in which there can be a sudden and large outflow by investors from generic 'deposits' (denominated in foreign currency) in banks in emerging economies to deposits in banks in developed countries. However, the analysis can be, as we will suggest, moulded and extended to deal with various related aspects such as *the Dutch disease*, local currency as the numeraire for foreign 'deposits' in banks, truly systemic flight to quality, and so on.

In our model, we study a one way CL from a representative commercial bank in a developed economy to a representative commercial bank in an emerging economy. This analysis can be extended to a two way credit line, which may be more relevant in the context of two somewhat equally reputed commercial banks in different countries. This can be a case of swap credit lines between commercial banks. This swap CL differs from swap CLs discussed in Obstfeld, et al. (2009) where the discussion is on the arrangement between central banks (and not between commercial banks).[7] Cordella and Yeyati (2010) discuss how the IMF can be a mediator in the context of swap CLs between central banks.

Throughout this paper we assume that 'bad banking and bad policies' are absent though the empirical evidence shows that this assumption is unrealistic (Caprio Jr. and Honohan, 2010). But the assumption serves a purpose. It reaffirms the point that there may not always be any inherent instability due to sudden outflow from emerging economies. Some instability that is actually observed can be more simply attributed to 'bad banking and bad policies'. This is important for policy making with regard to free capital mobility.

In our model, banks are well capitalized. This facilitates a focus on the

[7] Aizenman and Parischa (2010) show that swap CLs were arranged by the US with four creditworthy emerging economies.

liquidity aspect. It is true that often there is a problem of capital adequacy. Observe that if this is well known already then there would be little inflows in the first place. Typically, it is believed that there does not exist a serious problem in this context and there is then a sudden realization that such a problem exists. This can trigger a sudden outflow. While the problem is not one of liquidity to begin with, it can quickly become one. So it is important to deal with liquidity problem even if it is basically a capital adequacy problem.

We will study two types of CLs:

1. CL from a bank to a firm to help it exploit a possible new 'perishable' investment opportunity[8] in a closed economy (henceforth, CL^I), and
2. CL from a bank in a developed economy to a bank in an emerging economy to take care of sudden outflow of funds (henceforth, CL^S).

The first type of CL is very familiar. It will be used as a benchmark for studying the second type of CL, which is of interest here.[9]

The plan of the paper is as follows. We will first set out a benchmark model of CL^I (section 2). Thereafter, we will study CL^S (section 3). Then we will consider the puzzle that a market for CL^I exists but that for CL^S does not exist in practice (section 4). This will be followed by a discussion on possible extensions of the model to analyze closely related issues (section 5). The paper will end with some concluding remarks (section 6).

2 Credit line from a bank to a firm

The argument in this section is very simple. A bank needs to incur some cost of reserves if it is to sell CL^I. We will see in the next section how this

[8] Though the formal model that follows in the next section considers this case of a new investment, the argument is more general. It applies also to the case where a firm faces a possible liquidity shock in future. The liquidity shock then means that the firm needs to incur additional expenditure to be able to complete a project.

[9] A special case of the model is that the exchange rate is 1 and remains so and that the additional agency costs are zero. This special case is when there is flight to quality from less-reputed banks to more-reputed banks in a closed economy.

premise changes and how it helps to understand CL^S better. Though the model structure and notation used here is simple, it is somewhat elaborate. However, it serves a purpose as it will facilitate comparison with the main model in the next section. In this section, we will study the conditions under which a market for CL^I exists.

There are three dates 0, 1 and 2. We will consider a representative bank B amongst many identical banks. It acts as an intermediary between households and firms. The former hold (time) deposits (D) and bank capital (K). All households need to consume at date 2 only. The firms take loans (L). Bank deposits, capital and loans are in place already at date 0. Firm F has investments in place at date 0 (I^F). We assume that the interest rate on deposits (i_D) and the interest rate on bank loans (i_L) are pre-determined and given. Bank B recovers the loans with interest at date 2, and it repays the depositors and the shareholders at the same date. We assume, for simplicity, that there is no default on loans, given the limited purpose of the model. So the bank capital in the model in this section is, strictly speaking, not required. We have mentioned this for comparison with the model in the next section where it has a role.

There are several identical firms. We will consider a representative firm F. At date 1, a 'perishable' investment opportunity arises with probability p for firm F. This probability is given exogenously. A fixed amount R will be required if the opportunity arises. The only source of funds for this is borrowing from bank B at date 1. Firm F can ex-ante buy a CL from bank B at date 0. We will simply consider whether or not a market for CL exists at date 0.

If bank B sells a credit line, it will need to lend at date 1 if the demand for funds arises. For this, it has to hold reserves from date 0 onwards. The bank has to arrange for funds at date 0 and incur the two period interest cost i_R. If the investment opportunity arises for firm F, it will borrow. Then bank's reserves fall by R. If this opportunity does not arise, the firm will not borrow. The bank will then need to continue to hold reserves till date 2. There is no other lending opportunity for bank B at date 1.

Bank B will satisfy itself that firm F is sound and only then sell a CL.

In what follows, we will assume that bank B is satisfied. In other words, we focus on 'eligible' firm in this paper. From date 0 to date 1, bank B monitors firm F. Let M be the monitoring cost incurred by bank B. To simplify computations, we assume that this is paid at date 2. We will assume that firm F behaves 'well', given that the monitoring mechanism is in place.

Let i_I be the rate of return on the existing investments if the firm does not buy a CL. Let i'_I be the rate of return on existing investments if it does buy a CL. Assume that

$$i'_I < i_I.$$

The motivation for this assumption is as follows. Though the assets of firm F are in place already at date 0, their return depends on management practices (planning, execution, and so on). These management practices may, in turn, be influenced by whether or not the firm is monitored by bank B. The latter will do so if it sells a credit line. Firm F may be constrained to manage in such a way that it facilitates monitoring by bank B. Basically the idea is that the seller of CL can indeed easily and meaningfully monitor the actions of the buyer of CL. This can affect returns on investments. Hence, the above assumption.

The seller of CL is unconstrained in its portfolio choice in our model.

Both bank B and firm F are risk neutral. Both the bank and the firm maximize expected profits. Let π^k_{ij} denote profit of entity k in state i and environment j, where $i = \mathcal{R}, \overline{\mathcal{R}}$, $j = \mathcal{L}, \overline{\mathcal{L}}$, and $k = B, F$. Note that $i = \mathcal{R}$ if liquidity is required, and $i = \overline{\mathcal{R}}$ if liquidity is not required at date 1. Furthermore, $j = \mathcal{L}$ if credit line is in place, and $j = \overline{\mathcal{L}}$ if credit line is not in place. CL is in place when it is sold by bank B and bought by firm F. Finally, $k = B$ if entity is bank B and $k = F$ if entity is firm F. Let π^B_j denote expected profit of bank B in environment j, where $j = \mathcal{L}$ if it sells CL^I, and $j = \overline{\mathcal{L}}$ if it does not sell a CL. Let π^F_j denote expected profit of firm F in environment j, where $j = \mathcal{L}$ if it buys CL^I, and $j = \overline{\mathcal{L}}$ if it does not buy a CL. The probability of state $\mathcal{R}$ is p and that of state $\overline{\mathcal{L}}$ is $1 - p$. It follows now that

$$\pi^k_j = p\pi^k_{\mathcal{R}j} + (1-p)\pi^k_{\overline{\mathcal{R}}j}, \text{ where } j = \mathcal{L}, \overline{\mathcal{L}}, \text{ and } k = B, F. \tag{1}$$

At date 0, firm F has a choice between buying and not buying CL^I from bank B. Similarly, bank B has a choice between selling and not selling CL^I at date 0. Market for CL^I exists if $\pi^k_{\mathcal{L}} \geq \pi^k_{\overline{\mathcal{L}}}$ for each k, where $k = B, F$. This will give us the conditions under which a market for CL^I exists. Let P denote the price of CL^I. To keep the computations simple, we assume that the price is paid at date 2.

We will first consider environment $\mathcal{L}$ and then environment $\overline{\mathcal{L}}$. In each case, we will first consider bank B in each of the two states of the world, and then consider firm F in each of the two states of the world.

In environment $\mathcal{L}$ and state $\overline{\mathcal{R}}$, bank B receives interest on its loans, pays out interest on its deposits, incurs interest cost on its inventory of reserves, receives price of CL^I and incurs cost of monitoring firm F. Hence,

$$\pi^B_{\overline{\mathcal{R}}\mathcal{L}} = i_L L - i_D D - i_R R + P - M. \tag{2}$$

In environment $\mathcal{L}$ and state $\mathcal{R}$, there is only one change from the above. Bank B lends an amount R to firm F at date 1 at (one period) interest rate i. Hence,

$$\pi^B_{\mathcal{R}\mathcal{L}} = i_L L - i_D D - i_R R + iR + P - M. \tag{3}$$

We will next consider a similar exercise for firm F. In environment $\mathcal{L}$ and state $\overline{\mathcal{R}}$, firm F receives a return on its (constrained) portfolio, and pays out the price of CL^I. Hence,

$$\pi^F_{\overline{\mathcal{R}}\mathcal{L}} = i'_I I^F - P. \tag{4}$$

In environment $\mathcal{L}$ and state $\mathcal{R}$, there is one change from the above. Firm F earns from its new investment opportunity and pays interest to bank B for funds borrowed at date 1. Hence,

$$\pi^F_{\mathcal{R}\mathcal{L}} = i'_I I^F + rR - iR - P, \tag{5}$$

where r is the (one period) return rate on the new investment.

This completes the discussion on the profits, given a CL contract. We will next consider the case in which a CL contract is not in place. This case is very straightforward in this section. In both states of the world, bank B

earns interest on its loans and pays out interest on its deposits. Similarly, firm F earns (unconstrained) returns on its assets in place in both states of the world. Hence,

$$\pi^B_{\overline{\mathcal{R}}\mathcal{L}} = \pi^B_{\mathcal{R}\overline{\mathcal{L}}} = i_L L - i_D D, \tag{6}$$

and

$$\pi^F_{\overline{\mathcal{R}}\mathcal{L}} = \pi^F_{\mathcal{R}\overline{\mathcal{L}}} = i_I I^F. \tag{7}$$

We can now state our first result which we useful for later reference in the main model in the next section. The proof too is straightforward.

Proposition 1. Market for CL^I exists if $M + i_R R \leq prR - (i_I - i'_I)I^F$.

Proof: After substituting for $\pi^B_{\overline{\mathcal{R}}\mathcal{L}}$ and $\pi^B_{\mathcal{R}\mathcal{L}}$ from (2) and (3) in (1), we get

$$\pi^B_{\mathcal{L}} = i_L L - i_D D - (i_R R - piR) + P - M.$$

It follows from (1) and (6) that

$$\pi^B_{\overline{\mathcal{L}}} = i_L L - i_D D.$$

It is easy to check that $\pi^B_{\mathcal{L}} \geq \pi^B_{\overline{\mathcal{L}}}$ if and only if

$$P \geq M + (i_R R - piR) \equiv \underline{P}. \tag{8}$$

Next, after substituting for $\pi^F_{\overline{\mathcal{R}}\mathcal{L}}$ and $\pi^F_{\mathcal{R}\mathcal{L}}$ from (4) and (5) in (1), we get

$$\pi^F_{\mathcal{L}} = i'_I I^F + p(r - i)R - P.$$

It follows from (1) and (7) that

$$\pi^F_{\overline{\mathcal{L}}} = i_I I^F.$$

It is easy to check that $\pi^F_{\mathcal{L}} \geq \pi^F_{\overline{\mathcal{L}}}$ if and only if

$$P \leq p(r - i)R - (i_I - i'_I)I^F \equiv \overline{P}. \tag{9}$$

The market for CL^I exists if and only if both (8) and (9) are satisfied. The required result follows. ||

Condition (8) says that the price of CL^I must be greater than or equal to the expected net cost for the seller. The expected net cost of CL^I is the sum of monitoring cost and the expected net cost of reserves of bank B (net of expected income from lending reserves). Condition (9) says that the price of CL^I must be less than or equal to the expected net benefit of CL^I. The expected net benefit of CL^I is expected benefit minus the cost for the buyer. The expected benefit is the expected income from new investment opportunity (net of cost of borrowing funds). The cost for the buyer is the earnings foregone due to a constrained portfolio choice.

Proposition 1 states the condition under which market for CL^I exists. If the market exists, the price lies in a certain interval (see condition (8) and condition (9)). The above analysis is silent about the exact determination of price P, given that the market for CL^I exists. Clearly, we must have $\underline{P} \leq P \leq \overline{P}$, given that the market exists. Let us assume that the price depends on the bargaining power of bank B and that of firm F. Let α measure the bargaining power of bank B and $1-\alpha$ that of firm F. Then

$$P = \alpha \underline{P} + (1-\alpha)\overline{P}.$$

Note that though i (the interest rate paid by firm F to bank B for its possible borrowing at date 1) does not enter the condition for the existence of the market for CL^I in Proposition 1, it is one of the determinants of the price (see the equation above, definition of $\underline{P}$ in (8), and definition of $\overline{P}$ in (9)).

As we have seen in this section, bank B needs to hold reserves in order to sell CL^I. As Tirole writes,

> '... revenues and outlays are not perfectly synchronized. ... [corporations] must *hoard* liquidity either directly (by holding securities on their own books) or indirectly (by securing an explicit or implicit credit line from a *bank*, an insurance company, or a parent company, *which hold securities on their own balance sheets to back these lines of credit*).' (p. 55, Tirole, 2008, emphasis ours)

Banks may also take a slightly different route to making liquidity available. They may lend for short durations (and plan loans such that these are due

for repayment on a somewhat continuous basis). This leads to low returns on bank assets. It is as if they are holding part of their portfolio in liquid low-yielding assets or reserves, and lending another part for long durations at high interest. The point is that a bank effectively incurs cost of funding liquidity in order to sell CL^I.

Though typically a bank effectively needs to hold reserves in order to sell CL^I, this need can be small, if not zero, in some cases. In Gatev and Strahan (2006), an issuer of commercial paper buys a credit line from a bank to insure against the possibility that commercial paper does not sell. The bank under consideration is able to provide the facility of a credit line. In the extreme case, it can do so without holding or borrowing much cash. This is because at times when people are reluctant to invest in commercial paper, they view banks as safe institutions and park their funds there. When issuers of commercial paper draw on their credit lines from banks, the latter are able to lend because it is then that they have received funds. So in this way, a bank is able to honour its commitment without, to begin with, holding cash for this purpose. The cost of cash requirement in Gatev and Strahan (2006) is, in the extreme case, zero. Accordingly there exists, what we may call an easy market for a credit line between an issuer of commercial paper and a bank.

This arrangement between an issuer of commercial paper and a bank in Gatev and Strahan (2006) is somewhat similar to that between one bank and another bank in the model that follows in the next section. In our model of CL^S in the next section, when foreign depositors shift funds from a bank in an emerging economy to a bank in a developed country, the former bank draws on its CL^S on the latter bank, which has just 'received funds'. We will see the details of our model in the next section.

3 Flight to quality, and credit lines

In the previous section, we studied a benchmark model that dealt with CL^I. In this section, we will study the main model that deals with CL^S. We will first present the model (subsection 3.1). This will be followed by an analysis

of conditions under which a market for CL^S exists (subsection 3.2).

3.1 The model

There are two countries - a developed economy and an emerging economy. Each economy has several banks. Banks within an economy are identical. Consider a representative bank in each economy - bank B^d in the developed economy and bank B^e in the emerging economy. Bank B^d is internationally more-reputed bank and bank B^e is internationally less-reputed bank. This is exogenously given.

In each country, there is large number of firms and households. Firms borrow from banks within their own country, and invest in projects in their own country. (So there is no foreign direct investment or FDI in the model.) Households invest in bank deposits. Households could invest on their own or they may invest through 'funds'. This form may be more prevalent when households invest in 'deposits' in foreign banks. Henceforth, we will refer to them as simply investors instead of as households.

There are three dates 0, 1 and 2. Projects yield returns in period 2, which is when all settlements take place.

Let D^d denote deposits held by investors in the developed economy. We have

$$D^d = D^{dd} + D^{de},$$

where D^{dd} is investment by investor in developed country in bank B^d and D^{de} is investment by investor in the developed country in bank B^e. D^{dd} and D^{de} are exogenously given. The investors in the emerging economy hold deposits D^e. All of this is, for simplicity, invested in bank B^e. All agents in both countries need to consume at date 2 only. So there is no withdrawal from deposits for this purpose. However, there can be a change in the portfolio choice of foreign investors at date 1 (more on this later).

At date 0, bank B^k has some capital (K^k), and it has loans (L^k) to firms, where $k = d, e$. It is understood that the terms 'loans', 'deposits' and 'capital' are being used in a generic sense. Neither bank holds any

Assets	Liabilities
Loans to firms = L^d	Deposits = D^{dd}
	Capital = K^d

Table 1: Balance sheet of bank B^d at date 0, and at date 1 in state $\overline{\mathcal{R}}$

Assets	Liabilities
Loans to firms = L^e	Domestic deposits = D^e
	Foreign deposits = D^{de}
	Capital = K^e

Table 2: Balance sheet of bank B^e at date 0, and at date 1 in state $\overline{\mathcal{R}}$

reserves.[10] See the balance sheet of bank B^d and that of bank B^e at date 0 in Table 1 and Table 2 respectively. All figures in the balance sheet of bank B^d are denominated in foreign currency. All figures, except D^{de}, in the balance sheet of bank B^e are denominated in local currency. Deposits D^{de} are denominated in terms of the currency of the developed country.

We will assume throughout that the numeraire for international CL contract is the foreign currency.[11]

Each bank recovers the loans with interest at date 2, and it repays the depositors and the shareholders at the same date. We assume, for simplicity, that there is no default on loans. However, bank B^e can, as we will see, suffer a loss due to flight to quality at date 1. This loss can lead to a fall in bank capital. The reduced amount of bank capital is positive, given the assumption that banks have adequate capital. This is consistent with the focus on liquidity problem in this paper.

Two environments are possible - environment $\mathcal{L}$ and environment $\overline{\mathcal{L}}$. In the former environment, a CL is in place. In the latter environment, a CL is not in place. At date 1, there are two states of the world - state $\mathcal{R}$ and

[10] We have assumed that the cash reserve requirement for banks is zero. This is actually the case in many countries (such as Australia, UK, Sweden, Canada and New Zealand (Gray, 2011)).

[11] This is consistent with the practice by the IMF.

Assets	Liabilities
Loans to firms $= L^d$	(Old) deposits $= D^{dd}$
Loan to bank $B^e = \mathcal{F}$	New deposits $= \mathcal{F}$
	K^d

Table 3: Balance sheet of bank B^d at date 1 in state $\mathcal{R}$ and environment $\mathcal{L}$

state $\overline{\mathcal{R}}$. In the former state, liquidity is required as foreign deposits of bank B^e fall by a fixed amount $\mathcal{F}$ and those of bank B^d rise by an equal amount, where $\mathcal{F} \leq D^{de}$. In state $\overline{\mathcal{R}}$, liquidity is not required as there is no flight to quality. Probability of state $\mathcal{R}$ is q. Probability of the other state of the world is $1 - q$. This probability is given exogenously.

If state $\mathcal{R}$ is realized, then the outcome depends on whether the environment is $\mathcal{L}$ or $\overline{\mathcal{L}}$. If the environment is $\mathcal{L}$, then bank B^d lends an amount $\mathcal{F}$ to bank B^e. The latter is able to easily redeem its deposits. There is no pre-mature liquidation of assets or exchange rate depreciation in this case (more on this later). See Table 3 and Table 4 which show balance sheets of bank B^d and bank B^e respectively.[12] If the environment is $\overline{\mathcal{L}}$, then bank B^d does not lend to bank B^e. There is costly pre-mature liquidation of assets and depreciation of the currency in the emerging economy in this case. Bank B^e is able to redeem its deposits but it does so at a cost. See Table 5 and Table 6. These two tables need more explanation. They will become clear as we proceed. Note that we have assumed that there is no suspension of convertibility on capital account.

Next consider the case in which state $\overline{\mathcal{R}}$ is realized at date 1. Then there is no change in the balance sheets of the two banks from what they were at date 0 (regardless of whether the environment is $\mathcal{L}$ or $\overline{\mathcal{L}}$). See Table 1 and Table 2.

A credit line is an off-balance sheet item in our analysis. Therefore, it is

[12]The operational part of the flight to quality from bank B^e and the lending by bank B^d is as follows. Foreign depositors make electronic transfers or 'telegraphic transfers' (TTs) from their accounts in bank B^e to their accounts in bank B^d. The latter credits the accounts of depositors, and simultaneously debits the account of bank B^e. In other words, it extends a loan to bank B^e.

Assets	Liabilities
Loans to firms $= L^e$	Foreign deposits $= D^{de} - \mathcal{F}$
	Domestic deposits $= D^{ee}$
	Loan from bank $B^d = \mathcal{F}$
	Capital $= K^e$

Table 4: Balance sheet of bank B^e at date 1 in state $\mathcal{R}$ and environment $\mathcal{L}$

not part of the balance sheets of the banks.

Each bank is risk neutral. It maximizes its expected profits at date 0. Bank B^d has a choice between selling and not selling CL^S to bank B^e. Similarly, bank B^e has a choice between buying and not buying CL^S from bank B^d. We will explore whether or not a market for CL^S from bank B^d to bank B^e exists at date 0, given that foreign investments in emerging economies are in place already.[13]

Let i_L be the interest rate on bank loans if bank B^e does not buy a CL. Let i'_L be the interest rate on bank loans if bank B^e does buy a CL. For reasons similar to those considered in the previous section, we assume that

$$i'_L < i_L.$$

The interest rate on loans given by bank B^d is i_L regardless of whether or not it sells a CL for reasons mentioned in the previous section.

Let us treat the bank loans as marketable assets for analytical purposes to compute the possible losses of bank B^e in state $\mathcal{R}$ in environment $\overline{\mathcal{L}}$. Let the price of these assets at date 0 be 1. Let the price at date 1 be V. This is a random variable. Assume that $\mathcal{E}[V] = 1 - \delta_1$, where $\mathcal{E}$ denotes the expectations operator, and $0 < \delta_1 < 1$. δ_1 captures the loss due to pre-mature liquidation of the long term asset.

[13]It is true that this is an incomplete analysis. A more complete analysis would be where the foreigners' decision to invest in the emerging economy depended on whether or not a CL is in place. However, our analysis is still useful in the sense that the policy problem that is faced by many countries is precisely this. There are some investments in place already, and there is a need to examine whether or not it is useful to have an international credit line.

Assets	Liabilities
Loans to firms $= L^d$	(Old) deposits $= D^{dd}$
New loans to firms $= \mathcal{F}$	New deposits $= \mathcal{F}$
	K^d

Table 5: Balance sheet of bank B^d at date 1 in state $\mathcal{R}$ and environment $\overline{\mathcal{L}}$

Assets	Liabilities
Loans to firms $= L^e - [\delta_1 L^e + (1+\delta_2)\mathcal{F}]$	Foreign deposits $= D^{de} - \mathcal{F}$
	Domestic deposits $= D^{ee}$
	Capital $= K^e - (\delta_1 L^e + \delta_2 \mathcal{F})$

Table 6: Balance sheet of bank B^e at date 1 in state $\mathcal{R}$ and environment $\overline{\mathcal{L}}$

Let E_t denote the price of foreign currency (or numeraire) in terms of the local currency at date t, where $t = 0, 2$. We assume that exchange rates are floating. We normalize the exchange rate at date 0 at 1. E_2 is a random variable with mean 1. At $t = 1$, the exchange rate can depend on the state of the world and on the environment. Let E_{1ij} denote the exchange rate at date 1 in state i and in environment j, where $i = \mathcal{R}, \overline{\mathcal{R}}$ and $j = \mathcal{L}, \overline{\mathcal{L}}$. The local currency is expected to depreciate to $1 + \delta_2$ if and only if there is sudden outflow of capital and a CL is not in place, where $\delta_2 > 0$.

Formally, we have

$$E_0 = 1, \;\; \mathcal{E}[E_2] = 1, \;\; \mathcal{E}[E_{1ij}] = \begin{cases} 1+\delta_2, & \text{if } i = \mathcal{R} \text{ and } j = \overline{\mathcal{L}}, \\ 1, & \text{elsewhere.} \end{cases}$$

The motivation for the assumptions on exchange rate is as follows. Exchange rate is a random variable, given the regime of floating exchange rates. We have assumed that its mean value at date 1 and at date 2 is the same as its value at date 0 except in one case. If CL^S is not in place and there is a flight to quality at date 1, then the price of foreign currency is expected to appreciate.[14] The inclusion of exchange rate in the model is admittedly

[14]In the context of the well known case of East Asian financial crisis in 1997-98, 'Indonesia, Korea, Malaysia and the Philippines were hit the hardest - by December 1997,

ad-hoc in this non-monetary model. Further research can improve upon this.

Given that there are two numeraire, accordingly we have two different (sets of) interest rates (we have a dollar interest rate and a rupee interest rate, if the two currencies are dollars and rupees). Bank B^e may offer a higher interest rate than bank B^d, given that there is a higher actual or perceived risk in the former case. Also the interest rate on domestic deposits can be different from that on foreign deposits in the emerging economy in view of the possibility of a loss for bank B^e on deposits D^{de} due to their sudden withdrawal. So i_D^d, i_D^{de} and i_D^{ee} can differ from each other, where i_D^d, i_D^{de} and i_D^{ee} are interest rates on deposits D^d, deposits D^{de} and D^{ee} respectively. The interest rates are exogenously given.

Let $\mathcal{M}$ be the monitoring cost incurred by bank B^d. Let $\mathcal{P}$ be the price of CL^S. As in the previous section, it is assumed that these are paid in period 2.

This completes the description of the model. Note an interesting feature of the model. Reserves of bank B^d are zero and yet it can sell CL^S. See the balance sheets. In particular, see Table 1 and Table 3. This is in contrast to the case of bank B in the previous section. There bank B had to hold reserves in order to sell CL^I.

In the next subsection, we will explore the conditions under which the market for CL^S exists.

3.2 The market for credit line

We will explore the use of an international credit line to take care of flight to quality from emerging economies. Given the nature of the problem, it is not appropriate to use standard microeconomic marginal analysis to find optimal 'insurance' coverage in CL^S contract. So we will follow a different course. We will check if expected profits with CL^S are greater than those without CL^S, *given the (large) fixed size of the flight to quality.*

their currencies had depreciated (on average) by about 75 percent.' (Kaminsky, et al., 2003).

Let π_{ij}^k denote profit of bank B^k in state i and environment j, where $i = \mathcal{R}, \overline{\mathcal{R}}$, $j = \mathcal{L}, \overline{\mathcal{L}}$, and $k = d, e$. Let π_j^k denote expected profit of bank k in environment j. Given that the probability of state $\mathcal{R}$ is q, it follows that

$$\pi_j^d = q\pi_{\mathcal{R}j}^d + (1-q)\pi_{\overline{\mathcal{R}}j}^d, \quad j = \mathcal{L}, \overline{\mathcal{L}}. \tag{10}$$

Next consider bank B^e. In this case, in general, the profits depend on the uncertain exchange rate at date 1 and at date 2. Accordingly, in general,

$$\pi_j^e = q\mathcal{E}[\pi_{\mathcal{R}j}^e(E_{1\mathcal{R}j}, E_2)] + (1-q)\mathcal{E}[\pi_{\overline{\mathcal{R}}j}^e(E_{1\overline{\mathcal{R}}j}, E_2)], \quad j = \mathcal{L}, \overline{\mathcal{L}}.$$

Note that there are two uncertainties. First, there is uncertainty on whether or not liquidity will be required at date 1. Second, the exchange rate is uncertain. In the above formulation, there are two terms. In each term, we have taken expectation over the exchange rate.

In what follows, we will, for simplicity, suppress the elaborate form and write the above more simply as

$$\pi_j^e = q\mathcal{E}[\pi_{\mathcal{R}j}^e] + (1-q)\mathcal{E}[\pi_{\overline{\mathcal{R}}j}^e], \quad j = \mathcal{L}, \overline{\mathcal{L}}. \tag{11}$$

We will check if $\pi_{\mathcal{L}}^k \geq \pi_{\overline{\mathcal{L}}}^k$ for each k. This will give us the conditions under which a market for CL exists.

A credit line contract is in place (Environment $\mathcal{L}$)

We will first consider bank B^d and then come to bank B^e.

First consider the profit of bank B^d, given state $\overline{\mathcal{R}}$. Bank B^d receives interest on its loans, pays out interest on its deposits, receives the price of CL^S, and incurs a cost on monitoring. Hence,

$$\pi_{\overline{\mathcal{R}}\mathcal{L}}^d = i_L L^d - i_D^d D^{dd} + \mathcal{P} - \mathcal{M}. \tag{12}$$

Next, consider the state $\mathcal{R}$. There is one change from the previous formulation. Bank B^d receives interest on its lending an amount $\mathcal{F}$ to bank B^e and it pays interest on its new deposits $\mathcal{F}$ received at date 1. Hence,

$$\pi_{\mathcal{R}\mathcal{L}}^d = i_L L^d - i_D^d D^{dd} - \hat{i}_D \mathcal{F} + \hat{i}\mathcal{F} + \mathcal{P} - \mathcal{M}. \tag{13}$$

where $\hat{i}_D$ is the interest rate paid out on deposits that are received at date 1, and $\hat{i}$ is the interest rate on loans given to bank B^e.

This completes the discussion on profits of bank B^d, given CL^S contract. We will next consider a similar exercise for bank B^e.

First consider state $\overline{\mathcal{R}}$. Bank B^e receives interest on its (constrained) loans portfolio, pays out interest on its local deposits, pays out interest on its foreign deposits, incurs a loss (or gets a gain) on its foreign deposits due to depreciation (or appreciation) of the local currency at date 2, and pays out a price for CL^S. It follows that

$$\pi^e_{\overline{\mathcal{R}}\mathcal{L}} = i'_L L^e - i^{ee}_D D^{ee} - E_2 i^{de}_D D^{de} - (E_2 - 1)D^{de} - \mathcal{P}.$$

Given the assumption that $\mathcal{E}[E_2] = 1$, it follows that

$$\mathcal{E}[\pi^e_{\overline{\mathcal{R}}\mathcal{L}}] = i'_L L^e - i^{ee}_D D^{ee} - i^{de}_D D^{de} - \mathcal{P}. \tag{14}$$

Next, consider the state $\mathcal{R}$. The change in the formulation from that in the previous case is as follows. An amount $\mathcal{F}$ is withdrawn by foreign investors from bank B^e. To meet this demand for redemption, bank B^e borrows an amount $\mathcal{F}$ from bank B^d. For this, it needs to pay interest at date 2. However, it also reduces its interest payment on its deposits since some have been withdrawn. At date 2, bank B^e needs to redeem less deposits than in the previous formulation. Hence,

$$\pi^e_{\mathcal{R}\mathcal{L}} = i'_L L^e - i^{ee}_D D^{ee} - E_2 i^{de}_D (D^{de} - \mathcal{F}) - E_2 \hat{i}\mathcal{F} - (E_2 - 1)(D^{de} - \mathcal{F}) - \mathcal{P}.$$

Note that it has been assumed that depositors get interest on their deposits if and only if they stay invested till period 2. Given the assumption that $\mathcal{E}[E_2] = 1$, it follows that

$$\mathcal{E}[\pi^e_{\mathcal{R}\mathcal{L}}] = i'_L L^e - i^{ee}_D D^{ee} - i^{de}_D (D^{de} - \mathcal{F}) - \hat{i}\mathcal{F} - \mathcal{P}. \tag{15}$$

This completes the discussion on the profits of the two banks, given that CL^S is in place. We will next consider the case in which CL^S is not in place.

A credit line contract is not in place (Environment $\overline{\mathcal{L}}$)

We will first consider bank B^d and then come to bank B^e.

First consider state $\overline{\mathcal{R}}$. In this case, bank B^d simply receives interest on its loans and pays out interest on deposits. Hence,

$$\pi^d_{\overline{\mathcal{R}}\mathcal{L}} = i_L L^d - i^d_D D^{dd}. \tag{16}$$

Next, consider state $\mathcal{R}$. The change in formulation compared to that in the previous equation is as follows. Bank B^d receives interest on its new loans given out at date 1 and pays out interest on its new deposits received at date 1. Hence,

$$\pi^d_{\mathcal{R}\overline{\mathcal{L}}} = i_L L^d - i^d_D D^{dd} + \hat{i}_L \mathcal{F} - \hat{i}_D \mathcal{F}, \tag{17}$$

where $\hat{i}_L$ is the interest rate on loans given at date 1.

We will next consider a similar exercise for bank B^e.

First consider state $\overline{\mathcal{R}}$. Bank B^e receives interest on its loans, pays out interest on its local deposits, pays out interest on its foreign deposits, and incurs a loss (or gain) due to depreciation (or appreciation) of the local currency at date 2. Hence,

$$\pi^e_{\overline{\mathcal{R}}\mathcal{L}} = i_L L^e - i^{ee}_D D^{ee} - E_2 i^{de}_D D^{de} - (E_2 - 1) D^{de}.$$

Given the assumption that $\mathcal{E}[E_2] = 1$, it follows that

$$\mathcal{E}[\pi^e_{\overline{\mathcal{R}}\mathcal{L}}] = i_L L^e - i^{ee}_D D^{ee} - i^{de}_D D^{de}. \tag{18}$$

Next, consider state $\mathcal{R}$. The change from the previous case is as follows. At date 1, bank B^e loses foreign deposits of an amount $\mathcal{F}$ denominated in foreign currency. It has to redeem an amount $E_{1\mathcal{R}\overline{\mathcal{L}}}\mathcal{F}$ denominated in terms of the local currency at date 1. It has to now liquidate some of its assets. The number of units of assets that it needs to liquidate is $\frac{E_{1\mathcal{R}\overline{\mathcal{L}}}\mathcal{F}}{V}$. So it is left with $\left[L^e - \frac{E_{1\mathcal{R}\overline{\mathcal{L}}}\mathcal{F}}{V}\right]$ units of assets. It receives a return on these units at date 2. Hence,

$$\begin{aligned}\pi^e_{\mathcal{R}\overline{\mathcal{L}}} \;=\; & i_L\left[L^e - \frac{E_{1\mathcal{R}\overline{\mathcal{L}}}\mathcal{F}}{V}\right] - i^{ee}_D D^{ee} - E_2 i^{de}_D (D^{de} - \mathcal{F}) - \\ & [(1-V)L^e + (E_{1\mathcal{R}\overline{\mathcal{L}}} - 1)F] - (E_2 - 1)(D^{de} - \mathcal{F}).\end{aligned}$$

where $(1-V)L^e + (E_{1\mathcal{R}\overline{\mathcal{L}}} - 1)F$ is the capital loss at date 1. To see this, note that the final value of the assets at bank B^e at date 1 after redeeming some

or all of foreign deposits becomes $VL^e - E_{1\mathcal{R}\overline{\mathcal{L}}}\mathcal{F}$. Since the bank initially had L^e assets and $\mathcal{F}$ has been redeemed, it follows that the capital loss suffered by the bank is $L^e - (VL^e - E_{1\mathcal{R}\overline{\mathcal{L}}}\mathcal{F}) - \mathcal{F} = (1-V)L^e + (E_{1\mathcal{R}\overline{\mathcal{L}}} - 1)\mathcal{F}$.

Given the assumptions that $\mathcal{E}[V] = 1 - \delta_1$, $\mathcal{E}[E_{1\mathcal{R}\overline{\mathcal{L}}}] = 1 + \delta_2$, and $\mathcal{E}[E_2] = 1$, it follows that

$$\mathcal{E}[\pi^e_{\mathcal{R}\overline{\mathcal{L}}}] = i_L(L^e - A) - i^{ee}_D D^{ee} - i^{de}_D(D^{de} - \mathcal{F}) - \delta_1 L^e - \delta_2 \mathcal{F}, \tag{19}$$

where

$$A \equiv \mathcal{E}\left[\frac{E_{1\mathcal{R}\overline{\mathcal{L}}}\mathcal{F}}{V}\right].$$

This completes the discussion on profits of bank B^e, given that CL^S contract is not in place. We have already seen the case in which CL^S is in place. We can now state our next result.

Proposition 2. Market for CL^S exists if and only if $\mathcal{M} + q\hat{i}_L\mathcal{F} \leq q\{i_L A + \delta_1 L^e + \delta_2 F\} - (i_L - i'_L)L^e$.

Proof: Market for CL^S exists if and only if $\pi^k_{\mathcal{L}} \geq \pi^k_{\overline{\mathcal{L}}}$ for each k, where $k = d, e$. We will first check the condition under which this is true for $k = d$ and then for $k = e$.

After substituting for $\pi^d_{\overline{\mathcal{R}}\mathcal{L}}$ and $\pi^d_{\mathcal{R}\mathcal{L}}$ from (12) and (13) in (10), we get

$$\pi^d_{\mathcal{L}} = i_L L^d - i^d_D D^{dd} + q(\hat{i} - \hat{i}_D)\mathcal{F} + \mathcal{P} - \mathcal{M}.$$

After substituting for $\pi^d_{\overline{\mathcal{R}}\mathcal{L}}$ and $\pi^d_{\mathcal{R}\overline{\mathcal{L}}}$ from (16) and (17) in (10), we get

$$\pi^d_{\overline{\mathcal{L}}} = i_L L^d - i^d_D D^{dd} + q(\hat{i}_L - \hat{i}_D)\mathcal{F}.$$

It is easy to check that $\pi^d_{\mathcal{L}} \geq \pi^d_{\overline{\mathcal{L}}}$ if and only if

$$\mathcal{P} \geq \mathcal{M} - q(\hat{i} - \hat{i}_L)\mathcal{F} \equiv \underline{\mathcal{P}}. \tag{20}$$

Now consider expected profit of bank B^e. After substituting for $\mathcal{E}[\pi^e_{\overline{\mathcal{R}}\mathcal{L}}]$ and $\mathcal{E}[\pi^e_{\mathcal{R}\mathcal{L}}]$ from (14) and (15) in (11), we get

$$\pi^e_{\mathcal{L}} = i'_L L^e - i^{ee}_D D^{ee} - i^{de}_D D^{de} - q(\hat{i} - i^{de}_D)\mathcal{F} - \mathcal{P}.$$

Substituting for $\mathcal{E}[\pi^e_{\overline{\mathcal{RL}}}]$ and $\mathcal{E}[\pi^e_{\mathcal{R}\overline{\mathcal{L}}}]$ from (18) and (19) in (11), we get

$$\pi^e_{\overline{\mathcal{L}}} = i_L L^e - i^{ee}_D D^{ee} - i^{de}_D D^{de} - q\{i_L A - i^{de}_D \mathcal{F} + \delta_1 L^e + \delta_2 \mathcal{F}\}.$$

It is now easy to check that $\pi^e_{\mathcal{L}} \geq \pi^e_{\overline{\mathcal{L}}}$ if and only if

$$\mathcal{P} \leq q\{i_L A + \delta_1 L^e + \delta_2 F\} - q\hat{i}\mathcal{F} - (i_L - i'_L)L^e \equiv \overline{\mathcal{P}}. \tag{21}$$

Market for CL^S exists if and only if both (20) and (21) are satisfied. The required result follows. ||

Let us interpret condition (20) and condition (21). The former condition says that the price of CL^S must be greater than or equal to the expected net cost of CL^S for the seller. Condition (21) says that the price of CL^S must be less than or equal to its expected net benefit for the buyer.

Expected net benefit for bank B^e equals expected benefit minus expected cost. The expected benefit is that the following expected losses are avoided if CL^S is in place: (a) expected loss of return on some assets, (b) expected capital loss due to pre-mature liquidation of assets, and (c) expected capital loss due to depreciation of the local currency. The expected cost for bank B^e includes the expected interest payment on borrowing from bank B^d, and the foregone earnings due to a constrained portfolio choice.

The expected net cost for bank B^d equals cost minus expected benefit. The cost includes the monitoring cost. The expected benefit is the expected interest income from lending to bank B^e (net of opportunity cost of funds, which could have been used for loans to firms).

As in the case of Proposition 1 in the previous section, Proposition 2 is silent about the exact determination of the price of credit line, given that the market for CL^S exists. For reason similar to that in the previous section, we may postulate that

$$\mathcal{P} = \beta\underline{\mathcal{P}} + (1-\beta)\overline{\mathcal{P}},$$

where β and $1-\beta$ measure the bargaining power of bank B^d and that of bank B^e respectively. As in the previous section, though $\hat{i}$ (the interest rate paid by bank B^e to bank B^d for its possible borrowing at date 1) does not

enter the condition for the existence of the market for CL^S in Proposition 2, it is one of the determinants of the price (see the equation above, definition of $\underline{\mathcal{P}}$ in (20), and definition of $\overline{\mathcal{P}}$ in (21)).

In this section, we have studied theoretically the conditions for the existence of the market for CL^S. In the previous section, we studied theoretically the conditions for the existence of the market for CL^I. In practice, only the latter market exists (on a significant scale). The next section will compare the two types of credit lines to see why this is so.

4 The puzzle, and its possible resolution

In this section, we will see that it is rather puzzling that the market for CL^S does not exist, given that the market for CL^I does in fact exist. We will first explain the puzzle (subsection 4.1). Then we will consider its possible resolution (subsection 4.2). This section is more exploratory than definitive but it is interesting.

4.1 The puzzle

As seen already in the previous section, there is zero cost of reserves for the seller of CL^S. There are two interesting features in this context. *First*, there is a shift of some deposits from bank B^e to bank B^d in state $\mathcal{R}$ and environment $\mathcal{L}$ even though reserves with bank B^e are zero and even though there is no pre-mature liquidation of assets of bank B^e. *Second*, bank B^d need not have cash reserves to be able to lend to bank B^e. This is because it has received new deposits. It uses these funds to lend to bank B^e. The *inter-bank market for funds* described here differs from the usual and more familiar *inter-bank market for reserves*. In the latter case, banks with excess reserves can lend these to banks that have little reserves. However, in our model of CL^S, reserves with banks are zero by assumption. This is in sharp contrast to the case of CL^I in the previous section in which the seller of credit line needs to effectively hold reserves.

It may seem that the costs and benefits of CL^I and those of CL^S are not quite comparable. In one case, the purpose of the credit line is to get

liquidity to exploit a new investment opportunity. In the other case, the purpose of the credit line is to get liquidity to prevent losses on existing investments. Even so, we will make an assumption to get started on being able to say something about the possible existence of the market for CL^S given that the market for CL^I does exist.

Assumption 1. (a) $\mathcal{M} = M$, (b) $q\hat{i}_L\mathcal{F} \leq i_R R$, (c) $q\{i_L A + \delta_1 L^e + \delta_2 F\} \geq prR$, and (d) $(i_L - i'_L)L^e = (i_I - i'_I)I^F$.

Part (a) of Assumption 1 says that the cost of monitoring incurred by bank B in the context of CL^I is the same as the cost of monitoring incurred by bank B^d in the context of CL^S. Part (b) of Assumption 1 states that the expected cost of liquidity for bank B^d in the context of CL^S is less than or equal to the cost of liquidity for bank B in the context of CL^I. In the latter case, reserves need to be maintained by the seller of credit line. No such reserves are required in the case of CL^S though there are some expected costs due to foregone earnings from giving loans with the funds received by bank B^d. Part (c) says that the expected benefit of liquidity in the context of CL^S is greater than or equal to the expected benefit of liquidity in the context of CL^I. The expected benefit of liquidity in the context of CL^S is that losses due to flight to quality from bank B^e are avoided. These losses include loss of return on bank assets (which are diminished due to flight to quality), capital loss due to pre-mature liquidation of long term assets, and capital losses due to depreciation of the currency in the emerging economy (which is, in turn, due to sudden outflow of funds from emerging economies). The expected benefit of liquidity in the context of CL^I is that firm F can exploit the possible new investment opportunity. Finally, part (d) of the assumption above states that the foregone earnings due to a constrained portfolio choice for firm F in the context of CL^I are the same as those for bank B^e in the context of CL^S.

We can now state our next result.

Proposition 3 If there exists a market for CL^I, and Assumption 1 holds,

then there exists a market for enabled CL^S.

Proof: The proof is very simple. Formally,

$$\begin{aligned}\mathcal{M} + q\hat{i}_L\mathcal{F} &\leq M + i_R R \\ &\leq prR - (i_I - i'_I)I^F \\ &\leq q\{i_L A + \delta_1 L^e + \delta_2 F\} - (i_L - i'_L)L^e\end{aligned}$$

where the first inequality follows from part (a) and part (b) of Assumption 1, the second inequality follows from Proposition 1 and the premise that market for CL^I exists, and the third inequality follows from part (c) and part (d) of Assumption 1. It now follows from Proposition 2 that the market for CL^S exists. ||

Assumption 1 may or may not hold in practice. Accordingly Proposition 3 will or will not hold. (In particular, it may be argued that empirical evidence may not support the assumption that $M = \mathcal{M}$.) However, it is important to note the following. First, Assumption 1 is a sufficient condition for Proposition 3. It is not a necessary condition. So even if we need to dilute this assumption in the light of possible empirical evidence in this context, the basic result in Proposition 3 may hold. The basic result is that a market for CL^S exists if a market for CL^I holds (under some conditions). Second, we have assumed part (a), part (b), part (c) and part (d) separately. This set of separate assumptions is stronger than what is required for the basic result in Proposition 3 to hold. So again it is possible to have a diluted version of Assumption 1 for the result to hold. The point is that the conditions under which the basic result of Proposition 3 holds need not be as strong as they may appear in Assumption 1.

Third, it is true that the empirical evidence suggests that $q < p$ (the probability of the need for liquidity in the context of sudden outflow of capital is less than the probability of the need for loquidity in the context of a new business opportunity). This in turn suggests that the expected benefit of CL^S may be less than that of CL^I (see the right hand side of the condition in Proposition 1 and Proposition 2). However, observe that we have made the assumption of risk neutrality. If instead we assume risk

aversion (and keep in mind aversion to 'disaster' (Hicks, 1977)), then the basic point in this section is worth considering despite the fact that $q < p$. The basic point is that there is a possible puzzle that market for CL^S does not exist even though market for CL^I does exist.

We may reiterate that the basic motivation behind Proposition 3 comes from three sources. First is the empirical evidence that the costs of sudden outflow of capital from emerging economies have been high. So CL^S is very useful. Second is the insight that there is hardly any need to hold reserves to take care of the problem of sudden outflow of capital from emerging economies. This keeps a check on the cost of CL^S. Third, there is, in practice, a large market for CL^I even though this requires that a selling bank should hold reserves in some form and even though its benefit seems relatively small compared to the benefit of CL^S, which prevents a costly crisis.

The above analysis suggests that we indeed have a puzzle. In the next subsection, we will attempt to resolve this.

4.2 Resolving the puzzle

It is worthwhile to begin here with the basic idea of a market failure. This occurs obviously when a market does not exist even though it is in social interest. But there is a little more to add to this notion of market failure. The failure or the success of a market cannot be in a vacuum. It is obviously in the context of a legal framework that is provided by the government. If this framework is inappropriate, then markets cannot function properly and there can be many cases of, what seem to be, market failures. It is important then to rule these out. Accordingly, we may restrict the notion of market failure to only those cases in which the legal framework is appropriate to begin with and yet the market fails.

In the context of our analysis here, appropriate legal framework means that voluntary and mutually beneficial contracts can be carried out easily. For example, it is needed that contracts are enforced by the state and that the cost of this is not borne by the private agents. This is the concept that is typically used in the context of a closed economy. If we extend this to an

open economy, then for consistency we need to put in place a mechanism that ensures that international contracts are enforced at zero or low cost for private agents. At present, this is not the case. At present, the cost needs to be borne privately given the absence of an international government that enforces international contracts and given that there are difficulties for national governments in this regard. Enforcement of international contracts is only one of many examples in this context (see Tirole (2002) for a more elaborate view on this).

Let $\mathcal{N}$ be the additional agency costs in the context of international financial contracts, given the dual agency perspective (Tirole, 2002) (see section 1 for more on this). The usual agency costs due to separation of ownership and management are, for simplicity, zero throughout this paper. In view of this, henceforth, we will use the term *agency cost* and *additional agency cost* interchangeably.

One way to resolve the puzzle explained above is to argue that (additional) agency costs are involved in CL^S and not in CL^I. In other words, $\mathcal{N}$ needs to be included in the costs of CL^S. (On the other hand, there is no need to change the formulation of costs of CL^I.) Recall that the condition in Proposition 2 is as follows:

$$\mathcal{M} + q\hat{i}_L\mathcal{F} \leq q\{i_L A + \delta_1 L^e + \delta_2 F\} - (i_L - i'_L)L^e. \tag{22}$$

The amended condition after including the agency cost $\mathcal{N}$ is that

$$\mathcal{M} + \mathcal{N} + q\hat{i}_L\mathcal{F} \leq q\{i_L A + \delta_1 L^e + \delta_2 F\} - (i_L - i'_L)L^e. \tag{23}$$

It is possible that the first condition is met but the second condition is not met. This may explain why the market for CL^S does not exist.

In the light of the above analysis, there can be two views on the problem of non-existence of the market for CL^S. First is the standard view that we have a market failure. Second view can be that seemingly we have a market failure but actually there is a government failure at the international level to provide an appropriate legal framework that includes laws and their enforcement. In the absence of such a framework, markets cannot obviously function well.

Let us now see how we can possibly take care of the problem. What is needed is a second best solution to this problem. We have so far considered a direct CL from bank B^d to bank B^e. Consider now an indirect CL that is routed through the central banks in the two countries and an international institution (such as the IMF or the Bank for International Settlements (BIS)). Let us call such an international institution II. We will see how the cost of CL can be brought down with this arrangement.

Let C^j denote the central bank in country j where $j = d, e$. Let bank B^d sell a CL to bank C^d, which can in turn sell a CL to institution II. The latter can in turn extend a CL to bank C^d, which in turn extends CL to bank B^e. This chain of CLs is shown below:

$$B^d \quad \rightarrow \quad C^d \quad \rightarrow \quad \text{II} \quad \rightarrow \quad C^e \quad \rightarrow \quad B^e.$$

In this scheme, neither any central bank nor the international institution needs to provide funds. They act as mediators only.[15] In this scheme, bank B^d may need to lend to bank C^d. It is interesting that in this context $\mathcal{N} = 0$ since an international contract is not involved. It is true that the international agency aspect is shifted to the sub-link $C^d \rightarrow \text{II} \rightarrow C^e$. However, note that all three are public bodies and the (additional) agency cost has been shifted to the public authorities in this scheme. This scheme is consistent with the practices at the national level.

We may refer to the credit line that operates within the second best legal framework (discussed above) as *enabled* CL^S. Any market operation needs an enabling legal framework. It is as if the central banks and the international institution (II) have enabled an international credit line. To distinguish this credit line from that discussed in the previous section, we may refer to the earlier one as *ordinary* CL^S.

In the scenario in which the IMF and the central banks do not act as mediators between bank B^d and bank B^e, condition (23) needs to hold. However, in the scenario in which the IMF and the central banks do act as mediators, condition (22) needs to hold. It is possible that (22) does hold

[15] See Gottschalk, et al. (2005) for a similar view.

but (23) does not hold. The policy implication is clear. It is important that the IMF and the central banks act as mediators.[16]

Let us sum up the argument. We have a puzzle that the market for CL^S does not exist. This may be resolved by including the additional agency cost. The policy prescription is that we need some second best method of removing the additional agency cost. If this is done, there is a possibility that the market for CL^S could exist.

5 Discussion on extending the basic analysis

We have so far dealt with sudden outflows by foreign investors of capital from banks in emerging economies to banks in developed countries, and we have considered government intervention in the market for CL. In this section, we show that the above analysis can be moulded to deal with different kinds of problems associated with volatile international capital flows. We will consider several cases. The treatment is informal and brief here. Unless otherwise specified, the discussion that follows is with regard to enabled CL^S.

Local currency as the numeraire

In the formal model of CL^S in this paper, we assumed that D^{de} (deposits of the investors in the developed country in bank B^e) are denominated in foreign currency. Now assume that deposits D^{de} are denominated in terms of the local currency. If there is a sudden withdrawal from the local bank, and the latter has CL^S denominated in foreign currency, there is a mismatch. Its deposits are denominated in local currency but its CL^S is in foreign currency. This may have some potential effects. However note that the foreign investors would want to shift from deposits denominated in terms of local currency to deposits in the developed country that are denominated

[16]It is interesting that there is an unintended change from ordinary CL^S to enabled CL^S. Now $\mathcal{M} = 0$ for bank B^d since it is reasonable to assume that bank B^d does not need to monitor bank $\mathcal{C}^d$ for repayment. So there is an unintended subsidy, which may be neutralized as follows. Assume that the price received by bank B^d is $\mathcal{P} - \mathcal{M}$ (the price paid by bank B^e is $\mathcal{P}$ as in the case of ordinary CL^S).

in terms of foreign currency. So there will be demand for deposits denominated in foreign currency by the foreign investors at a time that local banks have access to funds denominated in foreign currency. So they can trade in the market. The foreign investors will sell deposits denominated in local currency for funds denominated in foreign currency. The local bank will sell funds denominated in foreign currency and redeem deposits denominated in local currency. So effectively there is hardly any serious problem for the working of the market for enabled CL^S.

The Dutch disease, and foreign exchange reserves

We have so far dealt with sudden outflows from emerging economies. A sudden and large inflow of capital into an emerging economy too can be problematic for it can lead to considerable appreciation of the local currency, which can hurt exports (for a very long time in some cases). This problem too can be tackled better if international CLs are in place. The adjustment mechanism works as follows.

As and when there are sudden inflows, there will be large supply of foreign exchange in a short period of time. This can be bought by the local central bank to avoid appreciation of the local currency. The central bank can then sell this foreign exchange gradually over time to avoid major changes in exchange rate. The central bank can do so without a fear that there can be a sudden outflow. This eventuality may be met in a different way if credit lines are in place. We have focused on this aspect in this paper. Given that the problem of sudden outflow can be taken care of with CLs, the central bank can more easily deal with sudden inflows with a *temporary* build-up of foreign exchange reserves.[17]

Truly systemic flight to quality

[17] With temporary build-up of foreign exchange reserves, volatile inflows are transformed effectively into stable inflows. It may be argued that there is a problem even with stable inflows. Capital inflows can lead to an appreciation of currency which can hurt exports and encourage imports. This can in turn adversely affect both the level and growth rate of output. This argument ignores the positive effect of possible greater investment on both the output and its growth rate.

In this case, investors shift from banks in emerging economies to money issued by reputed central banks (instead of deposits issued by reputed commercial banks in developed countries).[18] This can create difficulties for local banks in emerging economies.

In this case, the domestic commercial banks can buy a CL from the foreign central bank. A direct CL can be difficult. It can be indirect through an international institution (II) and through the local central bank to make it practical and give it more credibility. The chain of CLs can now be as follows:

$$C^d \quad \rightarrow \quad \text{II} \quad \rightarrow \quad C^e \quad \rightarrow \quad B^e.$$

The central bank in the developed economy (C^d) extends a CL to the II, which in turn extends a CL to the central bank in the emerging economy (C^e). Finally, the latter extends a CL to the commercial bank in the emerging economy (B^e). The chain of CLs shown above differs from that shown in subsection 4.2 in which we have one more CL from the representative commercial bank in the developed economy (B^d) to the central bank in the developed economy (C^d). Recall that in that case, the foreign central bank is a mediator. It does not issue its own money to take care of sudden and large capital outflow from the emerging economy. Now in the case of chain of CLs shown above in this section, the foreign central bank is not acting as a mediator. It issues its own money and lends the same. The foreign central bank, it may be said in this case, acts as the international lender of last resort.

We have now seen how the liquidity problem in even a truly systemic outflow can be taken care of. This problem is, however, more of 'academic' interest given the past experience of crises related to capital flows in many emerging economies. Typically there has been a desired shift to reputed commercial banks rather than reputed central banks in developed countries.

[18] This case can take a strong form. In this, investors shift from commercial banks in both emerging and developed economies to money issued by reputed central banks. The analysis of the strong form is qualitatively not very different from that of the weak form, which we have considered. So we will not consider this separately.

6 Summing up

We considered the market for an ordinary credit line (CL) from a bank to a firm to take care of a 'perishable' investment opportunity. Thereafter, we studied the market for an international CL to take care of flight to quality from emerging economies. An international CL has several benefits. It avoids or reduces losses due to pre-mature liquidation of assets and those due to depreciation of the local currency that tend to be associated with flight to quality. Despite these benefits, there is hardly any market for such CLs. This is in contrast to the market for an ordinary CL, which may be described as flourishing. There is a widespread view that in the case of CL to take care of flight to quality, the funds requirement is large and that it cannot be met in the market. So there is a market failure in this case. This problem of funding liquidity does not arise in the case of an ordinary CL. This view is not quite correct.

We have shown that an outflow from emerging economies can be an inflow into developed economies. So the so-called systemic outflow from emerging economies need not be systemic at the global level. This simplifies the problem of funding liquidity. Formally, in our model, a bank in the developed country can sell a CL to a bank in the emerging economy without incurring cost on holding reserves. It is interesting that the problem of funding liquidity is *easier* to handle in the case of a CL to take care of flight to quality than in the case of a CL to take care of a possible perishable investment opportunity.

While funding liquidity need not be a serious problem in the context of systemic outflow from emerging economies, there can be other difficulties. There can be high private (additional) agency costs involved in international CL contracts in the absence of an appropriate legal framework at the international level. In this context, we considered a second best solution, given *the dual agency perspective* (Tirole, 2002). The central banks and an international public institution like the IMF can play the role of mediators between banks in developed countries and those in emerging economies, and thereby reduce the private (additional) agency costs. We labelled a CL that

operates in such a framework as an *enabled* CL. It is possible that there will be a market for an enabled CL even while there is hardly any market for ordinary international CL to take care of flight to quality. This is suggested by a comparison of two types of CLs - one that is routinely used in business and requires reserve backing, and the other that is usually absent, that can be used to prevent a crisis and that does not require reserve backing.

Though our main analysis was in the context of a sudden and large outflow from banks in emerging economies to banks in developed countries, we extended the analysis to study other related problems such as the Dutch disease, and the use of local currency as the numeraire.

In recent years, the IMF has introduced Flexible Credit Line (FCL) and Precautionary Credit Line (PCL). So far central banks in only four emerging economies have bought these CLs. It has been argued by some that these CLs can be useful only up to a point, given that the IMF has limited funds and cannot issue its own currency. This criticism is misplaced. The IMF can borrow from the banks in developed countries that are most likely to receive funds when there is an outflow of funds from emerging economies, and it can do so with an ex-ante CL from such banks. In other words, it can act as a mediator between banks in the developed countries and those in emerging economies.

We often hear about 'co-operation' between central banks in the event of a financial crisis. What does this mean? One interpretation is that in the absence of an explicit and formal CL that is enforceable by an international court, we have an understanding between governments in different countries which may be interpreted as an implicit and informal CL that is enforced by considerations of trust, reputation and 'co-operation'.

It is interesting that the role of the central banks in our main model is not to provide liquidity in the event of a sudden outflow of capital from emerging economies. Instead, their role is that they can act as mediators between commercial banks, as in the case of the IMF.

In our model, we have assumed that the amount of capital flows from the developed economy to the emerging economy is exogenously given. Given that these capital flows are in place already, we worked out the conditions

under which a market for CL will exist. In other words, the capital flows are assumed to be independent of whether or not CL is in place. But we have seen how the exchange rate and asset prices can be more stable in the presence of a CL than in its absence. So it is possible that if we relax the assumption that capital flows are exogenous, our results will only be strengthened. A safeguard against volatility can encourage more international capital flows, which can be useful for development - at least in countries that have good institutions and macroeconomic conditions.

This paper has served a limited purpose. It has attempted to show that the conclusion drawn in the early writings in the aftermath of the East Asian Crisis (such as Bhagwati (1998) and Rodrik (1998)) in favour of some forms of capital controls was premature. It ignored the possible role of (enabled) international credit lines. We have explored these in this paper. However, to come to more definite conclusions, much further research work is needed.

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