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On Capital Inflows, Liquidity and Bubbles

Guillermo Calvo[1]

Columbia University

Abstract: The paper is motivated by the fact that past financial crises have raised serious concerns about a new wave of capital inflows, but there is still lack of clarity about the mechanism leading and facilitating those crises. This is a dangerous situation because under those circumstances policy could turn out to be severely misguided. The paper contributes to the discussion by arguing that, under full rationality, liquidity factors can generate outcomes that are observationally equivalent to the market bubbles that preceded most crises. The general point is conveyed through intuitive argumentation and through a simple model of the Diamond-Dybvig variety. The paper closes with a brief section on policy issues, and shows that some implications contradict conventional wisdom.

[1] This paper benefited from comments by Sara Calvo, Enrique Mendoza, Andy Neumeyer and Pablo Ottonello.

I. Introduction

Policymakers in Emerging Market economies (EMs) are facing a serious dilemma: while their economies are occasionally benefiting from a surge of capital inflows, they fear a replay of the 1990s and early 2000s when their economies underwent costly Sudden Stops (of capital inflows). A serious concern is that a capital-inflow episode could give rise to "bubbles," i.e., an artificial or transitory increase in some asset prices (typically in the real estate sector) that could go bust as a result of unpredictable external contagion or liquidity shocks, and trigger major credit disruption. This note will provide some support for the conjecture that a capital-inflow episode enhances the liquidity of some of the receiving-economy's assets, which in turn fosters larger flows and higher asset prices: liquidity creates wealth. However, liquidity may suffer a major setback as capital flows collapse (a Sudden Stop), potentially causing a severe impact on output and employment. These effects can occur even in the case in which Sudden Stop does not give rise to net capital *outflows*.

The topic of capital inflows and bubbles is by no means new (e.g., Caballero and Krishnamurty (2006)). However, the literature has focused on bubbles as *generators* of capital inflows, in contrast with the present note that stresses the opposite line of causation: from capital inflows to bubbles. Moreover, although this note is motivated by recent capital-inflow episodes in emerging markets, the same logic can be applied to any episode in which there is a rush of capital flows to a *sector* of a given economy. The Real Estate sector is a relevant example. The current bubble literature is also focusing on sectoral issues but, again, the inception and end of bubbles are assumed to be largely exogenous and at the center of sectoral capital flows (see, e.g., Martin and Ventura (2011)).

Section II discusses these issues in an informal manner, while Section III shows how some of the central insights can be rationalized in terms of a popular Finance model. The paper is closed with a brief policy discussion inspired by the conjecture that capital inflows could give rise to liquidity bubbles.

II. The Logic behind the Conjecture

Firstly, a few words about *liquidity*. A liquid asset's salient property is that it is widely accepted as a means of payment without major capital loss, a property that Menger (1892) labeled *salability*.[2] A prime example of a liquid asset is *cash*. Moreover, cash (particularly in the form of *fiat money*) is a good example to drive home the fact that *intrinsic* value is not a necessary condition for a liquid asset to fetch a positive price in terms of other intrinsically valuable commodities – illustrating the fact that *liquidity creates wealth*.

[2] A more rigorous definition will be given in Section III in the context of a formal model.

Salability is not a property that *per se* enhances utility or production. To take advantage of salability individuals and firms have to sell the asset. Therefore, liquidity is a property that can only exist in a social environment, it is an eminently *social good*, i.e., a good that enhances utility or production because it improves social interaction or, in the usual jargon, facilitates market transactions. Salability itself is facilitated by the existence of a market in which there is always an eager buyer for an eager seller.[3] These are familiar facts which, however, bear repeating to make the following discussion more self-evident.

A capital-inflow episode is defined as a situation in which capital *flows* to a given economy rise sharply relative to its recent past, and stay high for a considerable period of time. It should be clear that the emphasis is on *flows* not *stocks*. This may reflect the existence of adjustment costs and the likely fact that the news about attractive investment opportunities spread by word of mouth. This slow-adjustment feature will play a central role in the ensuing discussion. Savvy investors are likely to be the first ones to identify potentially attractive investment projects, which will be initially reflected in larger capital inflows. The news is eventually picked up by market analysts and transmitted – with a lag – to less well-informed investors through specialized newsletters and newspapers' financial columns. As less well-informed investors join the bandwagon, flows are likely to rise, increasing domestic asset prices in the receiving economy even further.

I will now turn to the core of the argument. Rational early investors realize that, as news spread, there will be a queue of eager new investors. This will likely raise expectations of capital gains, but that is not the point that I wish to emphasize. The first investors to arrive are subject to high liquidity risk because salability cannot be ensured unless there is a critical mass of potential investors who are familiar or eager to become familiar with the assets in question. But, as the news keeps spreading, the liquidity effect will start to kick in. The key point that I wish to emphasize is that early arrivers realize that their new assets have become more easily salable, more liquid, and *for that reason alone* more valuable. Hence, it is conceivable that just the *expectation* of capital inflows gives rise to higher asset prices driven by a liquidity effect that pushes those prices beyond what could be accounted for by standard "fundamentals" alone.[4] The evidence shown in Figure 1 is in line with this logic. The solid lines depict gross capital inflows and outflows around Systemic Sudden Stops for a 1980-2004 sample of EMs that

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[3] Liquidity, which until recently was discussed within a select group of researchers concerned about fundamental issues, like endogenous money and arbitrage irregularities, has now gained center stage. One reason is the realization that standard *fundamentals* are unable to explain some key phenomena associated with financial crises – like the strong impact of Lehman's collapse, and the sudden reversal of financial markets when central banks decided to come back to contain the panic wave. Useful references to the literature can be found in Allen and Gale (2009) and Shin (2010).

[4] It may help to think of asset price, q, as determined by the following equation: q = intrinsic value + liquidity value. The discussion in the text refers mainly to the "liquidity value" component.

suffered major output loss during financial crisis (more than 4% from peak to trough). Towards the peak of capital-inflow episodes both gross inflows and outflows exhibit a sharp increase, suggesting a revolving-door pattern consistent with enhanced salability.[5]

Salability of a given asset may be enhanced by increasing the liquidity of another set of assets in the same economy or region. This externality is due, among other things, to the fact that salability depends on expectations about macroeconomic policy. The expectation that, for example, the government will impose controls on capital outflows may seriously impair the salability of assets from that economy. Thus, investors have incentives to learn about macroeconomic and political aspects. However, once an investor spends resources to learn about those aspects, the same information becomes useful to assess other investment projects in the same economy or region. Thus, investment in knowledge about the macroeconomy is subject to increasing returns to scale. An implication of this is that policies that give greater incentives to "peer at" a given economy or region may trigger higher capital inflows directed to projects which are not necessarily those that formed part of the initial "bait."[6] This type of contagion across asset classes in a given economy or region will be relevant for the below discussion about monetary policy during a capital-inflow episode.

Moreover, if governments and the academic establishment miss the connection between capital inflows and liquidity booms – which I suspect they often do – there might be a tendency to attribute most of the rise in real estate prices, for example, to structural reform or greater policy credibility, inducing a similar view across the population at large.[7] This may give rise to larger capital flows and greater optimism. Actually, there exists some compelling evidence that *net* capital inflows tend to shoot up before Sudden Stop (see shaded bars in Figure 1).

However, if for some reason there is a stop in capital inflows – without necessarily causing the flow to become negative – asset prices could collapse because, on impact, asset salability would be impaired. The markings of bubble creation and destruction are certainly here! Notice that as assets become more liquid, they will attract short-term investors (*hot capital*), because of the salability factor. Thus, hot capital may be a *consequence* of capital inflows, not the other way around as is usually portrayed in policy debates. The boom-bust liquidity cycle need not be

[5] See Dvorak (2003) and Broner et al (2011) for similar evidence. The latter, however, stress asymmetric information and shocks, in contrast with the present discussion in which "liquidity" plays a prominent role.
[6] Calvo (2008) argues that the creation of Brady bonds may have given incentives for the capital-inflow episode that started at the beginning of the 1990s.
[7] These types of optimistic rationalizations were highly popular in EMs until crises erupted in the second half of the 1990s, as well as in the US until the subprime crisis. The *Washington Consensus* may have contributed to that kind of optimism. It was hard to put forward a contrarian view at the time; Carmen Reinhart, Leo Leiderman and I took a lot of flak at the IMF when writing Calvo et al (1993), claim that external factors could unravel the then ongoing boom. But yet another reason for the unwarranted optimism may have been "experts' silence," if they fear that they might cause a run by simply alerting the public about the possibility of Sudden Stop.

linked to irrationality. It could be generated by recession in advanced economies pushing capital out of their shores, a situation resembling current events – or any major event that obstructs the credit channel in advanced economies.

In a perfect-foresight environment, agents would know exactly the timing of the liquidity collapse and will try to pull out their funds before it happens. This observation shows that, unless irrationality prevails, under perfect foresight the process of liquidity destruction is likely to be gradual and, as a result, less damaging than the sudden stop episodes of the last quarter of a century (see Calvo and Reinhart (2000)). That leads me to conclude that for the boom-bust framework discussed above to be able to rationalize actual sudden stop episodes in which some players suffered significant capital losses, the bust must have a *largely unanticipated component* which is largely not taken into account in state-contingent contracts.[8] This is unlikely to be an appealing assumption for a theory involving conventional goods (an episode of overinvestment, for example) under rational expectations, because the theory would attribute the critical part of the drama to *deus ex machina*, i.e., exogenous factors. But the situation is very different for social goods like liquid assets: social goods are more likely to give rise to *multiple equilibria* because their market value depends on social explicit or implicit agreements or conventions. This is a well-known phenomenon in the theory of bank runs, for example. A bank run destroys liquidity of bank deposits. It can happen in the spur of a moment and need not be triggered by a deterioration of standard fundamentals (see Diamond and Dybvig (1983) and Allen and Gale (2009)).

The above bust scenario is not compelling for the case of cash, particularly in advanced economies, because experience clearly shows that the relative price of cash in terms of local goods and services (e.g., 1/cpi) does not collapse overnight unless there is a major real catastrophe. The collapse in the real value of cash is unlikely to be caused by a plain-vanilla liquidity shock. But, as I will argue, cash is not representative of the many other liquid assets that circulate in an economy, particularly assets whose liquidity is enhanced during a capital-inflow episode.

Consider an economy in which there is some degree of *price stickiness* (i.e. a situation in which, within certain limits, output supply is demand-determined at predetermined, sticky, local-currency prices). Price stickiness is a widespread practice in many economies, and has been shown to be robust to extreme circumstances, like large devaluation (see Burstein, Eichenbaum and Rebelo (2007)). Hence, price stickiness, plus regulations that make local cash legal tender, is likely to help to prevent a crash in local currency's output value.[9] This implicit guarantee is

[8] Interestingly, Calvo, Izquierdo and Mejia (2008) define Sudden Stop as a period in which the decline in capital inflows has a large unanticipated component.
[9] This conjecture is discussed and labeled The Price Theory of Money in Calvo (2012 b).

shared by assets which are protected by a Lender of Last Resort (LOLR), like demand deposits. However, governments are apprehensive to extending cash guarantees on liquid assets that are *non-systemic*, i.e., assets which demise is not likely to cause major damage to the rest of the system. One reason is that cash guarantees, unless subject to costly supervision, may lead to excessive risk-taking by the private sector (*moral hazard*) and eventual loss of government's control on fiscal deficit and money supply.[10] Another closely related reason is that price stickiness could start to unravel as massive bailouts become more likely, giving incentives for *currency substitution* (i.e., the use of a foreign currency as domestic means of payment) – debilitating the cash-resilience mentioned above, which could seriously compromise the price-stabilization role of the central bank. Consequently, unless the economy is severely financially underdeveloped, there will likely be a large set of semi-liquid assets that are, in principle, not protected by a LOLR.[11] This observation gains further relevance during a capital-inflow episode in which, as argued above, a possibly large liquidity cycle is set in motion, especially if the government does not see, or does not want to see, the connection between capital inflows and liquidity.

Having provided a rationale for a liquidity boom and bust associated with a capital-inflow/sudden-stop episode, which does not necessarily rely on irrationality assumptions, we can now proceed to discuss the impact of each phase of the cycle on the real economy. A liquidity boom increases the relative price of assets that become comparatively more liquid (real estate, say, recall footnote 4). This, in turn, increases the supply of real estate and reallocates resources away from relatively less liquid investments (manufacturing, say). Word of mouth will likely result in a gradual build-up of the real estate bubble; in contrast, as argued above, a bust may be large and sudden. Therefore, while during the build-up period the attendant resource reallocation may not cause major disruption, the situation may be quite different when the bubble bursts. This can be seen even in the case in which there are no financial ramifications. All it takes for trouble in the real sector to arise is for resource reallocation to be time-consuming. As the bubble bursts, resources will be pushed out of the real estate sector to be eventually reabsorbed in manufacturing. In the transition, however, unemployment may rise (and/or real wages fall precipitously) while manufacturing slowly converges to an equilibrium displaying a smaller participation of the construction sector.

A more relevant and interesting case arises when the liquidity bust impairs the credit channel. To illustrate, consider the case in which capital inflows take the form of external credit lines to

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[10] This may not instantly destroy the real value of cash, but lead to higher inflation, i.e., an insidious but no less worrisome loss of cash's real value.

[11] The qualifier "in principle" is needed because during severe financial crises governments are known to extend LOLR support to many sectors irrespective of ex ante arrangements – as illustrated by the AIG bailout during the subprime crisis. In EMs those unscheduled bailouts have generated large currency devaluation because, in contrast with advanced economies, during a Sudden Stop typically also the EM public sector loses access to credit.

the domestic banking sector. Banks may start lending to the real estate sector, timidly at first because of liquidity risk – but become emboldened later on as credit flows persist because, as noted, liquidity of real estate investments rises. Houses go on the market to be swiftly picked up by eager buyers, feeding the credit/liquidity frenzy. When the "music stops," though, real estate investments become instantly less liquid and house prices collapse. Borrowers' incentives to repay their loans subside and, all of a sudden, domestic banks realize that they face a mountain of non-performing loans. Even if loans keep being serviced on a regular basis, banks will have less incentives to lend (e.g., if they follow a Value-at-Risk strategy, see Shin (2010)). Therefore, the liquidity bust will give rise to a Domestic Credit Sudden Stop (DC_SS).[12] Problems are less severe if domestic banks are not directly involved in the capital-inflow process through wholesale funding (for empirical evidence and discussion, see Raddatz (2010) and Shin (2010)). However, banks are unlikely to get through unscathed in a liquidity crisis because collateral values are bound to fall. In the US, for example, households and small firms borrow against their real estate holdings. Therefore, a collapse in house prices gives rise to a DC_SS and a larger incidence of bankruptcies. Financial intermediaries may not suffer a run but credit dries up.

III. A Model of Capital Inflows and Liquidity Bubbles

In order to help to nail down some central features highlighted above, I will now discuss a simple example in which the *expectation* of capital inflows plays a key role in enhancing domestic liquidity and inducing domestic residents to take risks by investing in long-maturity projects. If large enough, the flows enhance expected welfare and give rise to a boom in asset prices and consumption. However, a Sudden Stop reverses all of that and may cause a meltdown in asset prices, and significant welfare loss in some sectors of the economy.

Consider a three-period economy: 0, 1 and 2. In period 0 investors are endowed with 1 unit of output which they must allocate to a short-maturity or long-maturity project. Short-maturity (or "liquid") projects yield 1 unit of output (= consumption goods) in period 1 or, alternatively, in period 2. On the other hand, a long-maturity project yields 0 units in period 1, but $R > 1$ units of output in period 2. Moreover, there is a market for long-maturity projects in period 1 where those projects can be sold at price q in terms of output or consumption goods in period 1 (see Table 1). The long-maturity project can be thought of as "tilled land." Land is tilled in period 0 and harvested in period 2. One unit of land yields R units of consumption in period 2 (i.e., R is the interest *factor* associated with investing in land).

[12] Following the methodology in Calvo, Izquierdo and Mejia (2008), I define a DC_SS as a fall in domestic credit *flow* exceeding two standard deviations, the latter based on historical statistical moments. There is a high correlation between Sudden Stop and DC_SS, see Figure 2.

Table 1. Payoff of Investment Projects

Period	1	2
Short-maturity project	1, or	1
Long-maturity project (or "tilled land")	q, or	R

In terms of the definitions in the text, the short-maturity asset is perfectly salable, because it is accepted as a means of payments and carries no capital loss. On the other hand, land is accepted as a means of payments at price q but is subject to capital gains or losses. This, incidentally, illustrates the difficulty likely encountered in constructing a *liquidity index* for each individual asset. Fortunately, though, this is not needed in the ensuing example.

Following Allen and Gale (2009, Section 3.2), I will start by assuming that population consists of a one-unit mass of atomistic "local" investors, who are uniformly distributed on the (0,1) interval, and that can be either "early" consumers (deriving utility from consumption in period 1, exclusively) or "late" consumers (whose utility depends on consumption in period 2, only). Investors do not know their types until period 1. The probability of becoming an early consumer is denoted by $\lambda > 0$. The preference shocks are stochastically independent across investors, implying, by the law of large numbers, that the share of early consumers is non-random and equal to λ.

c_1 and c_2 denote period-1 and period-2 consumption, respectively. For simplicity, the von Neumann-Morgenstern period utility index is assumed to be the same across time and denoted by u. The discount factor is assumed to be equal to 1. Therefore, expected utility at time 0, w, is given by

$$w = \lambda u(c_1) + (1 - \lambda)u(c_2). \tag{1}$$

This is a perfectly competitive economy and investors take the price of the long-maturity project in period 1 as given. Let x denote the share of an investor's portfolio allocated to long-maturity projects. The budget constraint is given by the following equations:

$$c_1 = (1 - x) + qx, \tag{2a}$$

$$c_2 = \left(\frac{1-x}{q} + x\right)R. \tag{2b}$$

Therefore, if $q > 1$, it is optimal to set $x = 1$, i.e., to allocate the entire portfolio to long-maturity projects. However, in period 1 early consumers will try to sell their land but there will be no buyers because no one invests in the short-maturity project, which is inconsistent with market equilibrium. Similarly, if $q < 1$, the portfolio will be entirely allocated to short-maturity projects, causing excess supply of those projects in period 1. Thus, as argued by Allen and Gale (2009), a competitive equilibrium calls for setting $q = 1$. By equations (2a and 2b), in equilibrium $c_1 = 1$ and $c_2 = R$. Hence, in equilibrium, expected utility w satisfies

$$w = \lambda u(1) + (1 - \lambda)u(R). \quad (3)$$

Assuming that all investors choose the same x, it follows that in equilibrium $x = 1 - \lambda$.

I will now extend the model for the case in which there is a flow of new market participants n, each one endowed with one unit of output. If the new participants arrive in period 0 and have the same characteristics as the locals, then the number of investors and investment in long-maturity projects increase to $1 + n$ and $(1 + n)x$, respectively. However, expected utility, and the price and share of long-maturity projects (w, q and x, respectively) remain the same. Moreover, once the n investors are in, they would be indistinguishable from the others. Whether they enter the economy or not makes no different for the locals. Therefore, an episode resembling a Sudden Stop, in which at time 0 the n investors choose to invest somewhere else, has no welfare effects on the locals.

The situation would be quite different if the new entrants are *expected* to arrive in period 1 and are late consumers. To show that this case is relevant for our discussion, let us make the realistic assumption that the new entrants are not familiar with local conditions and would not be able to till the land in period 0. They are constrained to enter the local market in period 1 when they already know their types. Early consumers among the new potential entrants will just consume their output endowment and stay away from the local economy. Hence, all the new entrants would be late consumers. This is consistent with a plausible scenario in which newcomers are not familiar with the local conditions (which involve not only technical aspects about the land but all sorts of institutional, legal and political characteristics) but are ready to commit their funds on projects that have already been started (tilled land in our interpretation). Notice that the expectation that new investors will be arriving in period 1 captures the view, discussed in the previous section, that there is a queue of potential investors willing to purchase the illiquid asset (tilled land).

Budget constraint for the locals is the same as in the case $n = 0$, and is given by equations (2a) and (2b). First, note that equilibrium $q \geq 1$ because if, contrariwise, $q < 1$, then (2) implies that $x = 0$: in equilibrium there would be no tilled land and, hence, no new entrants – implying that the economy boils down to the initial model where equilibrium $q = 1$; a contradiction.

Consider now the case in which $q = 1$. Recalling equation (2a) and that the mass of locals is equal to 1, locals' total consumption in period 1 is λ. On the other hand, the supply of consumables in period 1 equals short-maturity investment by locals, $(1 - x)$, plus the inflow of period-1 consumables from new entrants, n. Equating supply and demand of period-1 consumables, yields

$$(1-x)+n=\lambda, \tag{4}$$

implying that

$$1-x=\lambda-n. \tag{5}$$

Hence, as expected, when there are no new entrants (i.e., $n = 0$), $x = 1 - \lambda$ as in the previous case. Equation (5) holds at equilibrium if the right-hand side is non-negative. Moreover, if it is positive, the larger is the number of new entrants, the higher will be the share devoted to long-maturity projects by locals. The reason for this is that the new entrants provide liquid assets necessary to satisfy the demand for period-1 consumables by local early consumers.

Notice that GDP in period 2, Y_2, satisfies

$$Y_2 = xR. \tag{6}$$

Thus, GDP rises *even though new entrants do not engage in new investment projects*, they just acquire them from locals. The rise in output can be fully attributed to a *liquidity* effect. However, by (2), $c_{1,2}$ remain the same. Another way of reaching that conclusion is that, by (5) and (6), GDP net of transfers to "foreign" investors, $Y_2 - nR = (1 - \lambda)R$, is independent of n. Therefore, GDP rises but locals' welfare remains the same.

Consider now the case in which the right-hand side of (5) is negative. This implies that equilibrium $q > 1$. To prove it, notice that, by (2), optimal $x = 1$: locals are fully invested in long-maturity projects, i.e., land. The supply of land in period 1 would thus be equal to λ (= land liquidation in period 1 by early consumers). On the other hand, the only participants on the demand side are new entrants, whose demand for land equals n/q. Equating land's demand and supply, yields

$$q = \frac{n}{\lambda}. \tag{7}$$

Therefore, if the right-hand side of (5) is negative, (7) implies that $q > 1$. Moreover, by (2) and (3), expected utility satisfies

$$w = \lambda u\left(\frac{n}{\lambda}\right) + (1-\lambda)u(R). \tag{8}$$

Thus, as in previous case, $c_2 = R$, irrespective of n; but welfare w rises as n goes up, on account of the higher price of land. As capital inflows materialize (in period 1) the price of land and period-1 consumption rise, a phenomenon that one could characterize as "a boom in consumption and real estate prices."[13]

[13] In an open economy context, the rise in q could be interpreted as "real currency" appreciation.

Notice that the locals' decision to invest in land is governed by the *expectation* that capital flows will take place in period 1. Thus, boom conditions associated with capital inflows are not a reflection of accumulated flows. They result from the *expectation* that those flows will continue. Thus, it is the "length of the queue," if you will, not the accumulated flows that play a key role here. This is the central phenomenon stressed in the previous section.

Sudden Stop

What if capital inflows do not materialize and $n = 0$ (i.e., a Sudden Stop occurs)? Suppose, for the sake of concreteness, that expected $n > 0$ implies that the equilibrium price of land $q = 1$. I will call this the "ex ante equilibrium." In the ex ante equilibrium equation (5) holds, and can more explicitly be written as follows:

$$1 - x + n = \lambda[(1 - x) + qx], \qquad (5')$$

which boils down to (5) if $q = 1$. The expression in square brackets is consumption by early consumers (recall (2a)). Long-maturity investment x is predetermined ex post (i.e., in period 1). Hence, if n drops to $n = 0$, the price of land q must fall below 1 for equation (5') to hold or, more intuitively, for equilibrium in period 1 to hold. This implies that early consumers will be worse off. In turn, by (2b), the surprise fall in q improves the welfare of late consumers. This may seem paradoxical because late consumers can purchase more land from early consumers even though total land supply is unchanged. But the mystery is quickly dispelled by observing that the absence of capital inflow increases the supply of land *available* for locals.

This example illustrates two key features associated with Sudden Stop in practice: It may result in a (1) meltdown in real estate prices, and (2) drastic change in wealth distribution.

Volatility of Capital Flows, n

Recent experience has confirmed the conjecture that capital flows could be highly volatile. Figure 2 shows that the number of Sudden Stops in emerging market economies reached unprecedented levels around the Lehman 2008 episode, even though the epicenter of the crisis was somewhere else. Theory and empirical research suggest that *contagion* could happen if economies or sectors display major mismatches between assets and liabilities in terms of maturity or currency denomination (see, for instance, Calvo et al (2008)). In addition, the Lehman episode vividly illustrates the fact that crises in EMs could also arise if critical mismatches are located in advanced economies (see Figure 2).[14] In fact, Chile, where the public sector is a net international creditor, exhibited one of the largest Domestic Credit Sudden Stops, DC_SS in 2008.

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[14] I raised this conjecture in connection with the 1998 Russian crisis and its effects on some prominent international financial institutions (e.g., LTCM), see Calvo (2008).

All of this deserves greater theoretical research. However, I think that from the perspective of EMs it is a good "first approximation" to take capital inflows, *n*, as highly idiosyncratic, capable of displaying large and whimsical swings, which are somewhat independent of individual economies' conditions. In other words, severe financial contagion cannot be discounted. The previous discussion assumed that Sudden Stop takes individuals by surprise. This assumption is likely to be realistic for the Tequila and Asian crises of the mid nineties, but it is arguably less so going forward. A simple extension to account for individuals' realization that the economy can undergo Sudden Stop would be to assume that capital inflows are zero (i.e., Sudden Stop) with probability *s*, and equal to a given positive number *n* with probability 1 - *s*. Individuals choose *x* in order to maximize expected utility. The price of tilled land in period 1 will now be contingent on Sudden Stop. It can easily be shown, employing the same reasoning as in the simpler above example, that $q^{ns} > 1$ and $q^{s} < 1$ – where q^{ns} and q^{s} denote the price of land in absence and during Sudden Stop, respectively. Notice that the price of land would exceed 1 even though equilibrium *x* is interior (i.e., $0 < x < 1$). Thus, the model can rationalize a boom in land prices based on the expectation of capital inflows even though individuals invest in both liquid and illiquid assets (i.e., land) – which makes the model undoubtedly more realistic than the simpler one above.[15] The intuition behind this result is that as individuals become aware that the economy could undergo Sudden Stop, they have greater incentives to invest in liquid assets, which props up the price of land if Sudden Stop does *not* occur. A parallel result based on the same intuition is that the meltdown of land price in case of Sudden Stop if $s > 0$ is less pronounced than if $s = 0$.

External Liquidity Shocks

Empirical research suggest that capital flows may be affected by *short-term nominal* interest rates in the US (see Calvo, Leiderman and Reinhart (1993)). This fact can be rationalized in the present model if one assumes that once capital flows in, there is a fixed cost associated with reverting this operation through capital outflows. This is not the place to spell out the extended model in great detail. However, an informal discussion in a non-monetary context may help to get the main picture.

Suppose a setup similar to the basic model above, except that the horizon extends for three more periods, i.e., periods 3, 4 and 5, which are replica of periods 0, 1 and 2 in the basic model. In period 3, individuals start from scratch and, as in the simple model, they are endowed with one unit of output that they can allocate to land and (local) liquid asset. Foreign investors that entered the local market in period 1, are forced to stay in for the entire second cycle (i.e., periods 3-5); in other words, they become "locals." They can invest in the local liquid asset but are not allowed to invest abroad. In particular, they would not be able to invest in the external liquid asset. Let the interest rate factor on the external liquid asset be denoted by *i*. Therefore, the expectation that *i* will rise may induce foreign investors to stay out of the local market, staging a Sudden Stop. Segmentation of liquid-asset markets may be due to

[15] Recall that if $s = 0$ (the case studied in the previous sections) and *x* is interior, then equilibrium $q = 1$.

transaction costs or just expected policy actions on the part of local policymakers, like controls on capital outflows. The latter, in particular, could be perceived to be more likely as *i* is expected to rise.

IV. Some Policy Implications

In this section I will highlight some implications suggested by the approach put forward in this note. In particular, I will discuss the ability of some popular policy options to help offset the liquidity cycle.

- <u>Capital Controls</u>. A popular policy option is taxing short-term capital inflows. The effectiveness of this policy is questionable because implementation is hard and the private sector has numerous ways to bypass these regulations (see Magud, Reinhart and Rogoff (2011)). Moreover, unless capital *outflows* are also subject to controls, a Sudden Stop could trigger capital outflows by domestic residents fueled by savings that never took the form of capital inflows, or by reversing inflows that took place before the rule was put into effect (see Calvo (2010)). Given these limitations, it is advisable to focus on a critical lever of the liquidity/credit mechanism, namely, domestic banks – and attempt to stabilize items from banks' balance sheet that exhibit high volatility (volatile *n* in the above model). Salient examples are domestic banks' non-deposit, or wholesale, liabilities, especially short-term credit lines with international banks, and off-balance-sheet obligations (See Raddatz (2010); South Korea has been moving in that direction). Bank regulation is an imperfect art. Therefore, regulators should also keep track of symptoms that might reflect the existence of an unusual liquidity boom. A relevant example would be a dramatic surge in domestic credit. Recent research shows that periods of high credit growth are leading indicators of future crises (see Mendoza and Terrones (2008), Schularick and Taylor (2012), Agosin and Huaita (2010)). This may initially be triggered by a liquidity boom that increases collateral values. Thus, a complementary line of defense is to slow down credit expansion by increasing reserve requirements. This policy should be supplemented by tight credit market monitoring to make sure that those regulations are not offset by disintermediation.
- <u>International Reserves</u>. These are eminently liquid assets which are salable around the globe. They are the natural medicine against Sudden Stop because they can be used to offset the fall in *n* in our model. The IMF is now offering less expensive alternatives (e.g., Flexible Credit Line). The optimal level of reserves is still an open issue. Calvo, Izquierdo and Loo-Kung (2012) suggests that the optimal reserve level strongly depends on *global* risks, which are hard to evaluate ex ante. Recent experience, however, suggests that international reserves are highly effective in protecting some critical sectors (e.g., the export sector) from the effects of Sudden Stop (for a discussion of Brazil's experience in this respect, see Martins and Salles (2010)). A drawback is *moral*

hazard: the private sector may take the government's implicit guarantee into account and increase its exposure to credit denominated in terms of foreign currencies. In the model discussed here, for example, reserve accumulation (i.e., public sector investment in the liquid asset) will have no effect if the private sector internalized public sector holdings and reserve accumulation is financed through lump-sum taxes (a form of *Ricardian equivalence*). Thus, reserve accumulation might have to be accompanied by measures that limit such exposure, especially in sectors that are likely to be beneficiaries of central bank's largesse in case of crisis, like Brazil exporters. This may call for a radical change in the way central banks operate. Since the new tasks are politically charged, it may be advisable to keep them outside the central bank.

- Gross International Reserves. It is not unusual for governments to accumulate international reserves by borrowing (i.e., issuing public debt), an operation that goes by the name of "sterilized intervention." This type of operation is typically associated with an attempt to prevent currency appreciation without fueling domestic inflation. However, the liquidity approach discussed here suggests an entirely different motivation. Sterilized intervention is a swap by which the government in question acquires a highly liquid asset in exchange for a less liquid one, a feature that is reflected in the interest differential between these assets (higher on the less liquid asset), even when both assets are denominated in the same currency. As shown in the subprime episode, for example, US Treasury obligations comprise assets that are unlikely to suffer liquidity impairment during EM Sudden Stops. Thus, gross international reserves could help to partially offset the credit drought associated with such episodes, at least in the short run. This establishes a possible liquidity rationale for sterilized intervention: it is equivalent to a form of insurance against illiquidity.
- Monetary Policy. The dominant paradigm in monetary theory ignores the liquidity issues discussed here.[16] According to such paradigm, higher policy interest rate will make alternative investment projects less attractive. This would not necessarily lower capital inflows but it could help to redirect them away from the domestic credit market. The liquidity approach sheds some doubts about this conclusion. Suppose, in line with the discussion in Section II, that liquidity is enhanced by the size of capital inflows because it leads to better and more timely information about the receiving economy. Thus, a hike in the policy interest rate may be counterproductive, because it increases the set of attractive liquid assets during a capital-inflow episode, which may enhance the liquidity of other investment projects in the receiving economy.

[16] In fact, the dominant paradigm assumes that "money" is the only asset that provides liquidity services, even though the central bank controls the interest rate on an, in principle, highly liquid short-term asset. This glaring contradiction has been dealt with by virtually removing "money" from the models and substituting it by sticky prices (in terms of domestic money!).

- Current Risks. It is important not to miss a central but subtle point, namely, that a Sudden Stop – which according with the above arguments could trigger a domestic-liquidity meltdown – involves a fall in capital *inflows*. Thus, a Sudden Stop may occur even though it does not involve capital inflow *reversal*. This observation is relevant in the present circumstances. A decoupling of EMs from advanced economies is, in principle, a welcome development because it goes in the direction of redressing Global Imbalances (i.e., large US current account deficit), which may enhance growth in poorer regions of the world. It would be hard to disagree with the logic behind that point of view. However, this does not rule out the existence of price overshooting on account of the liquidity boom discussed in this note. After prices are pushed up beyond what is justified by standard non-liquidity fundamentals, it only takes the expectation that capital inflows will slow down in order for that to have a deflationary effect on asset prices that benefited from the liquidity boom. In absence of external shocks, price deflation may occur in an orderly fashion, but the current international situation is shaky enough that large external shocks cannot be ruled out. The shocks can come from the real sector (a spike in oil prices) but, as shown in Calvo, Leiderman and Reinhart (1993), they could also be the result of pure liquidity shocks, like a rise in the US short-term interest rate, for example.[17]
- Global Policy Coordination. Local solutions, especially if effective, may produce an undesirable global outcome. A case in point is controls on capital inflows. Encouraged by the IMF (see Ostry et al (2010)), many countries have imposed a variety of such controls, going from taxes on short-term ("hot") capital to new bank regulations. If effective, controls in country *j* will keep undesirable capital out of its sovereign space. But this does not solve the global problem because those flows will be redirected to country *i*, and so on – and a scenario of "competitive capital-control regulations" might be set in motion. There is no base to presume that the outcome will be a good one. As controls rise, for example, some of the "good" capital flows may be discouraged. Moreover, and more to the point, the expectation that tighter capital controls will be imposed in the future may stimulate the type of short-term speculative flows that controls are trying to suppress. Therefore, there is a clear need for policy coordination, a new Bretton Woods agreement that will spell out rules for preventing *globally* counterproductive regulations. Needless to say, this observation is also relevant if the flows are prompted by considerations other than liquidity.

[17] For a model in which a change in the *nominal* interest rate has an effect on the relative price of liquid assets, see Calvo (2012 a).

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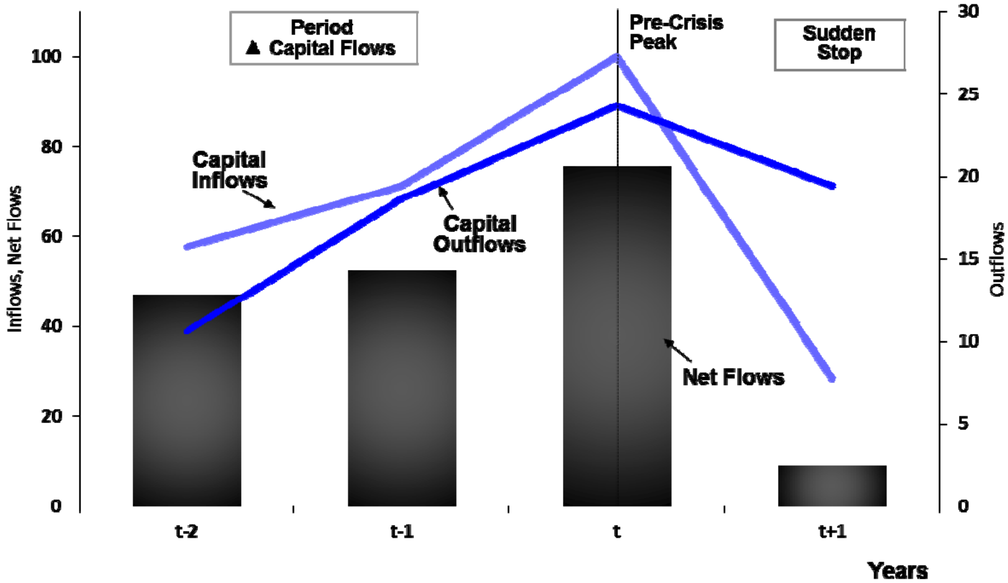
Figure 1. Capital Flows to EMs: Dynamics pre-Sudden Stop

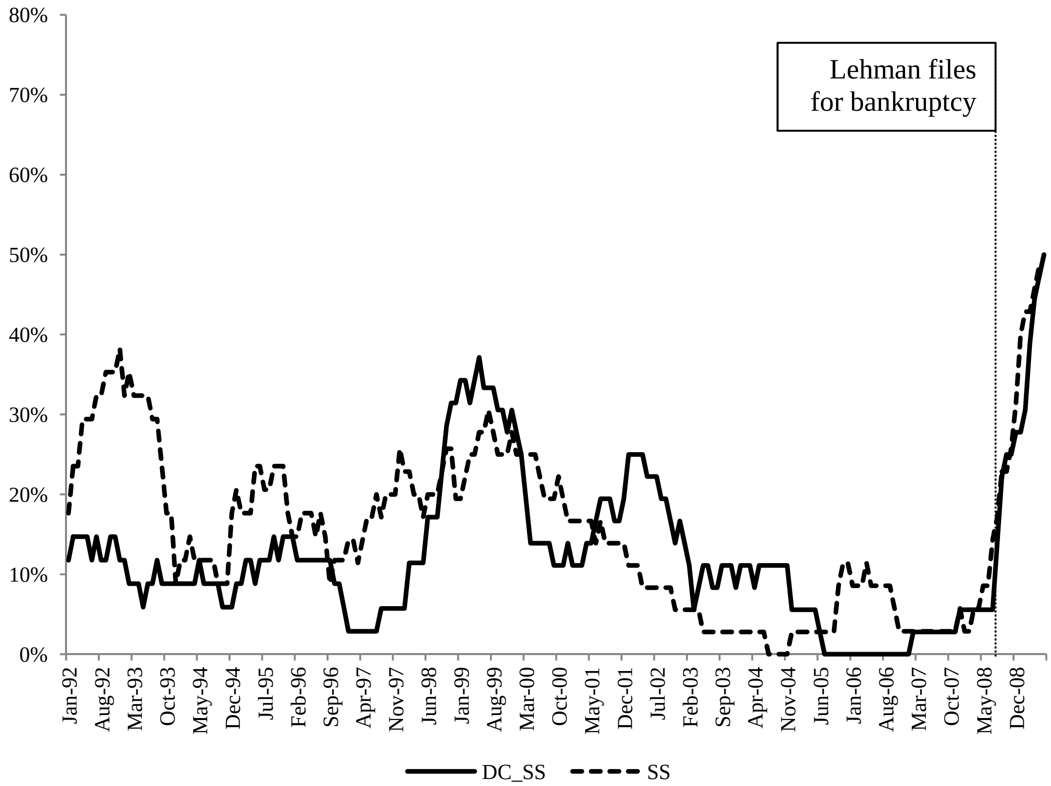
(Average episode of 3S Output Collapse, Real USD, Pre-Crisis Peak Capital Inflows =100)



Note: Average of 3S Output Collapses episodes in Calvo, Izquierdo and Mejia (2006). Excludes Peru and South Africa due to data availability.

Capital Inflows include Financial Account liabilities and Net Errors and Omissions. Capital Outflows include Financial Account assets. Net Flows is the difference between Capital Inflows and Capital Outflows.

Figure 2. Percentage of EMs exhibiting Sudden Stop and DC_SS



Countries included: Argentina, Bolivia, Brazil, Chile, Colombia, Czech Republic, Dominican Republic, Ecuador, Egypt, El Salvador, India, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Russia, South Africa, Thailand, Turkey, Uruguay and Venezuela.