LOOKING AT FINANCIAL CRISES IN THE EYE
A Simple Finance/Macro Framework

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Abstract. The paper starts focusing on a crucial characteristic of financial crises, namely, a breakdown of the bridge linking savers to dissavers. Thus, a first-best policy is to repair the bridge. In the meantime, fiscal stimulus packages could be justified as instruments to prevent sudden and pronounced changes in relative prices, which might otherwise lead to socially costly bankruptcies. Moreover, the paper claims that a successful framework should be able to rationalize episodes in which crises have a large surprise component, and contagion is rampant. This is addressed by showing that bank-run models of the Diamond and Dybvig (1983) variety can help to portray those features if financial institutions are somewhat free to engineer liquid instruments that are not fully protected by a Lender of Last Resort. A model is employed to show how those liquid instruments could generate *relative* price bubbles that burst if there is a bank-run type episode. Those episodes bring about a sudden stop in credit flows (thus connecting with the paper's initial discussion) which, under incomplete markets, have deleterious effects on output and employment. There are strong parallels with the Sudden Stop literature for emerging-market economies. In brief, the story line is that socially costly systemic crises start as liquidity crises that become credit crises, eventually generating solvency crises.

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I. Introduction

The recent financial crisis has proved, once again, that theory is a golden cage: it provides a framework to understand the world around us, but may make it hard to see beyond its brilliant railings. This might help to explain, for example, why so many mainstream economists and policymakers, upon realizing that output seemed to be on free fall, clamored for expansive fiscal policy. Theory is theory and, if it is free from logical gaps, theory is right. However, if theory misses key issues at work, it could be a pretty bad guide for policy, indeed. I am afraid that drilling the *Neoclassical Synthesis* into the minds of so many generations of students in a world in which advanced economies were free from major financial disruptions after World War II – has made the Neoclassical Synthesis the theory of first resort for the policymaker.[1] But, is the Neoclassical Synthesis a relevant framework for managing financial crises; a model that ignores shocks that stem, in a fundamental way, from a malfunction in financial intermediation?

I am no foe of expansive fiscal policy to palliate the effects of financial crisis. My concern is that the push for larger public expenditure often stems from models in which financial issues are not central. Rather, the emphasis is on issues like *thrift pandemic* (i.e., net savings' enlargement that goes beyond individual sectors or countries) coupled with imperfections in the labor market and/or liquidity trap. Naturally, if a thrift

[1] It should be noted that while advanced economies were enjoying the period of so-called Great Moderation, emerging market economies went through a series of wrenching financial crises. But it is rarely the case that mainstream macro theory is shaken up by accidents outside advanced economies. I cannot help wondering whether the subprime crisis' virulence could have been attenuated if policymakers in advanced economies had learned some of the lessons that emerging market economies so abundantly supplied. See Calvo (2005).

pandemic is the cause, then larger government expenditure appears as unquestionably the right medicine (just what the Neoclassical Synthesis doctor ordered).

I think it is time to focus sharply on these crises' epicenter, and place financial issues at center stage. In doing so, it soon becomes apparent that a financial system is like a nervous system that touches all corners of the economy and has crucial implications for policymaking. But to be able to discover the many aspects of financial dysfunction it is necessary to venture outside the golden cage, which may necessitate walking with hesitant baby steps. There is not much point in trying to develop sophisticated models at the start. In fact, sophistication may suck us back into the golden cage.[2]

Section II will discuss financial dysfunction in the context of non-monetary models. As it will become apparent, breakdown of financial intermediation shows up as a thrift pandemic although the cause is very different. I will place special attention on Debt Deflation, the phenomenon stressed most notably by Irving Fisher (1933) in a monetary context, but that can be rephrased and generalized in a non-monetary setup. Section III, in turn, discusses monetary models, i.e., models in which not all assets are endowed with *liquidity*, i.e., serving as a means of payment. It focuses on an issue which is inherent to the financial system but which is generally disregarded by macroeconomists, namely, *liquidity generation and destruction*. In a seminal paper Diamond and Dybvig (1983) show that even if banks' assets are highly illiquid it might be profitable for banks to finance those assets by issuing highly liquid deposits, if

[2] Premature beauty and elegance may be dangerously distracting. I wonder to what extent Hicks's (1937) masterful modeling of Keynes (1936) *General Theory* is responsible for macroeconomists having for a long time ignored the many deep insights about financial issues ensconced in Keynes' writings, starting with the *GT* itself; and, until recently (see e.g., Bernanke (2000), Calvo (2005)) also ignoring Irving Fisher's (1933) Debt Deflation, so central in current debate.

depositors are heterogeneous and their liquidity needs are hit by shocks that are not highly correlated across depositors. Liquidity provision is not free from risk because bank runs are possible. Banks runs occur if depositors believe that other depositors will try to withdraw their bank deposits at the same time. This is an *endogenous* shock which, by its nature, is highly correlated across depositors. The shock can however be neutered by an effective Lender of Last Resort that offers unlimited deposit guarantees. This important insight has not been incorporated into macroeconomic theory until recently (see Calvo (2009)). Doing so, one can show that asset prices exhibit bubble-type characteristics as a result of financial liquidity-enhancing innovation (e.g., marketable asset-backed securities); but, due to factors akin to bank runs, the liquidity generated in that fashion could evaporate overnight. This is elaborated at the start of Section III, and the resulting intuitions – which would now be based on a model that puts the financial sector at the center and allows for bubbles and crashes driven by financial considerations – are employed to discuss monetary and exchange rate policies, both in Advanced and Emerging Market economies, EMs. Section IV shows how the previous two Sections can be combined to tell a plausible story in which liquidity shocks lead to a sudden stop in credit *flows*. The story is closely linked to the already large literature on EM Sudden Stops (of capital inflows). Furthermore, Section IV presents computations showing that the cut in short-term bank credit in the US, during the dotcom and subprime crises, exceeded 4 standard deviations (computed using a historical record of credit-flow changes). Interestingly, credit flows sharply decline *after* the start of the dotcom recession (as reported by the NBER). In contrast, the subprime crisis shows reverse sequencing: recession *follows* credit flow contraction. These facts open interesting

questions which are briefly addressed at the end of the section. The paper is closed with some final remarks in Section V.[3]

II. The Non-Monetary Economy

Consider a non-monetary economy with heterogeneous agents. To simplify and focus on essential ingredients, I will start the discussion by assuming that output is homogeneous and perishable, and there is no capital accumulation. If financial markets are operative, most of the time *savers* and *dissavers* coexist, and in equilibrium gross ex ante savings, *S*, and dissaving, *D*, will be equated.[4] To simplify, once again, let us think of the capital market as a set of institutions that ensure that debts will be fully repaid. This is Exhibit A. Consider now the same economy with no capital market in which, therefore, agents are forced to consume their endowment at each point in time. This is Exhibit B. Clearly, Exhibit A Pareto-dominates Exhibit B because individuals in the former can replicate, if desired, their consumption path in Exhibit B. Suddenly switching from exhibit A to B is much like a surprise financial crisis for individuals living under the aegis of Exhibit A. After the switch, savings cannot reach dissavers. Hence, in equilibrium consumption of potential dissavers will necessarily fall. Thus, if savers attempt to keep their saving at the same level prevailing prior to crisis – which, contrary to dissavers, they can do by just consuming less than their endowment – thrift pandemic will arise. This shows, incidentally, that a Keynesian aggregate-demand impasse can occur in a non-monetary economy. If the government does not intervene, it is possible that the economy transitions from Exhibit A to B with no disequilibrium. Initially,

[3] The reader will find strong parallels between this paper and the bank-run literature, especially Allen and Gale (2007), which examines several of these topics from a finance perspective. The main value added of this paper is its emphasis on macro/policy in a systemic financial crisis context.

[4] This is strictly true at equilibrium with no uncertainty. This extreme case is a useful background for the ensuing discussion that will address major macro shocks like the elimination of financial markets.

however, thrift pandemic cannot be ruled out. In fact, announcements that the government will try to offset demand shortfalls by increasing government expenditure may make it rational for savers to keep their saving plans much the same, thus generating thrift pandemic's symptoms. Keynesian adepts would claim success when, actually, it is a case in which the medicine *causes* the disease!

What can be done? Obviously, fixing the capital market is the first order of business. If rapidly done, then, leaving aside *moral hazard* problems, this policy would qualify as a first-best. Unfortunately, real-life governments do not have the institutions or staff to reach that level of perfection. Alternatively, governments may try to borrow from savers (e.g., issuing Treasury bonds) and lend to dissavers, again replicating the capital market. But this is utopian because it would be tantamount to saying that the capital market can be replaced overnight by central government. The main difficulty in replicating first-best solutions is now clear: policies are not *neutral*; they call for skillfully rechanneling resources from savers to dissavers to bypass the blockage in the financial arteries.

Clearly, increasing government expenditure is a distant relative to the first-best solution. In the first place, public spending without reallocation to the private sector is just wasteful, unless expenditure can be directed to public goods. Even in that case, social welfare will fall (relative to blissful Exhibit A) if the supply of public goods was optimal prior to the financial crisis. Moreover, potential dissavers would suffer a double whammy because not only will they have to cut back consumption, but their future taxes will increase – unless the government can discriminate between prior-to-crisis savers and dissavers, which is highly unrealistic. This shows why expansionary fiscal policy is

usually accompanied by a set of special bills and regulations that try to offset the associated inequities and distortions. The resulting pasticcio of bills and regulations will have a heavy political component and, therefore, will be difficult to unravel after the crisis is over. The legacy could be heavy burden for future growth.

The Kahn-Keynes multiplier. A Detour

I will not try to extend the above setup to account for a multiplier effect. It suffices to remind ourselves that its power comes from the assumption that consumption is an increasing function of *current* income, in contrast with the *Permanent Income Hypothesis*, according to which *permanent* income (some average of present and future income) and not current income is the key determinant. The Permanent Income hypothesis may considerably weaken the multiplier effect. Under normal financial conditions, the Permanent Income Hypothesis is very appealing. But the situation is quite different if financial intermediation comes to a grinding stop. Under those conditions, individuals are much more constrained by their current income, like the unhappy citizens of our Exhibit B. Gross savers would like to lend to gross dissavers but there are no credible institutions to make that effective. Thus, *effective* aggregate demand, as Keynes liked to label ex ante aggregate demand under market *disequilibrium* conditions (relative to normal market conditions), is a function of current income, and the Kahn-Keynes multiplier applies with greater force.[5] Thus, the multiplier's relevance

[5] Keynes makes no reference to financial sector dysfunction in the *General Theory*'s chapters in which he discusses aggregate consumption. This is interesting because Keynes was aware of financial problems as is evident in many of his other writings. I suspect that a reason may be that he did not want to open too many battle fronts.

hinges more on financial disruption than the dubious consumption's psychological regularities emphasized in the *General Theory*.[6]

Debt and Relative-Price Smoothing

I will extend the model to the case in which there is outstanding debt and two types of goods. This allows me to address the debt-overhang issue that arises during crises. I will assume that prior to crisis there are static and intertemporal capital market transactions; after crisis, only static trade transactions are left standing. Clearly, shifting from one regime to the other will cause a change in relative prices. The change could be large because it is not dictated by slow-moving tastes or technology but by a shock in the capital market that seriously damages (actually, eliminates in our example) intertemporal trade. This shock may not cause serious bankruptcies if, prior to crisis, individuals were wise enough to include the capital-market implosion as a contingency, making repayment conditional on financial crisis. Otherwise, the most likely case, bankruptcies might mushroom overnight, led by those individuals whose debt obligations increase relative to their income as a result of the relative-price change. This problem was analyzed by Fischer (1933) upon noticing that price deflation during the Great Depression significantly increased the relative value of debts and contributed to massive bankruptcies. Fischer (1933) coined the phrase "Debt Deflation" to characterize the phenomenon. Debt Deflation is a major threat in countries like the US in which debts are largely denominated in US dollars. However, there is, in principle, nothing inherently *monetary* about this problem. For example, in EMs, where it is not unusual for debts to be denominated in terms of tradable goods (or foreign exchange), a *real* depreciation

[6] However, if income follows a random-walk process, the difference between current and permanent income gets blurred up and reinforces the appeal of the multiplier even under normal conditions.

(i.e., an increase in the relative price of tradables with respect to nontradables) produces effects similar to Debt Deflation. Actually, EM financial crises are typically accompanied by large *nominal* devaluation and sharp increase in inflation (not deflation); see Calvo et al (2006). Thus, even if monetary phenomena are behind the relative-price change, Debt Deflation is not necessarily a result of inflation or deflation. The basic fact is a change – typically large – in some key relative price, a non-monetary phenomenon.

Bankruptcies are socially costly, especially if they are caused by "black swan" events (as the expression is used in Taleb (2007)) that take most agents by surprise, and are not incorporated in state-contingent financial contracts. Economic activity is seriously impaired by debt repayment despite the fact that production could, in principle, keep going unabated. For that reason, countries have devised legal procedures like Chapter 11 by which economic activity goes on basically undisturbed while debtors and creditors reach an agreement. However, Chapter 11-type arrangements work when bankruptcies are not massive. The situation is very different if, for example, bankruptcies arise as a result of a large change in a variable like the real exchange rate that cuts a large swath across the economy. Many bankruptcies spring up at the same time. Moreover, bankruptcy of firm *i* could be due to its own problems or to problems in which its partners are involved, which cannot be assessed until the "dust settles." In addition, the judicial system is prepared to deal with the normal flow of bankruptcies. Thus, a bankruptcy epidemic will generate a long queue of unresolved cases. This may be costly in terms of growth. Consider a realistic extension of the model in which output is produced by capital and labor, and growth is possible thanks to capital accumulation and technical progress. With luck, unresolved Chapter-11 procedures may keep production at

full capacity. However, capital expansion and R&D are likely to be seriously impaired because they involve access to *new* credit, which will be hard to get until bankruptcy procedures are concluded (this discussion will be continued in Section IV).

Therefore, there exists a role for government for stabilizing, albeit temporarily, relative prices. One option is to increase public expenditure in sectors that would otherwise see a sharp decline in their relative prices. Textbooks do not discuss this role because financial dysfunction is ignored. But it just takes a basic understanding of those issues to realize that fiscal policy could help in ensuring what I would call "relative-price smoothing." Notice that firms that would otherwise suffer a sharp relative-price fall would be aware that they have been given emergency aid by the government; therefore, these firms are likely to take complementary action to self-finance (e.g., by cutting down dividend distributions and investment projects). This helps output recovery although, it must be noted, it may not enhance growth to the extent that liquidity accumulation is done at the expense of investment or technical change.

How effective is fiscal expansion for relative-price smoothing? This is an open question. I doubt that it will be of much use for EMs subject to Sudden Stop, i.e., large and largely unexpected fall in (external) capital inflows. First, because EM governments may be as much credit-constrained as the private sector (this will be further discussed in Section III). But, also, because Sudden Stop episodes tend to occur in situations in which capital inflows represent more than 4% of GDP, a large number if it has to fall on fiscal shoulders which, even if economically feasible, is sometimes delayed by political wrangling, as the recent US debate about TARP exemplifies.[7]

[7] Notice that the highly controversial TARP represented less than 2% of US GDP.

III. The Monetary Economy

A central characteristic of a monetary economy is that, in contrast to the non-monetary counterpart, not all goods and assets can serve as a means of payment. In the conventional macro model one asset is singled out as means of payment and called "money." However, in the real world there are many assets that play that role;[8] cash, bank checks, US Treasury Bills, for example.[9] The financial sector spends a great deal of resources creating goods or assets that serve as means of payment, an activity that goes back to banks' inception. Not all assets are equally convenient as means of payments, even after liquidity-enhancing engineering. A COD, for example, could be a good payment instrument for large corporations but it is dominated by cash to pay for a taxi ride. If assets were to be listed according to the "easiness" with which they can be employed as a means of payment, the list will likely be headed by cash in local currency followed, somewhere below but not very far, by Treasury Bills (at least for the US) and, recently, by asset-backed securities; beyond a certain point, assets become essentially worthless as means of payment. I will refer to this concept of "easiness to be employed as a means of payment" as "liquidity" of the asset in question: the easier, the more liquid.[10]

As shown in the seminal paper by Diamond and Dybvig (1983), bank liquidity that dominates cash is created at the expense of setting up a system that is subject to runs. This could be a highly profitable business for financial intermediaries, especially under imperfect competition. Since profitability depends on the novelty of the liquid

[8] In the General Equilibrium Arrow-Debreu model *all* goods are means of payment.
[9] This was highlighted in a string of papers I co-authored with Carlos Vegh. See, for instance, Calvo and Vegh (1995). For a more recent application, see Calvo (2009).
[10] An asset's liquidity also enhances its use as collateral. More on this in Section IV.

instrument, it is to be expected that there will be a race to create new and better liquid financial instruments, giving a rationale for the feverish pace of financial innovation experienced since the 1970s, and especially in the 2000s.[11] However, these instruments may be subject to runs, in which case liquidity might be destroyed on the spur of the moment, unless there is a Lender of Last Resort that ensures their market value.

Liquidity, Bubbles and Crashes.

The above insight can be employed to show that liquidity creation could have a positive effect on the relative price of the underlying assets (e.g., real estate). A simple example helps to convey the basic intuition.

Suppose output is produced by land, which is in fixed supply, and *real liquidity balances*.[12] The latter, in turn, is generated by (conventional) money and the market value of land, both in terms of output. The liquidity of land could stem from mortgage-backed securities or any asset of wide market circulation that employs land as collateral. More concretely, I will assume that, for an individual competitive firm, liquidity is given by $m + \theta pk$, where m is real monetary balances (in terms of output), p is the output price of land, k is the stock of land employed by the representative firm, and θ is a parameter (from the point of view of the individual firm), such that $0 \leq \theta < 1$. Output, y, is given by

$$y = \alpha k + \phi(m + \theta pk), \tag{1}$$

[11] Other plausible factors are the surge of inflation in the 1970s, the breakdown of Bretton Woods and, more recently, the accumulation of international reserves by EMs in order to fend off Sudden Stops. These factors may help to explain why financial innovation was relatively dormant before 1970s and speeded up after the Asia/Russia 1997/8 crises. The latter sent a strong signal to EMs that if they wanted to keep the IMF doctor away they had to armor-plate their economies by self-insurance, which took the form of liquid-assets' accumulation.

[12] For a discussion of the "money in the production function" literature, see Fischer (1974). For an application in the context of uniqueness of equilibrium in monetary economies, see Calvo (1979). The example in the text is just a straightforward extension.

where α is a positive parameter and represents a standard (linear) production function; the contribution of liquidity to output is captured by function ϕ, such that $\phi' > 0$, and $\phi'' < 0$. Setting $\theta < 1$ implies that land is assumed to be dominated by cash as a means of payment, given the same opportunity costs. Let r and π denote the real interest rate = the land rental (if the relative price of land, p, is expected to be constant), and the expected rate of (output) inflation, respectively. Therefore, assuming that p is expected to be constant through time,[13] the firm's quasi-rent is given by

$$y-(r+\pi)m-rpk. \tag{2}$$

Consider the benchmark case in which $r = \alpha$. Hence, by (1) and (2), profit maximization calls for maximizing

$$\alpha k+\phi(m+\theta pk)-\alpha pk-(\alpha+\pi)m \tag{3}$$

with respect to m and k. The corresponding first-order conditions are

$$\begin{aligned}\phi' &= \alpha+\pi,\\ \alpha+\phi'\theta p &= \alpha p.\end{aligned} \tag{4}$$

Therefore, by (4), at interior solutions (on which I will constrain my attention) one gets the following central result:

$$p=\frac{1}{1-\theta(1+\pi/\alpha)}. \tag{5}$$

Suppose $\pi = 0$. Then, the relative price of land in terms of output is an increasing function of θ; if $\theta = 0$ (the conventional case in which land yields no liquidity services), $p = 1$. Moreover, the relative price of land increases with inflation, π.[14]

[13] This holds at steady state. For a more complete analysis with liquidity in the utility function, and similar results, see Calvo (2009).

[14] Notice that if $\alpha + \pi = 0$, the Optimum Quantity of Money holds, the price of land would be independent of the liquidity coefficient θ.

The main point that I would like to stress here is that financial innovation can have a positive effect on land, not explained by conventional "fundamentals" (in this case, the conventional marginal productivity of land α). Standard analysis is bound to mistakenly identify the liquidity-linked rise in the price of land as a "bubble." Moreover, to the extent that the associated assets are subject to Diamond-Dybvig kind of runs, the liquidity coefficient θ could suffer a sudden fall, a crash. The crash would seem to support the view that we are looking at an unsustainable bubble in the conventional sense, but in the present setup the crash would be a result of failure, not in land, but in financial markets – a failure that an effective Lender of Last Resort could have helped to prevent.

An implication of the model is that to prevent bubbles and crashes, financial regulation must either put a stop to liquidity-enhancing financial innovation or – since the latter may neither be desirable nor possible[15] – increase the scope of the central bank to operate as a Lender of Last Resort with respect to the new instruments and institutions.

Monetary Policy.

The previous section is a helpful background for the ensuing discussion. I will interpret the subprime crisis as a process that ended in a massive destruction of liquidity, a collapse of the liquidity coefficient θ. What can a central bank do in the face of that? A literal application of the above model suggests that the central bank should try to offset the liquidity collapse by an increase in nominal money supply. It is easy to show that the latter would succeed in increasing the output and land prices, helping to fend off Debt Deflation *à la* Fisher (1933). However, by equation (5), changing nominal money supply

[15] Desirability is questionable. As shown in Calvo (2009), if there are no distortions in the real asset market, an increase in the liquidity coefficient θ is welfare-reducing. The same result can be shown in the present context.

has no effect on the relative price of land, *p*. Thus, to the extent that land is used as collateral for regular (non-liquidity producing) loans, the fall in *p* may result in an increase in the cost of credit and possible deleterious effects on output and growth. By equation (5), a more effective way in terms of the model would be to increase the rate of inflation. Or, in a more realistic extension of the model, to lower the policy interest, assuming that the latter is equivalent to paying interest on *m* (see Calvo (2009) for a discussion of this case). However, by equation (5), even these policies become ineffective if financial crisis makes land totally illiquid, i.e., $\theta = 0$.

Another difficulty for the effectiveness of monetary policy is that the private sector, facing a disruption in financial intermediation like the one discussed in Section II, rushes to place its savings in the form of public sector's bonds, especially in advanced economies ("flight to quality").[16] This makes those bonds closer substitutes to high-powered money, and pushes down their interest rates.[17] The initial flight to quality, thus, helps to increase the liquidity of public sector bonds. However, if this fails to offset the initial liquidity destruction associated with the financial crisis, the usual open-market operations – by which high-powered money is exchanged for short-term highly liquid public debt instruments – may not succeed in avoiding a precipitous fall in liquidity, and price deflation will ensue. I have already discussed Debt Deflation for countries like the US in the context of a non-monetary economy. In a monetary framework price deflation may bring about relative-price misalignment if not all prices and wages are fully flexible, a problem highlighted in conventional macro models. Preventing price deflation will, thus, require using other procedures, like Quantitative Easing, QE. QE involves a more

[16] EMs will be discussed below.
[17] This could be modeled by adding Treasury Bills as another liquidity-producing asset in function ϕ.

effective way of increasing total liquidity. Instead of exchanging two highly substitutable liquid assets as in standard open-market operations, QE consists of issuing high-powered money in exchange for illiquid bonds, e.g., "toxic" assets. Or, more directly, QE takes place by increasing fiscal subsidies financed by money creation. The sums involved may have to be huge because liquidity destruction is likely to be large, especially when panic strikes.[18]

Exchange Rates

Increasing the number of currencies complicates the picture but does not detract from the relevance of the above discussion. In practice, however, a multiplicity of convertible currencies complicates policymaking too. An unbalanced expansion of the supply of the different currencies, for example, may have a strong effect on exchange rates, causing frictions in international trade. A large bilateral devaluation may lead to accusations of beggar-thy-neighbor policymaking and be conducive to retaliatory protectionist policies. Therefore, global monetary expansion is better carried out by coordinating monetary policy across central banks to prevent large bilateral exchange rate swings among major currencies. Identifying factors that ensure effective coordination requires further study. I would conjecture that it may be easier to coordinate when there is widespread fear of output implosion, and much harder during the recovery phase. Laggard economies, for example, may be reluctant to exit easy money in the hope that recovery is stimulated by currency devaluation.

[18] The outcry about the doubling of Fed's balance-sheet (translation: doubling of high-powered money supply) can only be justified if the resulting increase in liquidity exceeds the liquidity collapse by a wide margin. As far as I know, Fed critics have failed to address these critical liquidity issues.

Emerging Market Economies

This class of economies deserves special attention. They are a veritable laboratory of financial crises going back to Mexico's 1994/5 *Tequila* crisis.[19] But an even more important reason for examining EMs as a separate class is that they portray some characteristics that are not found in advanced economies, namely, (a) financial failure showed up, first and foremost, on cross-border flows through a Sudden Stop (in capital inflows);[20] (b) by and large, EM currencies do not circulate outside national borders, and (c) in most instances, the crisis started in another country.[21] I will carry the discussion assuming that the three characteristics apply.

Characteristic (c) implies that central banks cannot help to create credit or (relevant) liquidity by issuing their own currencies. Beyond a certain point monetary expansion results in currency devaluation and inflation.[22] A Sudden Stop dries up credit and liquidity relevant for international trade. This cannot be created by EM central banks, unless the government has accumulated international reserves or obtained emergency credit lines from the rest of the world. This is a major drawback relative to advanced economies. EMs' situation is similar to that of a bank depositor whose checks become illiquid during a bank holiday: there is little he can do. If the bank holiday was anticipated, a precautionary measure would be, for example, to hold currency in a safe deposit box (equivalent to international reserves for countries, a strategy that has become popular in EMs after the 1997/8 Asia/Russia crisis). This shows the relevance of setting

[19] For details, see Calvo (2005).
[20] Note that the subprime crisis brought about a sharp cut in US *domestic* credit flows, but there still no evidence of the US suffering from a Sudden Stop of capital inflows, unlike during EM financial crises.
[21] The most dramatic example in this respect is the Russian 1998 crisis. See Calvo (2008).
[22] Unless countries face external deflation as it happened after the Lehman episode in September 2008. This allowed many EMs to generate large currency devaluations without higher inflation, in sharp contrast with other Sudden Stop episodes prior to the Lehman episode; see Calvo et al (2006).

up a liquidity safety net for EMs that run the risk of being hit by Sudden Stop. The safety net can be set up by accumulating international reserves or getting external credit lines. It is essential that the safety net provides large and timely liquidity support.[23]

A word of caution: safety nets are breeding grounds for *moral hazard* and *free riding*. If the government accumulates international reserves and obtains credit lines to fence off Sudden Stop, the private sector may have greater incentives to increase its exposure to liquidity shocks. There is anecdotal evidence about this in several EMs during the subprime crisis. If the problem intensifies, the central bank may have to implement closer control on free-rider strategies, and extend financial regulation beyond the usual boundaries. Moreover, provision of international liquidity during financial crisis is not easy. It could simply end up feeding capital flight. "Neutral" infusion of liquidity through, for example, foreign exchange intervention to prevent large currency devaluation, makes it easier for multinational firms (which are prime borrowers in EM domestic capital market) to short the domestic currency and siphon international reserves off to headquarters abroad. This is particularly attractive in a global crisis like the subprime in which headquarters are hit by liquidity crunch. To avoid this problem, it is advisable for governmental institutions like the central bank and finance ministries to go through regular simulation exercises (much like *fire drills*) in which procedures to make available international liquidity to the private sector are carefully discussed and decided. Both technical and political considerations are important. For example, to maximize the effectiveness of foreign exchange injections and prevent capital flight, several countries

[23] The IMF has made important strives in that direction by, for example, creating the Flexible Credit Line, FCL, for which countries must pre-qualify but it is intended to prevent crisis, not palliate its consequences. Mexico was the first FCL recipient. It amounted to around $45 billion. It sharply contrasts with the procedure followed during the 1995 crisis, when a $50 billion bailout package was granted but only three months into the crisis.

have opted for directing credit to some key sectors, like the export sector. However, heterodox policies like that could make policymakers easy targets for the opposition parties. Therefore, it may be advisable to open the simulation exercise to a wide political spectrum, at a time when they can be discussed at leisure and consensus is easier to reach.

Fiscal expansion in EMs is even more questionable than in advanced economies since, as a general rule, flight to quality does not favor EM public sector bonds.[24] Thus, EMs fiscal expansion during financial crises requires having saved during the fat years, like Chile; or being able to obtain credit lines from Multilateral Development Banks, MDBs. The latter has the advantage of helping to put a check on corruption and rent-seeking. In this respect, it is worth exploring mechanisms like Public-Private Partnerships, PPP, sponsored by MDBs.

IV. Credit and Liquidity

I started the discussion in Section II by examining the implications of a shock that obliterated credit. This served to highlight a central problem in financial crises. However, a systemic crisis model should be able to offer a rationale for the fact that, typically, an accident in a small corner of the economy, e.g., the market for subprime mortgages or the 1998 Russian default on domestic public debt, can generate a crisis that involves a large swath of the global economy. Besides, by singling out credit as the central problem, the model in Section II is unable to explain why recovery in many deep crisis episodes has not been accompanied by an equivalent surge in bank credit and capital inflows (for empirical evidence, see Calvo et al (2006)). These gaps are filled in Section III, where liquidity, not credit, is highlighted. In the first place, the Section offers

[24] However, this statement did not apply in the early phase of the subprime crisis until the Lehman episode, a period in which there was large capital inflows in EMs, employed mostly for international reserve accumulation.

a rationale for the creation and destruction of liquidity. Although it does not provide a complete theory of equilibrium selection, it appeals to available banking theory to claim that liquidity creation is an inherent banking activity which exposes the financial system to systemic crash.[25] By imbedding these intuitions in a macro model, I was able to argue that liquidity creation and destruction have their counterparts in output growth and crash. In the model in Section III these phenomena are not a consequence of cheating or unsophisticated investors. They are part and parcel of a financial system that has no effective Lender of Last Resort, a characteristic that recent financial crises seem to have shared. For example, the Russian 1998 crisis – a spectacular systemic crisis episode – saw the EMBI+ soar past the 1500 basis points mark overnight as, contrary to expectations, the IMF failed to bailout Russia and, thus, drove Russia to default on its domestic public bonds. The EMBI+ is an index of EM public bonds denominated in hard currency for which there was no safety net or Lender of Last Resort. Neither the Fed nor the ECB were responsible for preventing their collapse. These central banks eventually lowered their policy interest rates but only when problems hit home, by the collapse of LTCM, for example.

However, the liquidity approach in Section III is incomplete because credit is left out of the picture (except for some marginal comments in that Section). This Section will attempt to combine Sections II and III into a consistent whole, and show that a sudden stop in credit *flows* may be an important crisis factor.[26]

[25] I believe it is fair to say that either we do not have a convincing theory of equilibrium selection, or what is available relies on factors that are hard to observe by the policymaker. Therefore, from the policymaker's point of view, a self-fulfilling crash is observationally equivalent to an exogenous shift from a "good" to a "bad" equilibrium. See, for example, Morris and Shin (1998).

[26] What follows has a strong resemblance to the "credit channel" in the monetary literature (see Bernanke, Gertler and Gilchrist (1999)). The main difference is that I focus on shocks that stem from the financial

Suppose that crisis starts as a result of a liquidity-destruction episode that takes most people by surprise (a "black swan" event). For the sake of concreteness, I will assume that the financial system is composed only of commercial banks subject to fractional reserve requirements, and that the liquidity-destruction episode is a plain-vanilla bank run. On impact, deposits become less liquid, lowering output (recall equation (1)). In addition, the bank run destroys the credit channel, paralyzing credit *flows*, and throwing the economy into the type of impasse discussed in Section II. Informal credit channels may spring up, as conjectured in Calvo et al (2006), but such credit rechanneling is time-consuming because it involves new arrangements. In addition, the rechanneling may be incomplete because liquidity destruction lowers the market value of assets whose liquidity evaporates (following the lines of Section III) and, therefore, lowers the market value of collateral. In short, the liquidity shock brings about a stop in credit *flows*, which cannot be immediately regenerated. As argued in the EM Sudden Stop literature, a cut in credit flows may be all that is required to generate serious financial crisis and cause severe damage in the real sector. Credit stock may remain unchanged and still a sharp contraction in credit flows could trigger major crisis (see Calvo (2005, Chapter 12), Calvo et al (2005)). The simple intuition is that, by definition, for every agent in the economy the following identity must hold: expenditure = revenue + net credit inflows. Thus, a sudden cut in credit inflows may force unplanned and costly adjustment by potential dissavers, e.g., firing trained workers, giving rise to overdue interest payments. Moreover, contraction in credit flows translates into changes in relative prices and generates Debt-Deflation-type difficulties highlighted in Section II.

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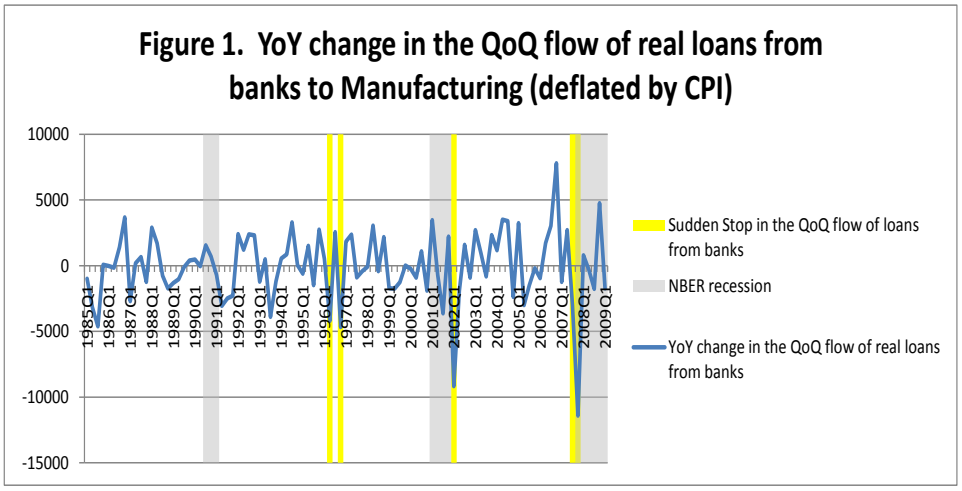
system that give rise to systemic effects which, in turn, aggravate financial dysfunction, as in the Great Depression and Sudden Stop literatures (see Bernanke (2000), Calvo (1998)).

These difficulties are likely to be more serious the larger and the less expected is the decline in credit flows in the eyes of market participants. There is a low probability that a large "black swan" decline in credit flows is incorporated in financial contracts. Therefore, "black swan" shocks are likely to trigger mass bankruptcies (discussed at some length in Section III). It is important to note that liquidity shocks driven by a self-fulfilling bank run have the potential of being "black swan" shocks because of the existence of multiple equilibria but, even more relevant, because economists do not have a theory of equilibrium selection that is easily testable or depends on easily observable variables. Under those circumstances, switching equilibria is likely to provoke a great deal of surprise, especially when it does not happen on a regular basis. I do not intend to claim that all bank runs are like that. Some can somewhat be anticipated, as would be the case if banks are known to be insolvent (as in Mexico 1994, prior to the Tequila crisis). But even under those circumstances the *timing* of the crisis is very hard to predict. Hence, when the bank run happens, the shock is not free from "black swan" characteristics.[27] These remarks also help to explain why eventually stopping a bank run – bringing banks back to health, as the saying goes – may not shield the real sector. Since the effects of bankruptcies on the private sector are hard to reverse, even restoring credit flows to their pre-crisis levels may not be enough to quickly restore output and employment. On the other hand, eventual output recovery, for example, may be achieved without an equivalent rise in credit because, as pointed out above, alternative credit channels may arise and firms may make increase retained earning but, as noted, credit rerouting mechanisms may involve a decline in medium-term growth.

[27] In the half of the 1990s there was widespread consensus that Russia would have to default on its private debt unless it undertook drastic fiscal reform. However, default in August 1998 took many key market participants by surprise and represented a major shock for EMs.

Credit-Flow Sudden Stops in the US

To show the empirical relevance of the above discussion, Figure 1 depicts credit-flow sudden stops in the US Manufacturing sector in the period 1985Q1 to 2009Q1. The methodology is parallel to the one employed for identifying EM Sudden Stops of capital inflows in Calvo et al (2006).



Yellow bars in Figure 1 stand for Sudden Stop Windows (for details, see Data Appendix), and grey shadow bars correspond to recession periods as defined by the NBER. The 1996 and 1997 episodes are borderline credit sudden stops; the other two are large. There is a Sudden Stop Point/Window in 2002Q1 and a Sudden Stop Point in 2007Q4, both exhibiting negative flow changes exceeding 4 standard deviations! The Sudden Stop Window corresponding to 2007Q4 is the interval [2007Q3, 2007Q4].[28] It is interesting to note that although both episodes could qualify as "black swans," the one in 2002 occurs *after* recession had already started, while that in 2007 does *before*. The first

[28] Notice that this credit sudden stop occurs way before Lehman's collapse, and that the latter is not accompanied by another credit sudden stop in the US. I suspect that, if any, sudden stops after Lehman's episodes are to be found in EMs.

episode is associated with the dotcom crisis and the second with the subprime crisis. This evidence suggests that the credit flow contraction in 2002 may have been a *consequence* of the dotcom crisis, while that in 2007 may be the *cause* of the subprime crisis and its global spreading. Sudden Stops that result from real sector problems may be less likely to infect other sectors through financial channels, helping to explain why the dotcom crisis was much more benign than the subprime, despite both displaying very large credit-flow contraction.

V. Final Words

1. The paper discussed a framework which is in line with observed features in systemic financial crises. The central ones are:

    a. Sudden metastasis of apparently limited sources of financial infection,

    b. Followed by a sudden cut or sudden stop in credit *flows*,

    c. Having a sizable negative impact on real sectors.

2. The framework is anchored on well-established bank-run theory, elegantly formalized by Diamond and Dybvig (1983). It does not require bringing new exogenous elements to trigger a bank run, because bank runs are inherent features of banking (especially "shadow banking") under fractional reserve requirement and imperfect Lender of Last Resort – a fact that is empirically supported by recent systemic financial crises.

3. This approach suggests that, contrary to some critics of mainstream macro (see Krugman (2009)), conventional macro theory already contains the basic ingredients to offer a rationale for systemic financial crises. To be true, the financial sector and key financial aspects have to take central role; one has to look at financial crises in the eye, as the paper's title suggest. This is a major innovation, but it does not seem to be outside the realm of current economics. Some parameters will have to be tweaked and some novel frictions incorporated, but I doubt that there is a need for overhauling the whole theoretical apparatus. In fact, important strides in that direction have already been taken (e.g., Bernanke (2000), and Bernanke, Gertler, Gilchrist (1999)). Besides, the recent crisis as well as the previous EM systemic crises offers a rich ground for empirical analysis to help guide the design of the new *Synthesis* (see Calvo et al (2006)).

4. What should be clear, however, is that simple-minded Keynesian theory supporting sizable expansion of government expenditure could be a misleading guide to policy. It certainly was one of Keynes' most enduring sound bites, but it does little service to his memory. He was extraordinarily more sophisticated than that.

5. On the other hand, DSGE models may impose too many technical restrictions that cloud the view from some basic insights. There will be plenty of time for that. As of now, I would put emphasis on examining the evidence and articulate some basic insights.
6. The paper leaves many open issues. An important empirical one is related to the observation that both the dotcom and the subprime crises display "black swan"

declines in credit flows (more than 4 standard deviations). However, the dotcom crisis was just a small bump in the road, while the subprime threatened to throw the world economy into a great depression. An interesting difference is that credit contraction in the dotcom crisis happened *after* recession started, while in the subprime it was the other way around – which suggests that financial factors were more likely the cause of recession in the subprime crisis. These are only two observations, making econometric inference worthless. However, there is a wealth of evidence coming from EM crises. Ongoing research suggests, for example, that in EM crisis, contraction of credit flows (more precisely Sudden Stop of capital inflows) precedes recession in most instances. This suggests that large credit-flow cuts that precede recession may not only cause recession in a single country or sector but, given the bunching of Sudden Stops, they may also have the potential of spreading crisis beyond its epicenter.

Data Appendix

The data employed in Figure 1 comes from the U.S. Census Bureau's Quarterly Financial Report encompassing Manufacturing, Mining and Trade Corporations (see www.census.gov/econ/qfr/index.html). Figure 1 employs the series Short-term debt, original maturity of 1 year or less: Loans from banks, for Corporations in the NAICS Manufacturing Sector, All Total Asset Sizes, deflated by the CPI. Flow at a given quarter is defined as the difference between the stock of short-term loans from banks in that quarter and the previous one. At year t quarter x, denoted tQx, the change in the credit flow is defined as Flow at tQx minus Flow at $(t-1)$Qx, and denoted Ch(tQx). Let $\mu(t\text{Q}x)$ be the mean of the series Ch(•) from 1981Q4 to the quarter prior to tQx, and let $\sigma(t\text{Q}x)$ be the corresponding standard deviation. Then, I define a Credit Sudden Stop Point as a quarter in which $\text{Ch}(t\text{Q}x) - \mu(t\text{Q}x) < -2\,\sigma(t\text{Q}x)$; moreover, I define a Credit Sudden Stop Window as the interval around a Credit Sudden Stop Point in which $\text{Ch}(t\text{Q}x) - \mu(t\text{Q}x) < -\sigma(t\text{Q}x)$. This is in line with the definition of a Sudden Stop (window) based on capital inflows; see Calvo et al (2006). In words, a Sudden Stop Point is a quarter in which the deviation of the change in the flow of credit from its mean is below 2 standard deviations, where the former and the latter correspond to the mean and the standard deviation of a historical series of flow changes. A Sudden Stop Window is built around a Sudden Stop Point by requiring that the deviation of the change from its mean is less than 1 standard deviation of the same historical series. Therefore, the concept identifies situations in which the change in the credit flow is negative and large with respect to its own history. In this application, windows are very narrow, only in one case exceeding one quarter.

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