Subprime Crisis and Efficient Bailouts

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Abstract

The subprime crisis in the U.S. and its ripple effects in other countries generated a great deal of debate on the necessity for, and the quantum of, bailouts. This study sets up an analytical framework to examine the relative efficiency of bailout instruments to overcome the short term liquidity problems and the associated solvency problem. The analysis also provides some guidelines for regulation to avoid similar crises in the future.

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> "There is a fine line between risk taking and recklessness. Risk taking drives innovation; recklessness drives over a cliff. In recent years, we had way too much of the latter. We are paying a huge price for that, and we need a correction." – Friedman (2008).

1. Introduction

The recent financial crisis has two essential dimensions. The first aspect is a liquidity problem reflecting the inability of financial institutions (FIs) to continue lending to business since they could not recover past loans that they granted. In addition, the reduction in the market value of the assets that they financed prevents the financial institutions from recovering their loans by selling the assets that they financed[1]. The second problem is that cumulative losses resulted in the erosion of the equity base of the FIs in addition to a reduction in the market value of their assets. It resulted in increasing their inability to finance even legitimate and fundamentally sound investments. This is generally the solvency problem.

Since all the major countries affected by the subprime crisis are otherwise economically resilient the immediate problem is one of providing adequate liquidity to sustain the economic activity. The other issue is clearly to protect the assets that lost their value temporarily and restore them when these economies bounce back. Bailouts must address both these requirements.

The subprime crisis is basically a U.S. problem. However, two types of ripple effects have been observed in other countries. Some FIs hold titles to the tainted receivables of the U.S. primarily because they erroneously expected higher returns from them. They have to address the resultant liquidity problem in their countries. In our own context, the main problem is due to foreign institutional investors (FIIs) withdrawing their dollar investments given the liquidity problems in their countries[2]. The resultant reduction in liquidity must be made up to sustain the economic activity that they enabled us to start.

There is already a great deal of debate on the necessity for, and the quantum of, bailouts. Given the urgency for concerted action, many policy announcements have already materialized. It is perhaps necessary to conceptualize a coherent analytical basis to appreciate such policies. The present study is an attempt to address this issue within an appropriate analytical framework.

The rest of the study is organized as follows. Section 2 deals with bailouts for the basic liquidity crisis. Section 3 modifies the results based on the patterns of financing the loans

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[1] The FIs or the borrowers may create this problem collectively. No one FI may be in a position to protect itself. This is one way of justifying claims for bailouts.

[2] To an extent this may also have an impact on foreign direct investment. Such long term issues will not come under the purview of bailouts considered here.

and assets of the FIs. Debt and equity will be acknowledged as the major instruments of finance. This analysis enables us to distinguish between the bailouts necessary to address the liquidity and solvency problems separately. We also consider the option of a trust holding the tainted assets in the form of a put option and selling them if their value increases adequately when normalcy is restored. In either case the trust needs to be financed initially through some bailout package. Securitization has been one of the major reasons for the subprime crisis. Hence, section 4 examines bailouts in the presence of securitization. Section 5 deals with the ripple effects and the bailouts that they necessitate. It transpires that such bailouts should be viewed as purely short term emergency measures so that excessive risk taking is not encouraged in the long haul. Further, as the above quote from Friedman suggests, there are some clear and desirable levels of risk taking to foster innovation and growth. Each of the models in the above sections, and the analysis thereof, has lessons for such regulatory diligence[3]. They will be detailed in each of the sections at appropriate places. On the whole, it appears that some prudential norms for lending as a fraction of the value of assets, a more explicit calculation of the probability of default, some constraints on FIIs withdrawing their investments suddenly, and similar policy measures will be necessary to minimize the damages due to the ripple effects. Section 6 offers a brief summary and notes some basic limitations of the analysis.

2. Basic Framework

Consider the case of a large FI, which we will call Shylock, providing loans L. We will assume that Shylock, true to his historic worth, provides loans to every possible activity, justifiable by economic fundamentals or purely speculative. Postulate that it charges an interest rate r. The institution however recognizes that not all borrowers are trustworthy. Some of them are bound to reneg on loan repayment. Let p be the probability of default[4]. The expected earnings will then be

$E = L(1+r)(1-p)$

There is no real problem[5] if $E \geq L$. This will be the case if

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[3] IIF (2008,p.65) observed the following. "Resolution of liquidity issues of the current market stress will depend on sound internal risk management decisions by firms; principles based regulation focusing on outcomes rather than quantitative requirements; and ongoing attention by the central banking community to liquidity in an internationally integrated, market based system." The crux of the matter is that early warning and regulatory diligence is more efficient than voluntary action with outcomes in perspective or corrective action after a crisis is recorded. Perforce, such early warning must be specified in terms of quantitative requirements.

[4] Note that we are only saying that there is a probability of default and not that there will be default and it occurs often enough to create the kind of liquidity crisis that we observed. Hence, one possibility is that, despite the due diligence exercised by the FIs, a disaster may occur due to sheer bad luck. Most observers, however, believe that the subprime crisis is not an accident. It was a deliberate creation of greedy FIs.

[5] Observe that any one actual realization will be either a collection or a default. If the loan is collected the FIs make a positive profit. What we are presuming here is that the

$p \leq r/(1+r) = p_l$

In a buoyant economy, where the economic fundamentals are strong, the probability of failure and default will be low. In such a case some amount of speculation may still not hurt the financial sector of the economy.

However, when $p > r/(1+r)$ the expected recoveries will begin to cut into Shylock's capital. Will they stop lending at some point to preserve the capital they can? They are greedy and overly confident that rating agencies will support their misadventures. As a result they continue lending until they go fully bust. They will stretch loans and/or keep lending until $E = 0$ and may be even beyond that. Clearly, this state of affairs cannot materialize over one unit of time or a short time horizon[6].

Problems of liquidity arise if the actual probability p^* of default exceeds p_l[7]. The FI can sustain its lending operations, while preserving its assets, only if there is a bailout[8]

$B = L(1+r)(p^* - p_l)$

Two observations are in order[9]. First, suppose the FIs started their operations with a stock A of assets. They can be preserved even if $p^* = p_l$. No bailouts may be warranted. Second, when $p^* > p_l$ the bailout offered by the regulator would be sufficient to protect A from erosion. In fact, this argument also suggests that the regulatory agency is giving the benefit of doubt to the FI that $p^* > p_l$ occurred purely randomly and not because the FI is deliberately at fault. In the U.S. subprime context this indicates that FIs are getting the

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FIs will keep it in the form of reserves and surpluses to be utilized in case of default. The problem in actual practice has been that the FIs use the surplus, whenever it is available, to issue more and risky loans and hold the government accountable to bail them out when there is a loss due to default. This attitude cannot be encouraged.

[6] Note that we are hedging in this manner because FIs and/or the corporate sector cannot claim bailouts every time they incur a loss.

[7] Actually the liquidity problems will arise even before this. For, fundamentally sound economic activity may require L^* of finances to intermediate real economic activity. The regulatory machinery may not be activated claiming that losses and bankruptcies are a part of a free enterprise economy. They will do so only if $p > p_l$. Stated differently, bailout may cover only those losses due to this excessive speculation that create severe economy wide liquidity problems.

[8] Some observers suggest that the original borrowers should get the bailout. For, after all, equity demands that the assets they acquired with the loan should belong to them. This may be justified if their default is purely accidental because of exogenous economic conditions. This is difficult to justify in the current subprime crisis. Secondly, this approach involves substantial transaction costs. Despite these considerations the case of bailouts for housing loan defaults in the U.S. has been dealt with in this manner. For, an attempt was made to restructure mortgages by reducing interest rates and reducing EMI by extending the duration of the loans.

[9] Clearly, if the FIs know apriori, with any degree of certainty, that such bailouts will be provided they will be prone to choose a higher p^*. It is therefore necessary to emphasize that such bailouts are a purely one time emergency measure. This alone can limit the risk taking propensity in the long run.

concession that the housing market collapse occurred exogenously and prior to the defaults by the borrowers. The maximum bailout needed will occur when p* = 1 because none of the loans can be recovered. Substituting this in the above expression yields
$B_m = L$
as expected.

Note the following. First, this argument suggests that a strict vigil on p should be maintained to make sure that p is at most equal to p_l. Long term regulatory prescriptions of this kind avoid the necessity for bailouts. Second, in the simple model it is not possible to prescribe norms for the quantum of lending in relation to Shylock's assets. We will presently show that we can endogenize this in more elaborate models. However, if there is an apriori suspicion that the loans L extended contain a speculative component the bailouts may be reduced accordingly.

One further aspect should be kept in perspective. When the borrowers take a loan they do so to generate some tangible assets like buying a house. At the time of default the FI has the option of foreclosure. It can then recover the entire amount of the loan, or a part thereof, to reduce its losses. This should be factored into the bailout calculation.

Return to the definition of $p_l = r/(1+r)$. If $r = 0.1$, $p_l = 0.091$, or 9.1 percent. In practice, this may be thought of as a very stringent regulatory measure. One alternative may be conceptualized as follows. Suppose the FIs feel that they can justify charging a higher interest rate if only they are willing to accept more risk. Let $r(p) = r_1 p$. Under these conditions the norm for p would be $p_l = (r_1-1)/r_1$ Assume, now, that $r_1 = 1.25$. Then, the limit on p is 0.2. The corresponding rate of interest is 25 percent. This simple calculation suggests that the prudential limit on p will perhaps be in the range of 9 to 15 percent. It would not be prudent to accept more risk than this[10].

3. Financing Assets

We now consider the effect of the financial mix used to finance the assets of the FIs. We basically acknowledge debt and equity as the financial instruments.

Assume that the FI has assets of value A which they utilize to extend loans L. Postulate that these assets are financed by eA of equity and the rest by debt. Consider the expected collection of loans. It will again be
$E = (1-p)L(1+r)$
However, under the present arrangement the FIs must pay an interest to the debt holders. This will be
I = interest payment

[10] It may be argued that many of these loans span several units of time. Hence, r should represent interest rates for the longer time span. It may even be necessary to visualize the possibility that default occurs after repayments have been made for sometime. For example, over a five year span if we consider $r = 0.5$ the value of p_l will be 1/3. Hence, some caution in interpreting these results is warranted.

$= r(1-e)A$
Clearly, a choice of p and L such that
$E = r(1-e)A+L$
would allow the FIs to preserve the value of assets and keep lending L. There will be no crisis of any kind if this occurs.

On the other hand, suppose E is equal to the entire loan L. When this happens the FI can still keep lending an amount L. However, they are unable to do so unless they deplete their equity. In other words, though a solvency problem may not be immediately discernible interest payments for debt servicing will begin to erode the equity base.

In general, we require
$r(1-e)A \leq eA$
if the equity should be adequate to make the interest payments. We therefore need
$e \geq r/(1+r)$

The equity will be fully depleted if
$r(1-e) = e$
Hence,
$e_m = r/(1+r)$
may be looked upon as a limit on the equity of the FIs.

Note that E = L implies that
$p = r/(1+r) = p_l$
As before, this is the prudential limit on p.

Observe that neither of these regulatory measures depends on the quantum of loans. In general, we cannot define prudential norms for lending if this approach is pursued.

Consider another alternative. When E is recovered, the FI may choose to pay interest dues to debt holders before conceptualizing more loans. In this process they will erode equity[11] as well if
$E = r(1-e)A - eA$
This will in fact be the worst case where both a liquidity crisis and a solvency crisis arise[12]. It would be certainly desirable to adhere to some well defined lending norms in this case. For, clearly, E is a function of L. We investigate this in the following manner.

Consider a given $p \leq p_l$. Then, E is positive and increasing with L. Higher values of L are in fact desirable. However, there is a lower limit on L given by
$L_l = A[r-e(1+r)]/(1+r)(1-p)$

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[11] In the extreme, the tolerance limit will be the erosion of the entire asset base. The analysis that follows can be easily modified even if this assumption is adopted.
[12] Obviously we are not allowing the possibility of making interest payments to debt holders from their own original loans. After all, that would be an unethical business practice.

For, if $L < L_l$, the lower level of realized earnings and equity would be inadequate to make the interest payments. The upper limit on L will be A itself. Indeed, if
$(1+r)(1-p) = r(1-e)$
That is,
$p = re/(1+r)$
there will be no solvency crisis at all. In the limit, where $p = p_l$, we have
$L_l = [r-e(1+r)]A$
so that we require
$e \leq r/(1+r)$
It can be claimed that
$e_m = r/(1+r)$
will be a prudential limit on equity.

Suppose, on the other hand, that $p \geq p_l$. Then, E is negative and is a decreasing function of L. Low values of L should be preferred. It can therefore be concluded that the maximum amount of loans in relation to the values of assets can be defined by
$L_m = [r –e(1+r)]A/(1+r)(1-p)$
This defines a prudential limit on L/A. It may be noted that L_m will take the value A if
$p = e + 1/(1+r)$
Similarly, if $p = r/(1+r)$, this reduces to
$L_m = [r-e(1+r)]A$
Note, however, that this value of L_m is always less than A.

For L/A to be positive we require
$r – e(1+r) \geq 0$
That is, $e \leq r/(1+r)$. Consequently, the maximum tolerable value of e is
$e_m = r/(1+r)$
The prudential norm for equity is the same as before.

Observe that if $r = 0.25$, $e = 0.2$ and the debt equity ratio is 4. It would be difficult to sustain any smaller value in the present analytical framework. Note the following argument to justify this low value. We are postulating that the FIs eroding all of their equity would be acceptable. Hence, the apriori expectation would be that a high level of equity should be tolerable. However, this increases the propensity of the FIs to accept more risky loans and creating a liquidity crisis more often. But we set this as one of the constraints. As a consequence the prudential limits on equity and probability of default coincide. Stated more pragmatically, the regulatory limit on the probability of default is binding in our framework and it drives all other regulatory norms and efficient bailout characterization.

Note, further, that the value of L_m/A increases if a higher value of p is acceptable. But it will be in the range of 15 to 20 percent for the entire reasonable range of interest rates.

Whatever be the amount of loan there is always a possibility of losing all of it in case of a default. The quantum of loss should not exceed eA if there should not be any erosion of the debt holder’s contribution even in such a case. Hence, it may be argued that

$L \leq eA$
Or, the maximum loan amount should not exceed
$L_m = eA$
However, the foregoing analysis suggests that this will be an unnecessarily restrictive norm.

In practice, the FI may deviate from these norms. For all practical purposes that will be the genesis of a liquidity crisis. It may arise in the present framework in one of three ways : $p^* > p_l$, , L^* deviates from A or L_m as the case may be, and/or e^* is too high. In general, the required earnings to maintain the normative levels will be
$E_m = r(1-e_m)A + L_m$
The actual E^* collected will be
$E^* = L^*(1+r)(1-p^*)$
The bailout needed can be conceptualized as
$B = E_m - E^*$
This enables the FI to come out of the liquidity crisis.

There is a solvency problem in each of these cases as well. For, the reduction in the value of assets exceeds the quantum of equity. Two approaches to bailout are discernible. First, ask the FI to file for a chapter 11 bankruptcy. In this case, the equity holders would have lost all their investment and the FI would be allowed to restructure its activities under judicial guidance. No further bailout is envisaged. Initially the U.S. sought to approach the problem from this perspective as reflected in the case of Lehman Brothers. The more recent bailout for the three automobile majors under consideration is also similar. Second, a bailout or a loan equivalent to the original market value of equity may be offered to restore the value of assets of the FI. Simultaneously, a trust will be set up to take possession of the equity, sell it when normalcy returns and repay the bailout amount or more if it is possible. This is one way of hoping that the public funds provided for the bailout are eventually recovered[13].

Let us examine the second option in greater detail. Suppose the tainted assets correspond to housing loans. Let H be their quantum. When the bailout is offered the trust expects that $H(1+r)^t$ can be recovered at time (t+1) with a probability $(1-\alpha)^t\alpha$. This is essentially the structure of a put option. For, the trust is essentially announcing that it would be willing to sell at time (t+1) if the market value is $H(1+r)^t$. The expected value of the put option is
$V = \alpha H/[1-(1-\alpha)(1+r)]$

[13] Note that the bailout may be in the form of credit created by the actions of the central bank. It need not be in the form of a fiscal policy action from the budgetary resources of the government. The efficiency of one of these routes in relation to the other is also an important issue. The choice may not depend on considerations of liquidity and solvency only. Larger macroeconomic issues like the recessionary trends and inflationary pressures may prevail.

This is the maximum bailout that will be offered to resolve the solvency problem, not the entire original market value of equity as indicated earlier. Note further that this option mechanism is sensible only if
$\alpha > r/(1+r)$
A larger bailout may yet be the only solution if α is lower and the economic recovery requirements are severe.

More elaborate financial instruments can be incorporated into the model though no additional insights into the regulatory prudential norms and the bailout package can be expected.

4. Securitization

FIs have been making innovative attempts to undermine the liquidity monitoring authority of the central banks by creating new financial instruments. Clearly, securitization is one such instrument. Its main effect has been a callous creation of excess liquidity and extreme risk taking behavior of FIs[14]. They have been supported by unhealthy practices of credit rating agencies[15].

Clearly, the primary effect of securitization is the increase in the volume of lending for a given asset base of the FI. To appreciate this, assume that the FI initially offered a loan L. A fraction q of these receivables is securitized in suitable tranches. The originator, in this case the FI, claims a consideration cqL from the special purpose vehicle (SPV). The FI may lend this also in turn[16]. The total loans generated will be
$L_T = (1+cq)L$

However, the total amount of the loan that the FI, as the originator, collects is
$L_o = (1-q)L + cqL = [1-(1-c)q]L$
Assume that there is a probability p of default at each stage of the securitization sequence. Then, the gains expected by the FI will be
$E_0 = [1-(1-c)q]E$

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[14] Doms, Furlong, and Krainer (2007) argued that the degree of risk implicit in the pool itself is not the major cause of the recent financial crisis. Instead, a reduction in the overall economic activity may have led to the inability to pay mortgages. A lowering of house prices is the more proximate cause.

[15] Hull, Predescu, and White (2004) suggested that credit rating agencies cannot anticipate the unexpected external exigencies that bring down the value of securitized assets. They can only react to them by downgrades when the information is available. Clearly, it will be too late to retract. Even if we consider such arguments to be somewhat circumscribed it may now be difficult to completely eliminate securitization and/or credit ratings since they are fairly well entrenched. Efforts are on to design adequate regulatory mechanisms. See, for example, IIF (2008).

[16] Conceptually, at any rate, the securitization process can be repeated ad infinitum. We will consider only the first round effects to illustrate the nature of the liquidity problem and the nature of bailouts needed.

where, as in section 2,
$E = L(1+r)(1-p)$
The SPV, in his turn, collects
$L_s = qL$
Hence, the expected value of his earnings is
$E_s = qE - cqL$

Given the instrument of securitization the FI is essentially sharing the risk associated with the loans that he grants. More often than not this emboldens him to increase risky lending. This aspect of securitization makes the financial transactions far more volatile[17]. For all practical purposes, the liquidity problems will be compounded unless the FI adheres to some prudential limits on q, the extent of securitization[18]. Hence, the meaningful question is about the efficient level of q.

This can be conceptualized as one that minimizes the total variance of returns to the FI and SPV. Let R denote the return and V its variance. Note that
$V(R_0) = L^2(1+r)^2[1-(1-c)q]^2p(1-p)$
and, similarly,
$V(R_s) = L^2(1+r)^2q^2p(1-p)$
Minimizing the sum of these variances with respect to q results in
$q = (1-c)/[1+(1-c)^2]$
The resulting q is an increasing function of (1-c). That is, a large c should reduce q in order to limit the excess liquidity created by the securitization process[19].

Consider the expression E_0 once again. $E_0 = (1+cq)L$ whenever
$p = [r\{1-(1-c)q\}-q]/(1+r)[1-(1-c)q] = p_l$
This suggests that the prudent level of probability of default that the FI should entertain should be lower. As before, in a crisis situation, the requisite bailout will be
$B_0 = [1-(1-c)q]L(1+r)(p^*-p_l)$
where q is defined above.

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[17] Landau (2007) noted that regulatory practices should keep three dimensions in perspective. First, in general, the SPVs do not have the financial structure or stability to absorb shocks. It is therefore necessary to define the obligations of the originator more precisely and inclusively. Second, observe that securitization is a complex, individual centered instrument. As such no single measure of risk may be adequate from a regulatory perspective. Third, we do not as yet have a credible framework of the desirable characteristics of a robust securitization process. Perhaps dimensions, other than risk characteristics, need attention. The following analysis is perforce limited in perspective.

[18] In most practical contexts the value of c is related to the present discounted value. Hence, there is no further choice with respect to c per se.

[19] Note that c = 1 implies that the FIs claim the entire amount securitized as consideration. Under these conditions there will be no justification for any SPV to accept securitization.

Note that the SPV is also exposed to the tainted receivables of the FI. He would need a bailout if
$p^* > (r-c)/(1+r)$
The quantum of bailout will be
$B_s = qL(1+r)[p^*-(r-c)/(1+r)]$
As noted earlier, risk sharing by the FI encourages him to take more risk. He is likely to take more than justifiable risk both with respect to the probability of default as well as the quantum of loans that he offers. This increases the need for much earlier bailout requirements in the presence of securitization. The quantum of bailout needed will also be larger. The SPV himself would need bailouts much ahead of the FI[20].

One further observation is in order. If the SPV issues equity in the form of pass through certificates (PTCs) their holders will experience a solvency crisis when the value of their assets is eroded. The bailout arguments are again similar.

It should also be obvious that the arguments of section 3 can be extended with the necessary changes. No new insights emerge.

5. Ripple Effects

Economies like ours experience ripple effects due to a different kind of greed. The rapid growth and the desire to do even better meant that we were willing to accept foreign financial inflows either in the form of foreign direct investments (FDI) or purely short term investments of FIIs in financial instruments. The motivation for the FIIs for making such investments can be traced to higher expected returns or paucity of profitable investment opportunities in their own country (possibly due to excess liquidity). When the subprime crisis reached its peak they experienced acute liquidity problems in their own countries. Perforce they had to withdraw this hot money. This is the primary genesis of the ripple effects and the liquidity crisis that we experienced.

To be sure these FII investments enabled our corporate sector to undertake some new economic activity so long as these resources are available. Liquidity problems surfaced as soon as these finances are withdrawn. Therefore, the problem is to provide adequate liquidity to all activities whose economic fundamentals are sound. Quite clearly, some speculative activities, though they do not have the subprime character directly, must face extinction. The problem for policy action is to distinguish between these two types. We will only attempt a very basic analytical framework in what follows.

Consider the context of FIs that have assets of value A. To simplify analysis assume that the entire investment of the FIIs is in the form of equity of these FIs. Postulate that the only equity of the FIs is this FII investment. Denote this by eA. Assume that the rest of the assets of the FIs are financed by domestic debt. Let us now assume that the FIs offer a quantity L of loans with a default probability p. As before, the prudent value of p is p_l.

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[20] For, $p_l > (r-c)/(1+r)$ whenever $c > ½$. This is most likely since c is equal to the present discounted value in most practical contexts.

The more important problem is to preserve the value of assets. For, some of the loans offered by the FIs have probably been used to finance some physical assets of the domestic corporate sector. The FIs may therefore choose to service debt even if they cannot extend any further loans and have also depleted their equity base. Hence, if $p \geq p_l$ the maximum L that the FIs can choose will be such that

$L_m = A[r(1-e) – (1-w)e]/(1+r)(1-p)$

where w is the probability of the FIIs withdrawing investments prematurely. For, the equity that can be drawn down is eA with probability (1-w) and zero with probability w. It follows that the maximum is

$L_m = A[r(1-e)-(1-w)e]$

corresponding to $p = r/(1+r)$. Observe that

$e \leq r/[r+(1-w)]$

is necessary because L_m cannot be negative in any practical context. Consequently, the maximum tolerable level of e is

$e_m = r/[r+(1-w)]$

This is an increasing function of w[21]. Intuitively, the more the FIs know that FIIs may withdraw without any notice the more risks they would be willing to take in attracting such investments.

The case where $p \leq p_l$ can be developed as in section 3. No new insights seem to emerge.

A liquidity problem will arise if $p^* > p_l$ temporally. The bailout needed will then be

$B = L(1+r)(p – p_l)$

The liquidity problem is related to FII investments only if $e^* > e_m$. A bailout

$B = rA(e^*-e_m)$

will be necessary.

The more pertinent issue is one of preserving the value of assets. In case of FIIs suddenly withdrawing the finances that they offered it would be necessary to provide

$B = eA$

of resources to sustain the assets and the economic activity based on A. This is a ceteris paribus argument under the assumption that there is no other reason to ask for any bailout. Everyday debate is loosely suggesting that this much increase in liquidity would be necessary[22].

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[21] For the sake of completeness consider the possibility of defining a desirable level of w. Clearly, the primary problem is the volatility they create in the equity markets. This volatility can be measured by w(1-w). Consequently, w = ½ maximizes volatility. The only guideline can be to stay as far away from w = ½ as practical. This is not a workable suggestion simply because FIIs withdrawing hot money cannot be predicted accurately let alone controlled. Policy measures should accept w as it materializes.

[22] This quantum of B may still be large. Hence, it would be desirable to regulate the flow of FII investments. Rao (2008) examined this issue in a different analytical framework. Perhaps requiring them to give a three months notice for withdrawing finances, agreeing to receive payments at the prevailing exchange rate, and so on would be efficient.

It should be noted in passing that FIIs may participate in the debt markets instead. The above analysis can be readily modified. No new insights seem to emerge.

6. Conclusion

The present study was based on the premise that there was excess liquidity, which when utilized carelessly, gave rise to the current financial crisis. Hence, we took a position that the bailouts that we conceptualize need not fully compensate all the losses incurred by all the institutions and individuals. The basic necessity is to identify the fundamental strengths of the economy and make sure that there is enough liquidity to conduct these activities. The problem then was to identify these prudential limits as the basis to define the bailout mechanisms. This study organized thoughts along the lines of one simple paradigm. Perhaps we should examine others in the long run interest.

It would be useful to summarize our conclusions about the regulatory practices and bailouts. First, the most important control mechanism is the probability of default. As noted in section 3, the limits on lending in proportion to assets become very stringent if we allow any violation of this. Such limits should also be monitored carefully. Second, when a crisis does occur, within a steady state operation of the probabilistic mechanism set up in this study, the bailouts should be strictly to restore the system to normative levels. This would involve some losses to several players in the system but that is an offshoot of the operation of the free enterprise economies. It would not be possible to justify bailing out the private operators for all their follies as soon as a crisis is recorded. However, the difficulty may still be one of restoring economic activity to levels justified by structural fundamentals. Calculating these requirements may yet involve some difficulties and we do not have any objective calculations at the present state of economic theory[23]. Temporary bailouts may be inevitable but stringent regulatory measures should be enforced to make sure that such errors do not recur too often. Third, the crisis may be purely due to unanticipated external exigencies even when norms are diligently followed. Surely, the FIs cannot be blamed in such contexts. Temporary bailouts to restore the system to normalcy can then be justified. But, adherence to norms must be enforced as soon as possible.

The efficiency of bailouts is predicated on the existence or creation of institutions, such as the trusts that hold the tainted assets, and their organization to return at least some part of the bailouts. The transaction costs involved here may be large. Indeed, the short run advantages of bailout may not be sustained in the long run in the absence of regulatory diligence. But it is not very easy to decide the limits to which individual initiative can be curtailed. A decision of this nature will depend on the judgment about the extent to which individual miscalculation and greed gave rise to the current financial crisis as opposed to

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[23] On careful reflection it appears that we do not really have any good estimate of the financial intermediation requirements to sustain a given economic activity. Similarly, there is no objective way of determining how much of this financing should be through the banking sector and what fraction should be from budgetary allocations.

sheer bad luck created by purely external exigencies. Formal models cannot capture these effects.

The ripple effects are more difficult to track down. In fact the FIIs withdrawing their investments suddenly is only a part of the problem. The concomitant reduction in the exchange rates, the extra costs of production that they entail, the effect that creation of extra liquidity has on interest rates, the likely underutilization of the capital assets built up when the going was good, and a whole lot of other ripple effects should be addressed. A short study like the present one cannot encompass all these issues.

In the final analysis, it should be obvious that analytically satisfactory answers to the short run liquidity problem are unlikely. As such some adhoc solutions will be implemented and most economies will come out of the impasse because their economic fundamentals are sound. What is important, however, is that we pursue this analysis until we discover efficient regulatory mechanisms which will assure us that a similar crisis will not occur again in the long run. Such regulation should apply to all the existing financial instruments and institutions as well as any new instruments that will be introduced in the future. Perhaps there is no other way to make sure that financial volatility is kept at a minimum.

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