

Liquidity regulation and the lender of last resort

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The recent subprime crisis has brought back to light proposals to regulate banks' liquidity as a complement to solvency regulations. Based on recent academic research, I suggest that liquidity regulations might indeed be a way to limit the pressure on Central Banks in favour of liquidity injections during crisis periods. Another crucial question is the allocation of responsibilities between the Central Bank, the Banking Supervisors and the Treasury in the management of banking crises.

The subprime crisis of last summer has brought back to light proposals to regulate banks' liquidity as a complement to solvency regulations. In a recent article¹ *The Economist* (usually less in favour of regulatory intervention) explicitly takes this position: "recent events suggest that it may not be enough to base a regime solely on capital adequacy. The turmoil in money markets revealed that some banks put aside too few liquid assets to meet a cash squeeze... The Basel 2 agreement fine-tunes the risk-capital framework but, as regulators freely admit, it has little to say about provisioning for funding shortages".

Indeed it is interesting to contrast the formidable energy and effort that international banking supervisors have dedicated to improving and harmonizing banks' solvency regulations across countries, with the scarceness of reflections on banks' liquidity. It turns out that there is a considerable cross country variation concerning liquidity requirements. Some of the existing requirements are based on stock measures (typically a minimum level of liquid assets in relation to the stock of liquid liabilities), while others are based on mismatch analysis (*i.e.* limiting the gaps between expected inflows and outflows of cash for short term maturities). Several countries (including Australia, Germany, Singapore and the Netherlands) have recently reformed their systems by introducing new quantitative rules for banks' liquidity regulation. Other countries are considering the implementation of such reforms.

Even before the subprime crisis, banking authorities were concerned with the increasing complexity and size of financial markets, together with the emergence of a small number of "Large and Complex Banking Organizations" controlling a large number of interrelated markets. Such a system might be perfectly efficient during "normal times" but it certainly leads to serious prudential concerns during a crisis period, when liquidity is scarce.

Another reason why banking authorities might be concerned with the liquidity of banks is that these

authorities have encouraged banks to use real time gross systems (RTGSs) for large value inter-bank payments, instead of deferred net systems (DNSs) which may be prone to systemic risk.² The RTGSs are highly liquidity intensive. For example the daily turn-over on the US RTGS Fedwire is currently about 16, while that on CHIPS, the DNS that constitutes its private competitor, is currently of about 500: roughly speaking Fedwire requires 30 times more liquidity than CHIPS for a similar flow of payments.³

Finally, banking authorities are concerned by the fact that banks take huge positions on all kinds of derivative products, which are opaque and might become very liquidity demanding during a crisis period. This was particularly clear during the subprime crisis, but was also illustrated by earlier spectacular examples (Metalgellschaft, LTCM,...). Inadequate liquidity management of derivatives positions can provoke disasters, especially if large banks adopt similar strategies and rely on similar market instruments to hedge their liquidity risks.

Under the influence of the Basel Committee for Banking Supervision (BCBS), solvency regulations have received a lot of attention in the last twenty years, leading first to an harmonization across countries around a very simple solvency ratio (Basel 1) then to a revised framework implying an incredible degree of sophistication (Basel 2). But are solvency ratios (whatever their complexity) sufficient to reduce the probability and extent of bank failures, especially in front of exceptionally adverse conditions? Theoretical results and common sense suggest that liquidity requirements may be a natural complement (or partial substitute?) to solvency requirements. In any case supervisors should consider a bank's liquidity risk in conjunction with its capital adequacy: in the absence of any doubts on banks' solvency, liquidity management would essentially reduce to a pure "plumbing" problem.⁴

It is commonly accepted that Central Banks have to perform some kind of emergency liquidity assistance activity (lender of last resort) towards commercial

1 The Economist (4th October 2007) print edition. Other citations from the same article are interesting: "The private cost to banks of being light on liquid assets was clearly too low compared with the public cost that the liquidity squeeze produced in terms of instability and high interest rates... For that reason, central banks had little choice but to intervene. Trying to discipline banks after the fact by withholding liquidity risked damaging the economy. What is particularly worrying is that huge convulsions in money markets were caused by potential losses in subprime lending that are small relative to banks' capital. Unless banks are forced to protect themselves, much bigger shocks in the future might require even larger interventions by central banks. Banking regulation may need to put as much emphasis on banks' liquidity as their solvency".

2 This is criticized by Selgin (2004), who disputes the suggestion that DNSs are intrinsically subject to systemic risk, at least in the absence of government intervention.

3 However the composition of payments on the two systems is different: the average payment on Fedwire is much bigger than on CHIPS.

4 Allen and Gale (2000 and 2004) show however that when financial markets are incomplete liquidity requirements for banks may be a useful prudential tool.

banks. For several kinds of reasons (which will be developed later), inter-bank and financial markets may be insufficient providers of liquidity to banks in trouble. A liquidity requirement is a way to limit the need to use the lender of last resort (LLR) facility. A cost and benefit analysis of the LLR is thus needed to determine the appropriate extent of liquidity regulations. *A priori* the Central Bank is in a better position than commercial banks to provide liquidity assistance to banks in trouble, especially during systemic crises. However, the impossibility of governments to commit on their future actions leads to a risk of forbearance during crises periods. Thus, there is a value in limiting *a priori* the need for emergency liquidity assistance by the Central Bank. This could take the form of additional liquidity requirements, in order to cover exceptional liquidity needs under adverse circumstances.

The plan of the rest of this article is the following: section 1 examines the sources of liquidity risks for banks and the main instruments that can be used for managing them. Section 2 briefly discusses possible market failures in the provision of liquidity and explains why regulation of banks' liquidity may be justified. Section 3 concludes by discussing the way in which such a regulation could be designed.

1| THE SPECIFICITIES OF LIQUIDITY RISK FOR BANKS

Like any other firm, a bank has to manage carefully its liquidity in order to be able to cover mismatches between future cash outflows and cash inflows. However the degree of uncertainty on these mismatches is clearly much higher in the banking sector. We first examine the sources of this greater uncertainty and then review the instruments that can be used for managing liquidity risk in banks.

1|1 Source of liquidity risks for banks

On the liability side, there is obviously a large uncertainty on the amount of withdrawals of deposits (including wholesale) or the renewal of rolled-over inter-bank loans. This is especially so when the bank is under suspicion of insolvency, when there is a

temporary (aggregate) liquidity shortage or when the economy suffers from a macroeconomic shock.

On the assets side also, there is some uncertainty on the volume of new requests for loans (or renewal of old loans) that a bank will receive in the future. Of course the bank could refuse to grant these new loans but this would in general lead to the loss of profit opportunities. This would also be detrimental to the borrowing firm if it is credit rationed, and more general to the economy as a whole: we have to remember that banks are unique providers of liquidity to small and medium size enterprises, which constitute an important fraction of the private sector. This credit rationing would be especially costly if the firm is forced to close down, possibly resulting in additional losses for the bank itself.

Off-balance sheet operations are a third source of liquidity risk for banks. Examples are credit lines and other commitments. More importantly, the formidable positions taken by banks on derivative markets can generate huge liquidity needs during crisis periods.

A final source of liquidity risk are large value inter-bank payments, for which Central Banks favour the use of RTGSs over DNSs, because they are less prone to systemic risk. However RTGSs are highly liquidity intensive and can only function properly if banks hold sufficient amount of collateral to back credit lines, either from the Central Bank or from other participants. The failure of a large participant in a large value payment system (LVPS) could provoke a big disruption to the financial system. Even a liquidity shortage or a "gridlock" due to a temporary stop in the payment activity of a large bank could have dramatic consequences. This creates a "too big to fail" issue since it is likely that the Central Bank would be forced to intervene in such a situation. To avoid or simply to mitigate such problems, *ex ante* regulation of the liquidity of large participants in RTGSs seems warranted.

1|2 Instruments of liquidity management for banks

In addition to their cash reserves, banks can rely on other assets as sources of liquidity. The most important are obviously government securities,

which can be used as collateral for borrowing liquidity. However, these securities are also used as collateral for LVPSs. This raises the question of cross pledging of collateral. Such cross pledging is in general warranted, since it allows using diversification between different sources of risk for economizing on collateral. However it requires sufficient independence between payment risks and other forms of liquidity risk, as well as a constant coordination between the Central Bank (who is sometimes in charge of monitoring the LVPSs) and the Banking Supervisors. Marketable securities and inter-bank deposits can in principle be sold easily⁵ but they can lose liquidity under adverse conditions. Finally, note that liquidity needs can be strongly reduced by the use of appropriate risk management methods (Froot and Stein 1998).

2| SHOULD BANKS' LIQUIDITY BE REGULATED?

This section briefly discusses possible market failures that may justify public intervention in the regulation and provision of liquidity to banks.

2|1 Possible market failures in the provision of liquidity

Banks have two fundamental characteristics: they play a crucial role in the financing of small and medium firms that do not have a direct access to financial markets and they principally rely on external sources (deposits) for financing these loans. The fact that banks have to screen and monitor their borrowers creates an opaqueness of banks' assets: as shown by Morgan (2002), these assets are difficult to evaluate by external analysts. This opaqueness generates possibilities of moral hazard, in the form of insufficient effort by banks for screening their borrowers, or for monitoring their activities after the loan has been granted. Modern corporate finance theory (see Tirole, 2006) has shown that in such a situation, liquidity needs (due for example to costs overruns in the borrowers' projects or to deposits withdrawals in the banks themselves) are

insufficiently covered by financial markets. Following Holmström and Tirole (1998), Rochet (2004) studies possible institutional arrangements that can solve this market failure (see also Rochet 2008). For example private contractual arrangements such as pools of liquidity accompanied with inter-bank credit lines commitments can be used to mitigate this inefficiency. This can be a substitute to emergency liquidity assistance by the Central Bank, at least in the absence of aggregate shocks (see below).

Opaqueness of banks' assets also creates an externality between lenders on the inter-bank markets, payment system participants, or between uninsured depositors. The decision to renew a short term inter-bank loan, a debit cap on a large value payment system (LVPS) or a wholesale deposit depends not only on fundamental uncertainty (the quality of the bank's assets) but also on strategic uncertainty (what other lenders or depositors will do). Freixas *et al.* (2000) study the consequence of such a strategic uncertainty on the risk of contagion on an inter-bank LVPS. In such a context, liquidity requirements can be a way to limit systemic risk. Allen and Gale (2000) also show how contagion can emerge when inter-bank markets are incomplete. Using the methodology of global games popularized by Morris and Shin (1998), Rochet and Vives (2004) show that a combination of liquidity requirements, solvency requirements and LLR interventions may prevent the occurrence of coordination failures on inter-bank markets. Such coordination failures arise when some (large and uninsured) depositors decide to withdraw, not because they think the bank is likely to be insolvent, but because they anticipate others will withdraw. The rationale behind liquidity requirements is that they reduce the impact of strategic uncertainty on the final situation of the bank, since they allow the bank to withstand larger withdrawals. The same is true for solvency requirements and lender of last resort intervention. The difficulty is to determine the appropriate combination of these three instruments that minimizes the total costs of prevention of such coordination failures.

Finally, some form of government intervention may be needed in case of macroeconomic shocks such as recessions, devaluations, stock market crashes and the like. The same is true for disruptions in

⁵ Securitized loans are also a source of liquidity for banks but securitization operations are costly and have to be planned in advance. They can hardly provide liquidity in emergency situations.

the payment system. Anticipating on this kind of intervention, banks may decide opportunistically to take an excessive exposure to such risks, knowing that they are likely to be bailed out in case the risks materialize. Rochet (2004) studies this question and shows that *ex ante* regulation of banks' liquidity maybe a way to mitigate this behaviour. We now develop this analysis and discuss possible rationales for the regulation of banks' liquidity.

2|2 Possible justifications for regulating banks liquidity

After having established that banks need liquid reserves, in particular because financial and inter-bank markets may sometimes be insufficient to cover their short term financing needs, it remains to understand why a regulation is needed, *i.e.* why the managers and shareholders of these banks do not choose by themselves the appropriate level of liquid reserves for their bank.

In fact, like solvency regulations, liquidity regulations can be justified by two forms of externalities: the first is associated with the protection of small depositors, who are likely to be hurt by the failure of their bank, but are not in a position to monitor or influence the decisions of its managers. This explains why in the vast majority of countries around the world, small depositors are insured and banks are regulated and supervised by Banking Supervisors, who are in charge of protecting the interests of depositors, or minimize the liability of the Deposit Insurance Fund (DIF). The second justification for banking regulations has to do with the protection of financial stability, *i.e.* the guarantee that the payment and the financial systems are able to channel the funds appropriately between economic agents, even if the country is hit by a large shock, like a recession, a crash of asset prices, a devaluation, or a terrorist attack. Thus, there are a micro-prudential aspect and a macro-prudential aspect to solvency regulations.

Similarly, liquidity regulations can be justified by micro and macro prudential reasons: they are a complement to the LLR facility, since they limit the need for emergency liquidity assistance when an individual bank is in trouble. Also they are useful during banking crises or in case of macroeconomic shocks, since they limit the need for a generalized

bailout. This is especially so because of the commitment problem of governments who typically feel inclined to intervene *ex-post* during a banking crisis. To limit this tendency, liquidity requirements should be conditioned on the bank's exposure to macro shocks (Rochet, 2004). In practice it means that uniform liquidity requirements could be replaced by more flexible systems, where the liquidity requirement may be more or less stringent according to the bank's solvency and/or to simple measures of the bank's exposure to several types of macroeconomic shocks, deduced for example from Value At Risk calculations under different scenarios.

An important issue concerns the need for public (as opposed to private) regulation, *i.e.* whether banks could regulate themselves, like participants in a clearing house. Holmström and Tirole (1998) show that the private solution can be sufficient if there are no aggregate shocks. However a purely private solution is likely to be relatively complex to implement. It would consist in requiring banks to form pools of liquidity and to sign multilateral credit lines commitments, specifying clearly the conditions under which an illiquid bank would be allowed to draw on its credit line. By contrast, emergency liquidity assistance by the Central Bank is probably simpler to organize, but may be prone to forbearance under political pressure. In any case, due to the possibility of macro-shocks, some form of government intervention is needed. The difficulty is then to avoid excessive intervention, such as *ex-post* bailouts of insolvent banks. We discuss this question in the next section.

As already noted, liquidity regulation of large participants in the payment system is also warranted, in order to limit the risk of needing massive liquidity injections by the Central Bank in case of a disruption in the payment system. Two policy questions arise:

- Is it necessary to impose an additional liquidity requirement (on top of a simple liquidity requirement, that is aimed at covering potential liquidity problem over a short period, say a week) to cover also intraday liquidity needs?
- If the answer to the first question is yes, how to design this additional liquidity requirement, taking into account that banks have the possibility to "bypass" the RTGS by either entering into bilateral netting agreements with other banks or using

competing DNS systems, which could be more prone to systemic risk?

Finally, it should be noted that systemic risk in payment systems and inter-bank markets could be eliminated altogether if the Central Bank decided to insure inter-bank transactions and payments finality against credit risk. This system was implicitly in place in many countries during most of the last century. Thus the only logical explanation for the recent movement towards RTGSs and limitation of LLR interventions is that banking authorities want to promote peer monitoring by banks. However Rochet and Tirole (1996a) show that the effective implementation of peer monitoring among banks may be difficult, due to commitment problems by governments. Liquidity requirements may be a useful way to mitigate these commitment problems.

3 | HOW TO REGULATE BANKS LIQUIDITY?

As we have seen, there are two essential motivations for regulating banks' liquidity, one being micro-prudential (*i.e.* limiting the externality associated with individual bank failures), and the other being macro-prudential (*i.e.* limiting excessive exposures to macroeconomic shocks by banks, under the expectation of a generalized bailout by the government). A simple liquidity ratio seems to be appropriate to cover the first objective, with the possible qualification that under-capitalized banks could be subject to more stringent requirements. This would be in the spirit of the "prompt corrective action" methodology imposed by the FDIC Improvement Act to US supervisors, *i.e.* the idea of some progressiveness in the restrictions imposed to problem banks, forcing supervisors to act before it is too late.

However, the macro-prudential objective of liquidity regulation seems harder to attain, given in particular the difficulty to forecast precisely the liquidity needs of banks during a crisis. One particular component of these liquidity needs is of course related to the intraday needs of the banks for channelling their large value payments on the RTGS, but it has to be stressed that other liquidity needs, equally important to cover during a crisis, may materialize only after two to five days (for example refinancing on the inter-bank

markets). This implies that the crucial distinction is not in terms of time horizon (intraday *vs.* two to five days) but rather between individual shocks, for which there is no reason to extend emergency liquidity assistance to banks that are insolvent (and therefore simple, uniform, liquidity ratios should be enough) and macroeconomic shocks, for which a massive liquidity injection by the Central Bank (and maybe a partial recapitalization of some of the banks by the Treasury) may be warranted.

Thus there seems to be a need for a second type of liquidity requirement, based on some indices of exposure to macroeconomic shocks by individual banks, and intended to limit the need for an *ex-post* liquidity injection by the Central Bank. These indices should be designed *ex ante* (and adjusted regularly) by the Banking Supervisors, possibly after using the internal risk model of each bank and different sorts of stress tests. One difficulty would be of course to avoid regulatory arbitrage, *i.e.* "window dressing" or manipulations of accounting information by the banks, in order to minimize their liquidity requirements, without effectively decreasing their exposure to macroeconomic shocks. In the context of LVPS, it would mean for example requiring cooperation and information sharing between the RTGS and any privately run competitor, and computing collateral requirements on an aggregate basis.

However additional liquidity requirements aimed at mitigating macroeconomic shocks could constitute a "waste" of liquidity, given that they would be used only under exceptional circumstances. A superior solution may consist in this case for the Central Bank to commit to provide conditional credit lines under the strict control of an independent Banking Supervisor. The characteristics of these credit lines (maximum amount, commitment fee, conditions under which they can be used) would be specified *ex ante* by the Banking Supervisor. The associated loans could be made senior to all other liabilities, thus limiting the risk of recourse to taxpayers' money.

In summary, liquidity regulations for banks can be justified, like solvency regulations, by two different motives: one is to limit the risk and the extent of individual bank failures, the other is to limit the need for massive liquidity injections by the Central Bank in case of a macroeconomic shock. In normal times, the pool of marketable securities that can provide liquidity to the banks is substantial.

Therefore a simple, uniform liquidity ratio may be all that is needed, with the possible qualification that the Banking Supervisors could require additional liquidity for undercapitalized banks, in the spirit of the "prompt corrective action" implemented in the USA. As for macro-prudential purposes, that is anticipating what would occur in case of a large macro shock, it is probably necessary to go further, and either to require additional liquidity, or secure a credit line by the Central Bank, both based on the

exposure of each individual bank to such macro shocks and carefully monitored by the Banking Supervisors. The definition of appropriate indices of such exposures to macro shocks (possibly using stress tests and worst case scenarios) is an important empirical challenge. Similarly, some form of cost-benefit analysis of LLR interventions would be useful in order to evaluate the exact costs of liquidity provision by the Central Bank, and the social cost of excessive liquidity.

BIBLIOGRAPHY

Allen (F.) and Gale (D.) (2000)

"Financial contagion", *Journal of Political Economy*, 108, 1, 1-33

Allen (F.) and Gale (D.) (2004)

"Financial intermediaries and markets", *Econometrica*, 72, 1023-1061

The Economist (2007)

"When to bail out: the case for more regulation of banks' liquidity", *print edition* of October 4th

Freixas (X.), Parigi (B.) and Rochet (J.C.) (2000)

"Systemic risk, inter-bank relations and liquidity provision by the Central Bank", *Journal of Money Credit and Banking*, 32(2), 611-638

Froot (K.) and Stein (J.) (1998)

"A new approach to capital budgeting for financial institutions", *Journal of Financial Economics*, 47, 55-82

Goodfriend (M.) and Lacker (J.) (1999)

"Limited commitment and Central Bank lending", *Working Paper*, Federal Reserve of Richmond

Hoffman (P.) and Santomero (A.) (1998)

"Problem bank resolution: evaluating the options", *Working Paper*, University of Pennsylvania

Holmström (B.) and Tirole (J.) (1998)

"Private and public supply of liquidity", *Journal of Political Economy*, 106(1), 1-40

Morgan (D.) (2002)

"Rating banks: risk and uncertainty in an opaque industry", *American Economic Review*, 92(4), 874-888

Morris (S.) and Shin (H.S.) (1998)

"Unique equilibrium in a model of self-fulfilling currency attacks", *American Economic Review*, 88(3), 587-597

Morris (S.) and Shin (H.S.) (2004a)

"Coordination risk and the price of debt", *European Economic Review*, 48(1), 133-153

Morris (S.) and Shin (H.S.) (2004b)

"Liquidity black holes", *Review of Finance*, 8(1), 1-18

Rochet (J.C.) (2004)

"Macroeconomic shocks and banking supervision", *Journal of Financial Stability*, 1(1), 93-110

Rochet (J.C.) and Tirole (J.) (1996a)

"Inter-bank lending and systemic risk", *Journal of Money, Credit and Banking*, 28, 733-761

Rochet (J.C.) and Tirole (J.) (1996b)

"Controlling risk in payment systems", *Journal of Money, Credit and Banking*, 28, 832-862

Rochet (J.C.) and Vives (X.) (2004)

"Coordination failures and the lender of last resort: was Bagehot right after all?", *Journal of the European Economic Association*, 6(2), 1116-1147

Selgin (G.A.) (2004)

"Wholesale payments: questioning the market failure hypothesis", *International Review of Law and Economics*, 24, 333-350

Tirole (J.) (2006)

"*The theory of corporate finance*", Princeton University Press