

# Lender of last resort:

## a review of the literature



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The maintenance of financial stability is facilitated by well-designed 'safety net' arrangements aimed at limiting the risk of disruption in the financial system (crisis prevention) and the consequences of disruption if it arises (crisis management). An important element of crisis management is the lender of last resort (LOLR) function. This article reviews the main ideas on LOLR reflected in the academic literature, going back to Henry Thornton almost two hundred years ago.

**THE CONCEPT** of LOLR originated at the beginning of the 19th century when Henry Thornton (1802) spelt out the basic elements of sound central bank practice with respect to distress lending. Walter Bagehot (1873), who is most often credited with establishing modern LOLR theory, expanded on Thornton's work (although without referring to him by name). Both authors justified the need for a LOLR whose role, they argued, was:

"...(1) to protect the money stock, (2) to support the whole financial system rather than individual financial institutions, (3) to behave consistently with the longer-run objective of stable money growth, and (4) to preannounce its policy in advance of crises so as to remove uncertainty" (Humphrey, 1989).

Bagehot suggested that, in a liquidity crisis, a central bank should lend freely, at a high rate of interest relative to the pre-crisis period, to any borrower with good collateral, where good collateral was any paper normally accepted by the central bank, valued at

between panic and pre-panic prices. He also recommended that the quality standards on collateral taken by the Bank of England during a crisis should be relaxed. Institutions without good collateral were assumed to be insolvent and should, Bagehot argued, be allowed to fail.

Although this description of the LOLR function continues to influence central bank policy makers today, current LOLR practices have also been shaped by changes in the financial and regulatory system over the past century.

This paper addresses the issues set out in the recent literature on LOLR support. It starts with the fundamental question of whether an LOLR is necessary and then reviews the modern debate on LOLR. This is followed by a discussion of when and why capital injections to insolvent banks might be necessary and, finally, the costs of LOLR and capital injections.

<sup>1</sup>: We would like to thank Alastair Clark, Paul Tucker and Geoffrey Wood for helpful comments.

## The need for a lender of last resort

The term 'LOLR' is used in different ways in the literature. In this paper, LOLR is taken to mean the *discretionary* provision of liquidity to a financial institution (or the market as a whole) by the central bank in reaction to an adverse shock which causes an abnormal increase in demand for liquidity which cannot be met from an alternative source.

The central bank provides liquidity (reserve money) in exchange for, or against the security of, financial assets. Although this increases the liquidity of a bank's balance sheet it does not change the overall value of its assets.

## Asymmetric information

This section addresses cases of emergency lending to illiquid but *solvent* institutions. The distinction between solvent and insolvent banks is a feature of the academic literature. In practice, however, a central bank may not always be able to make this distinction, particularly in the short time-scale in which a lending decision may have to be made<sup>2</sup>.

### Bank runs

A distinguishing feature of banks is that their assets are largely illiquid term loans while their liabilities comprise predominantly unsecured short term deposits. Moreover, deposits are paid out in full on a first-come-first-served basis. Most economists agree that these features of banks' balance sheets make them susceptible to depositor runs. Since in general banks' assets are not readily marketable, such runs can result in the forced disposal of these assets at depressed 'fire sale' prices and thence to the insolvency of an otherwise fundamentally sound bank. This potentially involves a welfare loss to the public as a whole which would justify public sector intervention, assuming that the benefit of such intervention outweighs the costs involved.

In the literature on bank runs, it is usually assumed that depositors are individuals or firms who have placed funds in a bank for an indefinite period but with the understanding that these funds may be redeemed at face value on demand or at short notice. This literature does not cover other types of bank liability such as interbank borrowing, CDs, bonds and commercial paper, all of which typically have a

pre-specified maturity. Although in practice some of these may be the source of liquidity problems for banks – for example short-term interbank lending may not be rolled over – the literature reviewed here focuses on deposits as defined above.

The first paper formally to model the possibility of bank runs was that of Diamond and Dybvig (1983), where it was demonstrated that despite certainty about the soundness of a bank, depositors may run due to co-ordination problems. This is because each depositor is aware that if other depositors withdraw early, the bank would have to convert illiquid assets into cash at a loss and might not therefore have enough cash to cover all deposits. Any external event, therefore, which triggers depositors to believe that other depositors will withdraw their deposits results in a run. Diamond and Dybvig described such events as 'sunspots' (exogenous uncertainty).

Diamond and Dybvig's argument that 'sunspots' alone can trigger runs has been criticised for being unrealistic (Dowd, 1992). More recently, Morris and Shin (1999) have developed the co-ordination failure idea by extending it to the general creditor-borrower relationship and introducing incomplete information. They demonstrate that if the soundness of the borrower is uncertain and different lenders have different beliefs about it, runs on the borrower may occur. The trigger for the run would be a commonly observed signal about the borrower which raises lenders' doubts about whether other lenders will find the borrower sound, even if they do not themselves share that view. It is therefore rational to pre-empt withdrawals of other lenders by withdrawing first.

Diamond (1984) argues that the core of a bank's business is to extend loans based on private information about the borrower. Depositors are not easily able to observe the financial condition of the borrowers or the bank, and the bank depositor-manager relationship therefore potentially gives rise to agency problems (depositors entrust their money to bank managers and rely on them to invest it prudently). If depositors believe managers are behaving imprudently, they can discipline managers by withdrawing their funds – ie run on the bank (Calomiris and Kahn (1991); Davis (1995)). An alternative to the threat of running would be to

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<sup>2</sup> Hawtrey (1932) argues that the central bank can avoid having to make a decision as to the solvency of a bank if it lends only on collateral. If the bank fails, however, the central bank will avoid losses only if sufficient margin had been taken to cover any fall in the value of the collateral.

demand higher interest rates. However, this would imply that depositors are capable of monitoring and pricing the risks bank managers take, which the bank run literature assumes they are not able to do. In fact, Avery et al (1988), and Park (1995), among others, find evidence that large, wholesale depositors *are* able to discipline banks by demanding higher interest rates; but there is no evidence that small depositors behave in this way. This is perhaps not surprising, if only because small deposits are typically protected by deposit insurance. In the absence of deposit insurance and where depositors are unable to monitor their banks, the decision to run will depend on depositors' confidence in their bank's management.

Thus the nature of the deposit contract, together with the absence of complete information on the assets of the bank, result in the possibility of a solvent bank experiencing a run. Deposits may be switched into cash and other non-bank assets, or into deposits at another bank which is perceived to be less risky.

As first argued by Thornton (1802), when a bank's depositors convert their deposits into cash or other non-bank assets, this creates a need for a source of liquidity outside the banking system. The drain on a bank's funds cannot be offset by borrowing from other banks as there is no corresponding increase in these other banks' liquidity. Moreover, such a flight to cash may be symptomatic of depositors' loss of confidence in the banking system as a whole, which would be characterised by a generalised liquidity crisis affecting many or all banks. Prior to the existence of central banks, such crises were a concern for financial stability. According to Bordo (1986), Miron (1986) and Goodhart (1988), however, the development of central banks has reduced their frequency. Miron in particular shows that prior to the creation of the Federal Reserve Board in 1914, US banking crises – reflected in a flight out of deposits of the banking system as a whole – occurred every three years on average, and followed a seasonal pattern. In contrast, almost no such crises occurred between 1914-1928.

More generally, during this century the creation of a broad safety net, including deposit insurance,

regulation and supervision, as well as LOLR, has often been credited with having helped reduce the occurrence of panic deposit withdrawals into cash and other safe, non-bank assets (see Friedman (1959)). Mishkin (1999) points out that the United Kingdom has not suffered a banking panic since the 1860s, despite a deposit insurance scheme being in existence only since 1979 (although it did of course have a central bank). Overall, the relationship between deposit insurance and financial stability is not clear cut. Indeed, Demirgüç-Kunt and Detragiache (1999) find in a sample of 61 countries between 1980-1997 that explicit deposit insurance schemes *increase* banking crises for countries that do not have an effective system of prudential regulation and supervision. One interpretation is that, unless other safeguards are in place, comprehensive insurance schemes induce more risk-taking.

#### *Failure of the interbank market*

Whereas a flight out of bank deposits generally creates a role for the central bank as LOLR, a transfer of deposits from one bank to another does not necessarily do so. This is because the resulting surplus liquidity in some banks could, in principle, be transferred back to the illiquid bank (or banks) through the interbank market (see, for example, Selgin, (1993)). However, this requires that the interbank market should work efficiently<sup>3</sup>.

In a normally functioning interbank market, the inability of a bank to borrow funds through the market indicates that it is insolvent or failing. However, the interbank market may not always operate smoothly and under certain circumstances solvent institutions may be unable to borrow. The literature identifies three sources of such problems in the interbank market, all arising from asymmetric information.

First, because the interbank market has access only to incomplete information, doubts may arise about the solvency of a bank which is in fact sound<sup>4</sup>. The authorities *may* be in a better position to observe the financial position of the bank, particularly if they have access to supervisory information. Berger *et al* (1998) test the hypothesis that

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<sup>3</sup>: Although the literature concentrates on runs by small and uninformed ('retail') depositors, in practice wholesale depositors are often the source of runs on individual banks (e.g. Continental Illinois).

<sup>4</sup>: Under such circumstances, even a bank with collateral that would normally be accepted would not be able to borrow if there was residual legal uncertainty over the title of the collateral. Efforts to remove this friction include the introduction of repurchase agreements and the European Union Settlement Finality Directive, which aims at reducing legal uncertainty and harmonising transaction laws across the European Union.

supervisors in the United States have more accurate information than the market on the health of financial institutions. They do so by testing whether supervisory assessments are more accurate than market assessments in predicting future changes in bank performance. They conclude that shortly after supervisors have inspected a bank, supervisory assessment on its future performance is more accurate than the market. This suggests that from time to time it may be efficient for a central bank with access to up-to-date supervisory information to lend to banks which the interbank market may (wrongly) have judged insolvent. However, they also conclude that if the supervisory information is *not* up-to-date, market assessments of changes in a bank's performance are more accurate than those of the supervisor.

Second, the interbank market may become more cautious in times of crisis. Flannery (1996) develops a model with incomplete information to illustrate this. He shows that where the liquidity problem is small, a bank with surplus liquidity would be able to lend to all illiquid banks and the overall return from such lending would be acceptable. Usually, however, an individual bank's surplus is insufficient to lend to all illiquid banks. This increases the probability of loss to the extent it is equivalent to putting 'all one's eggs into one basket'. Flannery argues that in such a case there is scope for the central bank to lend to troubled institutions. This is not, he claims, because the LOLR has better information (he considers this unlikely) but rather because it has the capacity to realise the benefits of diversification by lending to all illiquid borrowers.

A final form of interbank market failure described in the literature is presented by Freixas, Parigi and Rochet (1998a). In their model, they consider cases where liquidity may dry up in the interbank market because each bank refuses to lend if it cannot be confident that it will itself be able to borrow in the interbank market in order to address its own possible liquidity shortage. These expectations become self-fulfilling through a co-ordination mechanism similar to the one which generates bank runs in the Diamond and Dybvig (1983) model. One response is an LOLR, which is not itself subject to liquidity risk because it 'prints' the ultimate means of settlement

(central bank money), either to provide liquidity or reassurance to banks that liquidity will be available in the case of a shortage.

Some argue, as did Thornton (1802) and Bagehot (1873), that the concern of the central bank is to protect the level of the aggregate money stock. Thus, distribution problems – where funds are not efficiently recycled by the interbank market in the event of depositors switching out of some banks into others – should not matter as the overall stock of money remains unchanged. As discussed below, however, there is a substantial literature that emphasises the uniqueness of bank loans. Such credit relations are not easily transferable from one bank to another. Financing may therefore be disrupted, particularly to borrowers who do not have access to capital markets as an alternative. Such problems in the credit creation process, independent of the overall liquidity of the market, may need to be addressed at the level of the individual bank.

These possible interbank market failures<sup>5</sup> provide one rationale for LOLR. But intervention will be justified only if the benefits outweigh the costs (Freixas, 1999).

### **Systemic risk**

The potential effects on the financial system as a whole of the failure of illiquid but solvent banks are perhaps the most important rationale for LOLR. Failure could involve negative externalities if the ability of the financial system as a whole to operate smoothly and effectively was threatened.

### *Credit relations*

The failure of a large bank, or a number of smaller ones, could result in system-wide financial instability. Such failures could threaten the ability of the financial system to perform its primary functions, including provision of the payments system, the efficient pricing of risk, and the allocation of resources. On the last of these, Diamond (1984) models banks as intermediaries who specialise in gathering information about borrowers. This information is private to the bank and contributes to the development of relationship banking. Greenbaum and Venezia (1985), Diamond, (1989), Greenbaum, Kanatas, and Venezia (1989),

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<sup>5</sup>: To our knowledge though, there is no empirical literature that establishes the existence of these forms of interbank market failure.

Sharpe (1990), Rajan (1992) and Greenbaum and Thakor (1995), among others, study *relationship banking* and argue that banks develop customer relations with client firms to gather information about them over time. With the failure of a bank, that relationship is lost and the borrower is then faced with the task of finding a new lender, which will take time as that lender will have to replicate the screening/monitoring efforts of the failed bank.

The credit process is important because certain types of borrower, small firms and households in particular, would find it difficult or impossible to raise funds directly in capital markets. This point is made by, for example, Mishkin (1995) and Bernanke and Gertler (1995). Capital markets are accessible only to large firms with substantial reputations (see Diamond (1991a)) or those who have sufficient capital to pledge as collateral (see Hölmstrom and Tirole (1993)). Individual bank failures could thus result in a cutback in credit to some small firms and individuals.

Because the threat to financial stability is often related to the size of the failed bank, Goodhart and Huang (1999) produce a rationale for the 'too big to fail' doctrine. However, the small banks crisis in the UK in the early 1990s demonstrates that the degree to which a bank is systemic is 'context-dependent' and not necessarily dependent on size. The Bank of England at the time "was quite clear that, had... [they] failed to intervene [by helping a few small banks], the pressure would have spread, and ...[the Bank] would then have found it harder to stop" (George, 1994).

The decision to support banks will thus inevitably be the result of weighing-up the current and prospective costs of such support against the costs to the economy of financial instability. These costs of financial instability are normally proportionately higher for large banks, notwithstanding higher support costs, although not necessarily so (Freixas (1999)).

#### *Interbank credit risk exposures*

Because of the extensive network of interbank exposures of various kinds, the failure of one bank to

fulfil its obligations may have an immediate and direct knock-on effect on other banks.

One mechanism through which this may occur is interbank lending, which is usually unsecured. Although intuitively this is clearly a possible source of systemic risk, careful modelling of interbank market exposures has not been widely developed. Rochet and Tirole (1996) present a general model, the purpose of which is to "...provide a framework in which some of the issues surrounding systemic risk can start being analysed." Their contribution to this discussion is that they provide a model of the inter-linkages that exist between banks, grouped under the generic heading 'interbank lending'. In their model, peer monitoring is presented as a potential source of systemic risk via interbank lending. This is because, if peer monitoring is to be encouraged, the authorities must commit to closing all banks who suffer losses from interbank loan exposures: if the failure of one bank causes the failure of another which had lent to it, both banks must be allowed to fail. If this is not the case, there would be no incentive for peer monitoring. Because it is difficult for the central bank to commit to a closure policy that would allow knock-on effects to occur, Rochet and Tirole conclude that the practical relevance of peer monitoring is seriously reduced.

Empirical analysis of the magnitude of interbank market exposures, and thus their likely systemic consequences, is constrained by a lack of available data. However, in one study of interbank exposures, Michael (1998) concludes that such exposures in the United Kingdom interbank market are significant, particularly amongst the large settlement banks which provide payment services to other banks.

Another source of systemic risk lies in the operation of settlement and payment arrangements<sup>6</sup>. Humphrey (1986), McAndrews and Wasilyew (1995) and Angelini, Maresca and Russo (1996) all examine the risks posed by payment system exposures and conclude that they are significant, although to varying degrees, depending on system characteristics. The most fundamental difference is that between payment systems with deferred (uncollateralised) net settlement and those with real-time gross settlement<sup>7</sup>.

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6: See Bank of England (1989) and Hills and Rule (1999) in this issue for a discussion of the potential risks inherent in payments and settlement systems.

7: A deferred net settlement system is one in which a bank's net position – the difference between the sum of the value of transfers it is owed and owes – is calculated at a point in time, such as the end of day, and at the same time a corresponding payment/receipt is made (see BIS (1997a)).

Systems with deferred uncollateralised net settlement generate substantial interbank exposures. From the time payment instructions are exchanged until the settlement is completed, the receiving bank is exposed to the sending bank. Kobayakawa (1997) and Schoenmaker (1995) discuss the possibility of systemic disturbances in a deferred net settlements system.

A real-time gross settlement system (RTGS) eliminates these exposures between members. However, if the central bank provides uncollateralised intra-day liquidity (as is the case with Fedwire in the United States) to facilitate the process of real-time settlement, the central bank takes on the credit risk. In the European Union, central banks have addressed this risk by themselves taking collateral from members of the systems in overdraft.

Freixas and Parigi (1997) compare the benefits and costs of a real time gross settlement system and a deferred net settlement system. They conclude that a gross payment system is preferable when the probability of bank failures is high (for a given cost of bank failures), the cost of holding reserves is low and the volume of payments is low<sup>8</sup>.

Empirical evidence on interbank exposures arising from payment and settlement systems is limited. Using data from the Federal Reserve's large value transfer system, Fedwire, Furfine (1999) concludes that the threat to systemic risk posed by bilateral payment system exposures relative to capital is exaggerated. However, as Furfine's data represent just twenty per cent of the interbank exposures in the US system, he concedes that his results may represent a conservative estimate of the importance of system risk via interbank exposures as a whole.

### Contagion

The possibility of runs on individual banks as a result of the combination of the deposit contract and asymmetric information was considered in the section on bank runs. Widespread runs which affect several

banks in a domino fashion (contagion) are considered in this section.

The failure of one bank may lead to runs on another bank if depositors perceive similarities between the two (Docking, Hirschey, and Jones, 1997). Although bank portfolios may vary, certain banks may specialise in similar types of business (e.g. commercial real estate, automobile loans etc.) or geographic areas (e.g. regional banks) and may therefore hold similar assets. If the failure of a bank leads depositors in similar banks to withdraw their deposits, while depositors in dissimilar banks do not, the contagion is said to be information-based (Chari and Jagannathan, 1988). That is, depositors take the decision to withdraw their funds based on information about the similarity of the two banks. If, however, the failure of a bank results in wide-spread runs regardless of any assessment of similarities or differences between banks, such a situation is referred to as 'pure panic' contagion.

The idea that the failure of a bank may change depositors' confidence in the solvency of other banks, independently of the correlation in asset quality, has been expressed often but seldom modelled. This view assumes that depositors' irrational behaviour may lead to a run on a sound bank in reaction to another bank's failure. Such an occurrence is implied, for example, by the Diamond and Dybvig (1983) model, described earlier<sup>9</sup>.

Kaufman (1994) presents evidence addressing the question of whether past episodes of wide-spread bank runs were motivated by pure panic, or were information-based. He reviews empirical studies that assess the reaction of uninsured depositors (for which equity-holders are used as a proxy) to the failure, or announcement of significant losses, of another bank<sup>10</sup>. These studies examine whether, following a bank failure, share prices fall more for banks with similar characteristics than those with dissimilar ones (e.g. size, geographical location) to the failed bank. Similar studies published since

<sup>8</sup> In practice, RTGS may not require higher reserves but would operate on the basis of intra-day credit by the central bank. The cost would therefore be the conditions imposed by the central bank in providing such credit (e.g. collateral, interest etc.).

<sup>9</sup> Krugman (1999) argues that the recent east Asian crisis appears to have had some characteristics of a panic. In particular, the pattern of capital outflows from Asian countries in 1997-98 only partly reflected the pre-crisis fundamentals in the affected economies (see Haldane (1999) in this issue).

<sup>10</sup> These include studies by Wicker (1980), Aharony and Swary (1983), Swary (1986), Lamy and Thompson (1986), Cornell and Shapiro (1986), Federal Reserve Bank of Cleveland (1986), Smirlock and Kaufold (1987), Peavy and Hempel (1988), Madura and McDaniel (1989), Wall and Peterson (1990), Smith and White (1990), Musumeci and Sinkey (1990), Dickinson, Peterson, and Christiansen (1991), Gay, Timme and Young (1991), Karafiath, Mynatt, and Smith (1991), Kane (1992), and Aharony and Swary (1992). These are all event-studies (i.e. measure share-price reaction to particular events). Other studies (not reviewed by Kaufman) include Saunders and Wilson (1996), Gorton (1988), Schoenmaker (1996) and Calomiris and Mason (1997).

Kaufman's review include Liu and Ryan (1995), Aharony and Swary (1996), and Docking, Hirschey, and Jones (1997). They all support the view that contagion very rarely takes place due to pure panic. Rather, information-based contagion through perceived similarities between banks is found to be far more significant, although these studies are not directly based on deposit contracts.

### Central banks' response to illiquidity problems

If LOLR implies the exchange of illiquid assets (whether for a bank or for a market) for reserve money, in order to be fully credible the provider of LOLR facilities needs to have unlimited capacity to supply reserve money. The issues are somewhat different however depending on whether the shortage is at the level of a firm or the market generally<sup>11</sup>.

### Lending to the market

Since Bagehot's day, there has been a substantial widening and deepening of interbank markets. One view in the academic literature is that in the light of these developments, emergency liquidity provision need only ever be made to the market as a whole through OMOs (see, for example, Goodfriend and King (1988), Bordo (1990), Schwartz (1992, 1995))<sup>12</sup>. This is because, as discussed earlier, the interbank market would ensure the allocation of liquidity from banks with surpluses to those with deficits, provided that the latter are considered creditworthy<sup>13</sup>.

OMOs are also the principal mechanism through which monetary policy is implemented by the central bank on a day-to-day basis in normal circumstances. The question of whether or not a distinction can be made between monetary policy and LOLR support to the market as a whole therefore arises. Goodfriend and King (1988) draw no distinction between the two, arguing that LOLR to the market as a whole is

monetary policy aimed at smoothing interest rates (the supply of reserve money is increased to match an increase in reserve money demand, thus stemming upward pressure on interest rates). There is little other modern literature on the matter, but Thornton (1802) suggested LOLR support is to satisfy extraordinary *short-term* increases in the demand for reserve money whereas monetary policy is aimed at targeting medium-long run growth in monetary aggregates (and thus inflation)<sup>14</sup>. However, regardless of the motive, LOLR support to the money market as a whole will involve an increase in the supply of reserve money in order to satisfy the increase in reserve money demand. Since there is no distinction between the operations used for LOLR to the market and for monetary purposes, Goodhart (1999) argues that the term LOLR should be used only for central bank liquidity support to individual banks<sup>15</sup>.

### Liquidity support to individual institutions

The main reason put forward in the literature for central bank lending to individual banks is that the inefficiencies in the interbank market described earlier could result in some solvent banks becoming illiquid because they cannot borrow from other banks. While LOLR support to the market as a whole increases the supply of reserve money, lending to specific banks need not. Any bilateral lending may be offset through reduced provision of liquidity to the market as a whole via OMOs, implying that although the composition of the central bank's assets change, the supply of total reserve money does not.

It is important to note too that the distinction between illiquidity and insolvency discussed in the analysis above is seldom clear-cut in practice. Goodhart (1995), Lastra (1997) and Goodhart and Huang (1999) all argue that the time-scale required

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**11:** Since usually one important source of information in assessing solvency is from supervisory returns and there is risk involved in using public funds, the provision of LOLR will usually require close co-operation and exchange of information amongst the central bank, the supervisor (in countries where this is located outside the central bank) and the government. In the United Kingdom this has been formalised in the Memorandum of Understanding (MoU) between the Bank of England, the Financial Services Authority and HM Treasury. The MoU is set out as an annex in the Bank of England Quarterly Bulletin, May 1998.

**12:** It should be noted that in practice most central banks have a limited number of counterparties in OMOs who are expected to on-lend to the market more generally. These counterparties are selected on the basis of strict criteria. The Bank of England, for example, requires that counterparties (i) have the technical capability to respond to OMOs, (ii) maintain an active presence in gilt repo/bill markets, (iii) participate regularly in OMOs, and (iv) provide useful information on market conditions and developments.

**13:** As discussed in the section on the failure of the interbank market, this view implies that the central bank has no informational advantage over the interbank market.

**14:** In practice, faced with a sudden increase in financial instability, e.g. the 1987 stock market crash, central banks have sometimes loosened monetary policy in order to maintain monetary stability.

**15:** It is possible, however, as with the plans for Y2K, for central banks to satisfy temporary increases in the financial system's demand for liquidity through either discretionary increases in the supply of reserves, or passive increases where standing facilities are provided, without changing their monetary policy interest rate.

for making a decision as to whether or not to lend to a bank is often too short to be able to arrive at firm conclusions over its solvency. Even where the potential sources of pressure are observable far in advance, eg Y2K, or build-up slowly, such as the small bank crisis in the UK in the early 1990s, and the authorities can thus plan somewhat, the need for action at short notice is still possible. Moreover, a bank which is solvent *ex ante* may not be so *ex post*; e.g. a future deterioration in the general economic situation may mean that a bank which was solvent at the time of the liquidity injection becomes insolvent later. Central banks which lend in such circumstances should have a clear exit strategy.

### Risk-capital support

#### Justification

So far this article has described LOLR as being largely motivated by the negative consequences bank failures originating in liquidity problems have on the stability of the financial system. The stability of the financial system can of course also be threatened by the failure of an obviously *insolvent* bank. Moreover, it is possible that the failure of an insolvent non-bank financial institution could also pose a systemic threat. In such circumstances the *ex ante* provision of risk capital rather than liquidity support may need be considered by the authorities.

Systemic risk aside, it is possible that it may be less costly to restructure an insolvent bank than allow it to fail<sup>16</sup>. James (1991), among others, has obtained results showing that the liquidation value of a bank is lower than its market value as a going concern. Guttentag and Herring (1983) also make this point, stating that “banks usually are worth more alive than dead even when their worth alive is negative.” This is primarily a justification for the take-over of bad banks by good banks. However, some argue that, failing this, capital injection by the public sector accompanied by restructuring of a bad bank may be justified where the benefits outweigh the costs of doing so.

Goodhart and Huang (1999) argue that financial instability resulting from the failure of a bank is characterised by panic in which the behaviour of depositors becomes unpredictable. Mistakes in the

conduct of monetary policy are thus more likely to occur. They argue that when the central bank is approached by a bank for liquidity support, it does not have time to verify whether or not the bank is solvent. If the central bank provides support to a bank that is revealed later to be insolvent, it will incur a direct financial loss as well as suffering a reputational cost. The central bank will therefore in practice need to weigh the probable cost of providing capital to a possibly insolvent bank against the cost of the instability that its failure could generate.

#### The provision of risk capital in practice

Empirical analyses of the resolution of cases of bank default indicate that failing banks are more often dealt with through the injection of capital rather than being liquidated. Goodhart and Schoenmaker (1995), for example, gather evidence on the effective resolution policies in 24 countries. Out of a sample of 104 failing banks, they find that 73 resulted in rescue and 31 in liquidation. Santomero and Hoffman’s (1998) review of bank default resolution similarly establishes that access to the discount window in the US between 1985 and 1991 was often granted to banks with poor CAMEL ratings that later failed<sup>17</sup>. (Access was granted, they argue, in order to keep institutions afloat – even those which were known to be insolvent – so as not to impose further costs on the deposit insurance fund which had suffered large losses.)

#### Who should provide capital to banks?

There are a number of reasons why the provision of LOLR support and the provision of risk capital for insolvent banks may or should fall to different institutions.

In theory, emergency support in its strictest sense to solvent but illiquid banks implies no risk to the central bank. In practice, as discussed in the section on liquidity support to individual institutions, the value of the collateral may fall below the value of the loan thus creating a risk to the central bank. Therefore, lending to a bank – particularly a large one – that is not clearly solvent, could expose the central bank to potential loss. Many central banks would not be in a position to take on such risk independently and therefore it would require a

<sup>16</sup>: Note that this also provides further justification for extending liquidity support to illiquid, solvent but non-systemic banks.

<sup>17</sup>: CAMEL ratings are scores assigned by US supervisors that reflect their judgement of a bank’s Capital, Asset quality, Management, Earnings and Liquidity.

government guarantee to cover the central bank exposure (Goodhart and Schoenmaker (1993) and Goodhart (1999)).

Stella (1997) argues that a central bank may not need capital in the same way as commercial banks. Capital is necessary for commercial banks in order to provide a buffer against losses, to provide start-up funds, and to overcome moral hazard problems with creditors. He argues that none of these factors applies in the same way to central banks. Stella calculates a central bank's net worth taking into account the net present value of future income (including seignorage revenue), so that the importance of subscribed capital for central banks is reduced. However, he argues that a weak balance sheet (resulting perhaps partly from exposures to troubled banks) may compromise its independence and ability to retain flexibility in its conduct of monetary (and foreign exchange) policy.

In practice, if an institution were *clearly* insolvent the government would need to make a decision on whether or not to provide risk capital to prevent its failure. Although the central bank would probably advise on the systemic consequences of the failure of the institution, the government's decision for support might also be made on other criteria (eg for social reasons).

#### **The costs of LOLR/capital injections – moral hazard**

Any form of insurance, and liquidity and capital support are no exception in this respect, creates moral hazard. Moral hazard arises when the provision of insurance, by modifying the incentives for the insured party to take preventive actions, increases the probability of occurrence of the event being insured against. Moral hazard is inherently forward-looking: a particular episode 'creates' moral hazard only to the extent that it influences expectations of how a similar situation will be dealt with in the future. In principle, where liquidity support can be clearly separated from provision of risk capital, the moral hazard created will be limited to possible mismanagement of liquidity risk. Capital support, however, may raise expectations that the financial institution is insured against mismanagement of virtually all types of risk, including credit and market risk (from which particular benefits may accrue).

#### **Moral hazard in emergency assistance and bailouts of individual institutions**

If exercised too leniently, LOLR may lead to banks expecting liquidity support from the central bank "...as a matter of course" (Bagehot, 1873). Indeed, if liquidity support is extended on terms more favourable than are available in the market, it ceases to be lending of *last resort* altogether. It is for this reason that Bagehot's 'rules' proposed, among other things, that lending be made at a rate high relative to the pre-crisis rate. This, he believed, would ration access to liquidity and decrease the moral hazard problem. Also, a penalty rate was thought to be a fair price to pay for the protection offered to the failing bank through the provision of liquidity or to cover the central bank's risk exposure (Humphrey, 1989).

An injection of capital, on the other hand, may have two effects on bank behaviour (Freixas and Rochet, 1997). First, it gives the bank managers and shareholders incentives to take additional risks so as to maximise the subsidy implicit in such a rescue. Second, the possibility that the official sector will provide risk-capital to a failed financial institution may reduce the incentives for uninsured creditors to monitor the behaviour and performance of the institutions to which they have lent (Kaufman (1991) and Rochet and Tirole (1996)). Whereas deposit insurance is explicit and typically covers only retail depositors, and then usually only up to a certain amount, capital injections *implicitly* insure all investors<sup>18</sup>. They will thus further reduce the incentives of partially insured depositors to monitor *and* also weaken the incentives of uninsured investors and peer banks as well.

Both Thornton (1802) and Bagehot (1873) were well aware of this risk of moral hazard. As Bagehot put it, "any aid to a present bad bank is the surest mode of preventing the establishment of a future good bank". Bagehot's proposal to lend only on security reflects the attempt to eliminate the moral hazard capital provision entails.

Under modern financial conditions, however, the applicability of Bagehot's rules is questionable. To begin with, the idea of lending at a penalty rate is often challenged and in practice emergency lending

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<sup>18</sup>: One exception is the current deposit insurance scheme in Japan which covers all depositors and creditors. However, mainly in recognition of moral hazard concerns, this scheme is planned to end in March 2001 (see Nakaso (1999)).

to individual solvent institutions has sometimes been made without applying a premium over the current notional market rate (Goodhart and Schoenmaker (1995), Prati and Schinasi (1999)). This occurred, for example, during the Savings and Loans crisis in the United States. This divergence from Bagehot's rules has several justifications: lending at a high rate may (i) aggravate the bank's crisis (Crockett (1996); Garcia and Plautz (1988)); (ii) send a signal to the market that precipitates an untimely run, unless it is provided covertly; and (iii) give the managers incentives to pursue a higher risk/reward strategy to get themselves out of trouble ('gamble for resurrection'). These risks may be more likely in modern financial systems where clearly solvent financial institutions should normally be able to obtain liquidity from the interbank market.

However, as we have seen, it may be socially desirable for the public sector to intervene even when faced with a clearly insolvent institution. Prati and Schinasi (1999) and Giannini (1999) point out that in many industrial countries, authorities have often felt the need to advance support even when confronted with a genuine insolvency problem.

One means of limiting the moral hazard leads to the notion of 'constructive ambiguity'. As Corrigan (1990) has argued, by introducing an element of uncertainty into the provision of support, pressure can, in principle, be maintained on banks to act prudently, since the latter will not know individually whether they will be rescued or not. Constructive ambiguity is, by definition, difficult to pin down and formalise. An informal definition of the notion can be found in a recent G10 Report which states that:

"... any pre-commitment to a particular course of action in support of a financial institution should be avoided by the authorities, who should retain discretion as to whether, when and under what conditions support would be provided. In addition, when making such a decision, it is important to analyse rigorously whether there is a systemic threat and, if so, what options there may be for dealing with systemic contagion effects in ways that limit the adverse impact on market discipline" (BIS, 1997b).

As this passage makes clear, *ex ante* constructive ambiguity is a complex notion, encompassing, besides uncertainty as to whether intervention will take place

at all, also uncertainty regarding both the *exact timing* of the intervention and the *terms* and *penalties* attached to any particular intervention.

Ambiguity regarding whether intervention is actually taking place, which implies that liquidity assistance may be provided covertly, might be desirable either to avoid 'imitation effects' within the banking system or where, due to the bank's size and operational ramifications, the handling of an individual bank's problem risks itself triggering systemic repercussions (Enoch, Stella, and Khamis, 1997). The rationale for this type of secrecy, in circumstances where wide-spread panic has not yet occurred, was, for example, set out in a speech by Eddie George, Governor of the Bank of England, where he stated that:

"...we usually try to keep the fact that we are providing systemic support secret at the time... If people know that we are so concerned about systemic fragility that we have judged it necessary to provide support, that could lead to a wider loss of confidence. They would wonder how far that support would be extended, and we could rapidly find ourselves in the position where we were in practice underwriting all the liabilities of the banking system" (George, 1994).

When a panic has already set in, however, it is sometimes recognised that management of the crisis, including support operations, may usefully be made public. This is because transparency during a crisis may reduce uncertainty and thereby have a calming effect on financial markets (Bagehot, 1873).

Ambiguity regarding the conditions attached to liquidity support, in turn, may be needed to keep managers and shareholders uncertain as to the cost they will have to bear should a firm's illiquidity result from imprudent behaviour (Crockett, 1996).

The downside of constructive ambiguity is that it places a large degree of discretion in the hands of the agency responsible for crisis management. As in other fields of economic policy-making, discretion raises a time-consistency problem: while it is in the interest of the authorities to deny their willingness to provide a safety-net, *ex post* they may later find it optimal to intervene. Lack of transparency enables them to avoid having to justify treating differently what the general public may perceive as identical situations. Enoch, Stella and Khamis (1997) argue that central bank

discretion in handling individual cases could be balanced against firm rules for disclosure after the event<sup>19</sup>. Indeed, as the IMF's Code of Good Practices on Transparency in Monetary and Financial Policies itself testifies, an effort is currently being made in this direction (IMF, 1999)<sup>20</sup>.

In practice, the effectiveness of constructive ambiguity as a check on moral hazard can be expected to be greater to the extent that there exist procedures for 'punishing' the managers and shareholders of imprudently managed intermediaries. Furthermore, the effects of moral hazard have often been contained by rules directly constraining or indirectly encouraging banks and other financial intermediaries to act prudently, including in managing their capital and liquidity.

'Punishing' the managers and shareholders of imprudently managed intermediaries is widely regarded as crucial in the context of official capital injection. As Andrew Crockett has recently put it:

"... if it is clear that management will always lose their jobs, and shareholders their capital, in the event of a failure, moral hazard should be alleviated" (Crockett, 1996).

The extent to which moral hazard and time consistency problems have been limited in practice in individual countries is, of course, debatable. Unsurprisingly, countries that experienced serious banking problems have also felt it necessary to modify their institutional set-up. In the United States, for example, the S&L crisis stirred a heated debate on whether limits should be placed on the degree of forbearance authorities may show in deciding when to trigger 'punishment strategies'. The debate led to the revision of the overall safety net through the FDIC Improvement Act (1991), which aimed at making it "more incentive-compatible by providing for a graduated series of regulatory sanctions to mimic market discipline" (Benston and Kaufman (1998)). The notion of Prompt Corrective Action – according to which sanctions become mandatory after a certain threshold has been reached – is an important component of the reform.

### **Concerted private sector lending – a possible solution to the moral hazard problem**

As discussed earlier, disruptions in the interbank market may justify a role for the central bank as LOLR if such problems cannot be overcome in some other way. However, the central bank may be able to overcome the market's co-ordination and information problem through organising private sector liquidity support rather than lending itself.

The central bank may have a role of bringing potential lenders together where individual banks, even when known to be solvent, are unable to obtain funds due to co-ordination problems among creditors. This is the basis of the interbank market failure in Freixas, Parigi, and Rochet (1998) (which builds on the co-ordination failure literature of Diamond and Dybvig (1983)), described in the section on failure of the interbank market. Such co-ordination problems could be resolved by the central bank bringing all banks together and encouraging dialogue: if banks are able to reassure one another that liquidity will be forthcoming, interbank lending will resume.

The other failures of the interbank market described earlier are related to uncertainty about the solvency of the bank in question. In such cases, some pressure by the central bank on surplus banks to lend may be warranted if the former has superior information to markets participants (via the supervisor, involvement in the payment system or as part of an application for emergency liquidity assistance).

Giannini (1999) points out that often in the past central banks have acted as an agent organising the channelling of other banks' private funds – concerted lending – to the bank in difficulty. In principle, organising such private sector support could be either the responsibility of the central bank or another official agency (Fischer (1999)). The central bank, however, as the bankers' bank and at the heart of the monetary and payments system, has an advantage in organising private sector liquidity support because it can provide agency (eg escrow) facilities or act as a principal intermediary.

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<sup>19</sup>: This is exemplified by the Bank of England's handling of the small banks crisis in the early 1990s where, at the time, it was not made public that the Bank was providing assistance to a small number of small banks. After the direct systemic threats were averted, however, the Bank then disclosed its operations to the public and accounted for its actions (see for example *Bank of England Annual Report*, various issues).

<sup>20</sup>: "...aggregate information on emergency financial support by financial institutions should be publicly disclosed through an appropriate statement when such disclosure will not be disruptive to financial stability" (IMF, 1999 para 7.3.1).

Central bank involvement in organising private liquidity support is targeted at overcoming co-ordination problems<sup>21</sup>. The central bank should not need to 'coerce' other banks to lend as all parties should be better off doing so. If the central bank does pressure banks to lend, or to lend on terms that would improve the failing bank's position relative to what it would otherwise have been, then this would indicate that the problem is not purely one of co-ordination. In such a case, private sector support is still, in effect, subsidising the failing bank (Goodfriend and Lacker, 1999).

More generally, co-ordination problems may be difficult to overcome because of the short-term competitive advantage surplus banks experience during a crisis. In these circumstances, 'moral suasion' and regulatory powers may be required to instil a co-operative attitude into what are otherwise keen competitors. This seems to underlie Kindleberger's view that:

"... the optimum may be a small number of actors, closely attuned to one another in an oligarchic relation, like-minded, applying strong pressure to keep down the chiselers and free-riders, prepared ultimately to accept responsibility" (Kindleberger, 1989).

Historical evidence seems to confirm the existence of a tension between the effectiveness of concerted support and the degree of competition in the financial system. Orchestrated liquidity support operations occurred often in the past. The Bank of England's co-ordination of the rescue of Baring Bros. in 1890 and its organisation of a 'life-boat' during the secondary banking crisis in the early 1970s (see Reid (1982)) are prominent examples, as is the Clearinghouse System – a private institutional framework in place for dealing with liquidity problems – operating in the United States from the 1860s up to the 1910s. Such private sector solutions, however, became less feasible as the degree of competition in the market increased. The Clearinghouse System was brought down, at the beginning of the century, by the marked increase in competition in the key U.S.

financial centre, New York. Likewise, orchestrated operations became more difficult to organise in the United Kingdom during the 1980s, when the difficulties encountered in the rescue of Johnson Matthey Bankers Ltd., a London bank which had been an active market-maker in the gold bullion sector, in an environment of heightened competition led the authorities to rethink their approach to LOLR support (Capie et al (1994))<sup>22</sup>.

The notion that liquidity support should be seen primarily as the responsibility of the institutions operating in the market has, however, remained in countries where competition in the financial system has until recently been somewhat limited eg France, Italy, and Germany: in the last of these it was formalised with the creation, in the 1970s, of the so-called LikoBank to deal with liquidity problems at smaller banks. The U.S. authorities at the beginning of the 1990s were concerned that the climate of competition characteristic of their financial markets prevented this feature of continental European banking practices from being reproduced on the other side of the Atlantic. As Corrigan put it:

"Private institutions either are more willing, or feel more compelled, to participate in stabilisation or rescue efforts in foreign countries than they are in the United States.(...) Where a handful of banks dominate national banking systems, that handful of banks feels more directly threatened by potential dangers of a systemic nature than do banks here in the United States" (Corrigan, 1990).

However, the handling of the crisis of Long Term Capital Management (LTCM), in 1998, may reflect a change in view of the importance of systemic risk to counterparties of financial institutions. As William McDonough (1998) recently stated, the failure of LTCM would have had substantial repercussions on financial markets, on which LTCM's counterparties "voiced their own concerns" so that, in the end, "a private sector solution... involving an investment of new equity by Long-Term Capital's creditors and counterparties" was reached<sup>23</sup>. This may suggest that in some circumstances a financial institution can be

**21:** An analogy can be drawn with the Bank of England's 'London Approach', which is aimed at overcoming co-ordination problems amongst creditors of non-financial institutions (see Kent (1997) and Brierley and Vlieghe (1999)).

**22:** It should be noted, however, that the more recent failure of Barings in 1995 was because the magnitude of Barings' losses were uncertain since open positions in derivatives markets made the risk to potential creditors unquantifiable (see the evidence given before the Treasury Select Committee by Eddie George, Governor of the Bank of England (Treasury and Civil Service Committee, 1995)).

**23:** Statement before the Committee on Banking and Financial Services in the United States Congress, October 1998.

'too big to fail' even from the perspective of the rest of the private sector.

### Summary

This paper has identified, from the literature, two main reasons for the existence of the central bank's role as LOLR:

- informational asymmetry which makes otherwise solvent banks vulnerable to deposit withdrawals and/or the drying up of interbank lending in times of crisis; this can result in insolvency for otherwise sound banks, and thus a welfare loss to the bank's stakeholders.
- the potential risk to the stability of the financial system as a whole following the failure of a solvent bank. Widespread financial instability may prevent the financial system from performing its primary functions including the smooth operation of the payments system, and intermediating between savers and borrowers with an efficient pricing of risk. Such problems may be induced by the failure of a large financial institution, or a group of smaller ones, which have ripple effects on other financial institutions through direct credit or payments exposures or via contagion.

Risks to the stability of the financial system as a whole also arise with the failure of a large insolvent bank (and possibly non-bank financial institutions). In such cases, the government would make a decision on whether or not to provide risk capital to prevent its failure. The central bank would likely play a role in providing objective expert advice on the systemic consequences of the failure of the institution concerned.

LOLR and/or capital support should be considered only when the benefits from intervention outweigh the costs, particularly of moral hazard and also potential losses to the tax-payer.

Two channels of possible LOLR support are identified in the literature – (i) lending to the market as a whole and (ii) lending to individual institutions. LOLR support to the market as a whole is used to deal with generalised liquidity shortages. Such operations (which are made against high quality collateral) reduce the general level of short-term interest rates or prevent them from rising further. Put another way, such support increases the supply of reserve money. The distinction between LOLR support to the market

and a loosening in monetary policy is not easily made leading some academics to suggest that they are one and the same thing.

Central bank emergency liquidity support to individual illiquid but solvent institutions occurs when such institutions cannot borrow from other banks or from the central bank through normal facilities. Unlike lending to the market as a whole, lending to individual institutions need not increase the size of the central bank's balance sheet, but will change its composition. This implies that there need be no conflict with monetary policy. It is likely that such lending is made against collateral not acceptable in normal monetary operations or on the interbank market. Therefore, emergency assistance may expose the central bank to risk should the bank which receives it become insolvent and the value of the collateral taken subsequently fall below the value of the loan. In practice, when an institution faces a sudden liquidity crisis, it is sometimes difficult for the central bank to obtain timely and detailed information to assess whether the institution is fundamentally solvent or not. A central bank may therefore mistakenly lend to an insolvent bank. Moreover, what may start as an illiquidity problem may evolve into an insolvency one. In such circumstances it is important that the central bank has a clear exit strategy.

The literature identifies a number of costs from providing liquidity and especially solvency support. There is a direct financial cost involved in the explicit provision of risk-capital to insolvent institutions and in losses incurred through providing liquidity to banks which turn out subsequently to be insolvent. Moreover, by insuring banks against the costs of liquidity or solvency problems, the provision of support may result in banks being less concerned than would be the case otherwise to avoid such problems (ie it promotes moral hazard). In particular, if LOLR is given to individual firms on too favourable terms, it may cease to be last resort lending altogether and banks may come to rely on it as a matter of course. More importantly, the expectation of bail out in an insolvency situation may result in bank managers and shareholders taking excessive risks and creditors and uninsured depositors not properly monitoring their banks.

A potential method to reduce, although not eliminate, the moral hazard problem is, as suggested by Bagehot

more than a century ago, through imposing a high rate (relative to the pre-crisis period) but this may: (i) aggravate the bank's crisis; (ii) send a signal to the market that precipitates an untimely run; and (iii) give the managers incentives to pursue a higher risk-reward strategy in order to repay the higher rate ('gamble for resurrection'). In practice, moral hazard has often been reduced through maintaining a degree of uncertainty about which financial institutions receive support and which will be allowed to fail

('constructive ambiguity') coupled with procedures for 'punishing' the managers and shareholders of imprudently managed intermediaries. In addition, safeguards have been used to limit the impact of moral hazard and the amount of discretion allowed in liquidity support. The cost to the public sector has also been minimised through the central bank/supervisor encouraging liquidity support from the private sector.

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