

Financial Stability and Central Banks
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Jeffrey M. Lacker
President, Federal Reserve Bank of Richmond

The financial market events of the last nine months have raised a number of questions about our financial markets and institutions, about financial regulation, and about the central bank's role in credit markets.¹ Some analyses have focused on the drying up of trading activity in certain structured finance products where the key observation is how abruptly liquidity conditions in a financial market can change. Others have focused on the underlying fundamentals of credit quality in these financial products, with a key observation being that, after the fact, it looks as though many decisions regarding the extension of credit yielded quite disappointing results.

These two perspectives are clearly interrelated, since the loss of liquidity in asset-backed and related markets appears to have come about largely because of significant shifts in people's assessments of the underlying credit quality. Despite this intimate connection, emphasis on one or the other tends to lead to very different interpretations of recent events. An emphasis on liquidity is often associated with a view that financial market instability represents a breakdown in the functioning of markets, while an emphasis on credit quality suggests the view that such disruptions are simply the natural way that markets (even well-functioning markets) adjust to large changes in peoples' beliefs about fundamentals.

In my remarks here today, I would like to discuss financial stability and central banking. I realize that a great deal of ink has been spilled on this topic, some of the earliest and most influential of which was spilled in this very city. But more recently, specifically the last 30 years, there has been an outpouring of economic research on the stability of banking institutions. What I have to offer is a discussion of recent financial market turmoil and policy responses from the viewpoint of this body of work.

In this line of research, economists have developed detailed, coherent accounts of both of the views I described. These represent competing theories of financial instability, and these different theories have distinct implications for the appropriate responses of government and central bank policy to market disruptions. A breakdown of the process by which the market distributes liquidity among its participants is often cited as a justification for a relatively active approach to central bank lending. On the other hand, a market adjusting, even quite awkwardly, to a shift in participants' understanding of the underlying risks might imply that such lending, by interfering with the price discovery process, is potentially counterproductive.

In some ways the research has been inconclusive – it remains very difficult to determine the underlying causes or nature of financial disruptions in real-time, when policy responses need to be formulated. But this research has improved our ability to think about costs and benefits of policy choices, I think. I will emphasize in particular the importance of paying attention to the long-term consequences of central bank actions in financial markets. As always, the views I express are my own, and not necessarily shared by my colleagues in the Federal Reserve System.

Maturity transformation is a basic function of financial institutions, instruments and markets

The traditional description of banks and the economic role they play is that they engage in “maturity transformation.” Their lending is tailored to meet the needs of their borrowers for longer maturity debt to finance purchases or large investment projects and to shield them against the risk of losing funding. Their liabilities are tailored to the desires of the ultimate providers of funds for short-term assets to be prepared to meet unexpected expenditure needs or investment opportunities.

In principle, one could imagine a financial intermediary whose assets and liabilities are well matched in maturity and liquidity. But the nature of the preferences and needs of households and businesses that provide and use funds is such that a deliberate mismatch – that is, a maturity transformation – has historically been more socially useful and thus profitable. Such a mismatch exposes the financial intermediary to obvious risks, however, and thus requires compensation in the form of a spread between the returns earned on lending and the returns paid to savers. Savers accept a lower return in exchange for flexibility in accessing their funds, and borrowers pay more in exchange for the certainty of their funding source.

This, then, is the traditional view of banking – funding long-term financing needs in a way that satisfies savers’ desire for short-term, liquid assets. But this same sort of transformation takes place in a variety of ways today outside of the traditional (commercial) banking system. For example, asset-backed commercial paper, which grew very rapidly between 2003 and the first half of 2007, allowed money funds and other investors to place short-term, liquid funds in securities backed by mortgages and other longer term instruments. More broadly, many structured finance arrangements involve maturity transformation. Repurchase agreements also provide a means for investors to make very short term (overnight) investments backed by longer term securities, as does such specialized instruments as Auction Rate Securities.

Maturity transformation raises the possibility that a surge in demands by liability holders to “get their money back” could overwhelm an institution’s ability to liquefy the assets in its portfolio.² This is the traditional story of bank runs, and it motivates, in part, the view I cited earlier that financial markets are inherently unstable. Since banks’ assets are less liquid than their liabilities (their deposits), they could have trouble meeting the demands of a large number of depositors to “cash-in” all at once. Knowing this makes depositors

likely to run if they think such a large cash-in event is looming. So a run, in this view, can become a self-fulfilling prophecy. This means that a run can occur even if the bank's assets are fundamentally sound, in the sense that if held over a longer horizon the return would be sufficient to repay liability holders in full. The reduction in realized value associated with early and perhaps disorderly liquidation of an intermediary's assets in response to such a run is a deadweight cost that presumably could be avoided if the run could be prevented.

Fundamental runs versus self-fulfilling prophecies

Economists have made great progress in recent years in formalizing the reasoning I just sketched, and in understanding precisely what circumstances are required for this reasoning to make coherent sense. Researchers have found it useful to distinguish between what I'll call "fundamental" and "non-fundamental" runs. Non-fundamental runs are of the self-fulfilling variety; if all depositors who do not need their money right away believe that other such depositors will not withdraw their money, then no run occurs. In another potential equilibrium, the belief that other patient depositors will withdraw nonetheless induces all patient depositors to withdraw, thus confirming their beliefs. Fundamental runs occur when people seek to remove their money from an intermediary because they have information that makes them mark-down their valuation of the intermediary's assets; waiting is not a reasonable option (that is, not an equilibrium). This distinction is important because the two types of runs have very different policy implications. Preventing a non-fundamental run avoids the cost of unnecessarily early asset liquidation, and in some models can rationalize government or central bank intervention. In contrast, in the case of runs driven by fundamentals, the liquidation inefficiencies are largely unavoidable and government support interferes with market discipline and distorts market prices.

The ability of theoretical models to predict non-fundamental runs appears to be very sensitive to the assumptions used in constructing the model. So economic theory does not provide a clear prediction about if and when such runs would be likely to occur. However, in most instances of runs that we have observed – for example, the wave of U.S. bank runs in the Great Depression – careful analysis has shown that banks that experienced runs tended to be in observably worse condition than those that did not.³ That is, there usually appears to be some fundamental impetus behind a run.

Recent events in money markets have been compared to bank runs, even though they occurred outside the traditional commercial banking sector. Examples include the flight from asset-backed commercial paper last summer, the failure of auction rate security refinancings, and the problems faced by Bear Stearns in the week leading up to its agreement to be acquired. Can these be characterized as non-fundamental runs? Certainly, some ABCP was backed by subprime mortgage debt, for which there was good evidence of reduced fundamental value, and there was uncertainty for a time about how much of any given issue was backed by such debt. Moreover, many ABCP holders were contractually constrained to hold only investment-grade paper, and thus would have had

to sell if it was downgraded. This, together with the availability to issuers of other funding sources outside of the CP market (albeit at higher rates), seems to offer a plausible explanation, based on fundamentals, of the rapid fall in issuance volume that began last August. Similarly, significant concerns were circulating publicly regarding mortgage-related assets on Bear Stearns' balance sheet, making money market counterparties (short-term investors) reluctant to continue dealing with the firm.

The case of auction rate securities appears to be peculiar because the underlying credit quality of most issuers – municipalities, for instance – was not called into question. Interest rates on auction rate securities are set at periodic auctions, in which security holders choose whether to keep their investment in the security by participating in the refinancing auction or to withdraw their funds instead. Auction rate securities thus represent a maturity transformation in which less liquid assets are funded by more liquid liabilities. But ARS contracts also explicitly provide that if there is insufficient interest in an auction by either new or existing investors, then the security converts into a long-term instrument, such as a more conventional bond, typically paying a substantially higher rate of interest. As a result, the underlying assets need not be liquidated. The consequences of a run-like departure of investors are thus different than in the case of a bank run or a flight from some other money market instruments. This is an important distinction, because it highlights that the extent to which maturity transformation creates the possibility of fragility or instability in financial institutions or markets depends critically on the contractual terms adopted by the intermediary.

Financial fragility is endogenous

The intuition behind the classic bank run story is that banks are susceptible to runs because depositors are free, at any time, to claim all of their money on demand. This is a contractual choice, and one that makes some sense given depositors' demand for short duration, liquid savings instruments. But if a bank can restrict its depositors' ability to demand their funds on the spot in certain circumstances – in the event of heavy demands for withdrawals, for example – then the bank will be less susceptible to a run. And there is ample precedent for deposit contracts with such characteristics. In 19th century U.S. banking panics, banks preserved their liquidity, individually, by suspending the convertibility of their deposits into currency.⁴ They also had recourse to collective actions through the issuance of loan certificates by clearinghouses in the major cities, which allowed the clearinghouse members to meet their interbank obligations and customers to make interbank transfers without drawing on banks' scarce supplies of currency.⁵

The auction failures in auction rate securities bear a resemblance to 19th century suspensions of convertibility in that liability holders were converted into less liquid claims. One result from the research literature is that such contractual provisions are capable of preventing or limiting self-fulfilling, or non-fundamental runs.⁶ The prospect of suspension discourages liability holders from attempting to withdraw funds unless their need is genuine, and helps convince them that other liability holders will be similarly discouraged. Institutions that engage in maturity transformation can also limit

their susceptibility to runs by holding a greater share of their balance sheets in liquid assets, or by financing themselves with less liquid liabilities – for instance, by limiting their leverage or issuing longer-maturity debt. Note that bankruptcy itself constitutes an enforced suspension of convertibility.

The general principle here is that while maturity transformation can be socially useful, it is not inevitable; the extent of maturity transformation and of vulnerability to run-like behavior is a function of the contractual arrangements a financial intermediary voluntarily assumes.

Any form of self-protection against run-like outcomes is likely to be costly, though. Holding more liquid assets limits the gains from the fundamental asset transformation that the institution is engaged in. A policy of suspending convertibility, while making a bank less susceptible to non-fundamental runs, could also limit the ability of depositors to access their funds in episodes of fundamentally-driven financial strain, and perhaps at times when they genuinely need liquidity themselves, thus reducing the inherent value of the deposit contract.

Central bank lending

The usual presumption is that institutions and their counterparties implicitly weigh the expected costs and benefits of alternative contractual arrangements in designing financial structures that best suit their financial needs.⁷ The incentives of financial intermediaries and their counterparties to construct resilient arrangements are also influenced by the policy regime under which their transactions take place. If people anticipate that in situations of financial stress the government or central bank will intervene in a way that limits private losses, then there is likely to be less interest in taking costly steps to avoid those situations.

Banks have historically benefited from access to support in the form of central bank credit. Discussions of the role of the central bank as a lender of last resort, particularly in times of financial stress, often cite Walter Bagehot's account of the Bank of England's practices in the 19th century.⁸ Bagehot's advice is often summarized by the simple prescription, "lend freely at a high rate, on good collateral."

The relevance of Bagehot's dictum for recent central bank lending is not at all clear, however. There is an important distinction to be made between monetary policy operations, which vary the total quantity of central bank liabilities, and credit policy, which alters the composition of the central bank's assets.⁹ Modern central banks target an interest rate, which requires that they adjust the quantity of their liabilities – generally bank reserves – in response to fluctuations in the demand for those liabilities. By itself, a central bank loan increases both the liabilities and assets of the central bank. Absent offsetting asset sales, the additional reserves would tend to drive the interest rate below target. Therefore, central bank lending operations are generally "sterilized" via offsetting

asset sales.¹⁰ The lending programs introduced by the Federal Reserve since December have all been sterilized.

The lending about which Bagehot wrote was *unsterilized*; that is, it represented net increases in the liabilities of the Bank of England. Bagehot's advice was essentially to increase the supply of central bank money when the demand for it rises in a crisis. "Lend freely at a penalty rate" meant to supply reserves elastically to prevent interest rates from spiking above the penalty rate in a crisis.¹¹ In short, Bagehot's dictum was about the *size* of the central bank's balance sheet, not the *composition* of its asset holdings. The credit risk thereby taken on by the central bank was a *byproduct* of the lending required to expand the supply of reserves, not the *objective*. (Incidentally, interest rate spikes were a common feature of many U.S. financial panics in the late 19th century, to which the formation of the Federal Reserve in 1913 was in part a response. Unsterilized discount window lending was the method by which the founders envisioned the Fed would conduct monetary policy and prevent panics.)

There are economic models in which central bank credit policy is capable of ameliorating or even preventing non-fundamental runs when they can occur. By lending when other market participants are unwilling to lend, the central bank can provide the intermediary with resources to forestall costly closure or liquidation of assets. As I argued earlier, however, instances of run-like behavior since last summer appear to be attributable to real fundamental causes, as do the broader financial market stresses. As the likely severity of the slow-down in housing markets and the associated decline in home prices became apparent, it also became clear that the securities backed by mortgages originated in 2006 and early 2007 were going to perform significantly worse than had been anticipated. This realization affected any institution or instrument with mortgage-related exposures. When the resulting flight from asset-backed commercial paper caused exposures to come back on to the balance sheets of banks that had sponsored such programs, uncertainty about some banks' exposures raised their funding costs, most notably in the term interbank market, as evidenced by widening LIBOR spreads. Prices of mortgage-backed securities were depressed by the heightened uncertainty about returns, and also by the likelihood that low returns would be correlated with adverse economic outcomes. This uncertainty impeded the use of such securities as collateral for short-term financing. Investment banks that were prominently involved in mortgage-related securities activities were particularly affected.

The ideal central bank lending policy would require making clear distinctions between different possible sources of bank or financial distress. If an episode of financial disruption is a true liquidity crisis, like a non-fundamental run on the banking system, then aggressive central bank lending can, in theory, stem the crisis and prevent unnecessary insolvencies that impose real losses on the economy. Lending when in fact the financial sector is just coping with deteriorating fundamentals, however, distorts economic allocations by artificially supporting the prices of some assets and the liabilities of some market participants. Moreover, it is likely to affect the perceptions of market participants regarding future intervention, and thus alter their incentives and future choices.

Moral hazard

Moral hazard is the central problem that the financial safety net necessarily brings with it. And this problem exists even if central bank lending ensures that the resolution of a problem institution leaves its shareholders with nothing. Market discipline on risk-taking by financial firms comes more from the cost of debt finance than from equity holders (given the limited liability nature of equity). So it is the potential consequences of central bank lending for creditors that raises moral hazard concerns by reducing the cost of debt and potentially leading to greater leverage than would otherwise be chosen.

People often think of the moral hazard problem associated with a financial safety net as a “due diligence” problem. That is, investors in protected securities or lenders to protected institutions feel less of a need to assess and monitor the creditworthiness of their counterparties. This is a valid concern, but I think it construes moral hazard too narrowly in this setting. My discussion of the choice of leverage points to broader implications of central bank lending for the contractual structure of financial arrangements, not just on the monitoring of investment portfolios. In particular, the expectation of safety net support can weaken the incentive of counterparties to build provisions in to their financial contracts that reduce their susceptibility to (non-fundamental) runs. More broadly, an intermediary with access to the financial safety net has less incentive to manage their liquidity in a way that suitably minimizes the possibility of disorderly resolution of solvency problems.

Recent work by one of our Richmond Fed economists makes this point very clearly, using the standard model of banking theory.¹² He and his New York Fed coauthor consider a setting in which if there is certainty that no government (or central bank) assistance will be forthcoming, then the banking contracts developed will include provisions that allow for suspensions of payment and these will prevent non-fundamental runs from occurring. On the other hand, if such central bank assistance is possible and a non-fundamental run actually does start, the government will choose to intervene in order to alleviate the *ex post* inefficiency associated with a run. But, knowing that this intervention is forthcoming, banks do not self-protect, and thus leave themselves more susceptible to runs. So peoples’ expectations regarding central bank policy choices in times of stress can affect the very robustness of the system.

This strikes me as a deeper form of moral hazard than what people usually have in mind. In times of financial crisis, the understandable central bank imperative is to alleviate the stress. But the expectations such actions engender could very well make future crises more likely. The classic time consistency problem is as relevant to central bank credit policy as it is to monetary policy.

Supervisory authority

The economics of central bank lending closely parallel the economics of private line of credit lending.¹³ Both provide funding on very short notice to entities that need liquidity. Both create moral hazard because they can shift potential losses from short-term to long-term claimants. To contain moral hazard, private line of credit agreements employ an array of contractual provisions, such as giving the lender the right to monitor the borrower and rescind the commitment if specified loan covenants are no longer satisfied. The contracting parties presumably calibrate loan covenants in a way that balances the costs of intrusiveness against the benefits of improved incentive alignment.

In the case of central bank lending, the same purpose can be served by government supervision and regulation of the institutions that are eligible to borrow from the central bank. Clearly, the extent of supervisory oversight should be at least commensurate with the extent of access to central bank credit in order to appropriately contain moral hazard. The dramatic recent expansion in Federal Reserve lending raises the possibility that market participants view future access to Fed credit as having been substantially broadened. For evidence, market participants could point to the fact that entities formerly viewed as unlikely to have access to the discount window, such as the primary dealer subsidiaries of investment banks, have now been granted access.

Actions and statement in the period ahead are likely to shape the evolution of market participants' perceptions about the extent of the safety net. And these perceptions will shape their choices about contractual arrangements and exposure to risk. In my view, there is value in communicating policy intentions clearly. Deliberate imprecision – the so-called “constructive ambiguity” approach – leaves it to market participants to draw inferences for future policy from our past actions. Without an articulated statement of intention regarding lending policy, the time consistency problem is likely to be a difficult challenge because it will be hard to resist the future temptation to mitigate financial market stresses when they arise.¹⁴

In establishing new boundaries of central bank lending and adjusting the supervisory regime accordingly, a number of considerations are relevant. More expansive boundaries could conceivably prevent more avoidable liquidation costs in the case of non-fundamental runs, but in the case of fundamental runs more distortions would result. In addition, supervision itself is a costly endeavor, both in direct resource use and in the fallout effects on economic allocations. More broadly, expansion of the government financial safety net could substantively alter the balance between financial entities that are closely regulated and those that are regulated primarily by market discipline.¹⁵

The crucial constraint, however, is that the articulated policy be time consistent – that is, a commitment not to lend beyond the new policy boundaries should be credible. Financial market participants are likely to retain some doubt about the exact limits of the safety net; after all, the previous, smaller version of the safety net had fairly well-articulated limits. The danger is that the effect of recent credit extension on the incentives of financial market participants might induce greater risk taking, which in turn could give

rise to more frequent crises, in which case it might be difficult to resist further expanding the scope of central bank lending.

My former colleague Marvin Goodfriend and I wrote about this problem 10 years ago.¹⁶ We drew the parallel to the building of monetary policy credibility after the inflationary experience of the 1970s. We noted that central banks, the Fed included, made many statements about their desire to see inflation come down during the 1970s, but it was not until strong and costly actions were taken, with broad (though not universal) public understanding and support, that inflation was broken in the 1980s. If actions speak louder than words in the case of central bank credit policy as well, then the only credible way to limit expectations of future lending is to “incur the risk of short-run disruptions in financial markets by disappointing expectations and by not lending as freely as before.”¹⁷

Conclusion

To summarize my brief review of the economics of financial stability; there are models in which runs are self-fulfilling prophecies, are costly, and could be avoided, perhaps through central bank intervention. Other runs arise from fundamental developments, and for these, central bank intervention interferes with market discipline and distorts market prices. My reading of recent financial market events suggests to me that fundamentals have been at work – given the large shortfall in mortgage returns confronting the financial sector, the resulting strains should not be surprising. But it is almost always impossible to know precisely how much of a market disruption is justified by any observed shift in fundamentals, so determining whether a run is fundamental or self-fulfilling is very difficult. With either type of run, though, central bank support can weaken the incentive of financial intermediaries to structure their contractual arrangements to protect against run-like behavior. In the short-term, governments and central banks may be able to alleviate financial market strains, but such intervention may affect financial intermediaries’ choices in a way that makes instances of financial distress more likely. So policymakers face an excruciating dilemma when the potential and more immediate cost of inaction appears greater than the longer term costs of lending aggressively.

Much has been written in recent years about what role central banks play in assuring financial stability. This is understandable, and appropriate. Certainly, a central bank's macroeconomic policy can have a large impact on the stability of financial markets, through the control of inflation and inflation expectations. This is perhaps the greatest contribution central banks can make to the overall performance of financial markets. Beyond that, the central bank's historical role as a lender of last resort places it squarely in the center of financial disruptions as they unfold. We are perhaps not as close to a consensus on the proper conduct of this role as we are with regard to price stability. But as we continue to learn about the causes and nature of financial instability, I believe we should strive for policy that is informed by the lessons learned in the achievement of price stability. Chief among those is that a central bank can achieve better outcomes if it

can establish credibility for a pattern of behavior consistent with achieving its long-term goals.

¹ I am grateful to John Weinberg and Huberto Ennis for help in preparing this speech.

² Douglas Diamond and Phillip Dybvig, "Bank Runs, Deposit Insurance and Liquidity," *Journal of Political Economy*, 91/3 (June 1983), 401-419.

³ Charles W. Calomiris and Joseph R. Mason, *The American Economic Review*, Vol. 87, No. 5, 863-883, 1997.

⁴ Charles W. Calomiris and Gary Gorton, "The Origins of Banking Panics: Models, Facts, and Bank Regulation," in *Financial Markets and Financial Crises*, R.G. Hubbard, ed. Chicago: University of Chicago Press, 1991.

⁵ They could also simply merge with another banking institution.

⁶ Neil Wallace, "A Banking Model in which Partial Suspension is Best," *Quarterly Review*, Federal Reserve Bank of Minneapolis, Fall, 11-23, 1990.

⁷ One exception to this presumption is the case of externalities – actions that affect others that are not parties to the agreement. But in financial markets, it is hard to see how anyone would be affected except by virtue of having made a voluntary decision.

⁸ Walter Bagehot, *Lombard Street*. London: Harry S. King and Co., 1873.

⁹ Marvin Goodfriend and Robert G. King, "Financial Deregulation, Monetary Policy and Central Banking," *Federal Reserve Bank of Richmond Economic Quarterly*, May/June, 3-22, 1988.

¹⁰ Typical Federal Reserve Bank discount window lending before the recent turmoil occurred late in the day, and was generally unsterilized. These interventions can be viewed as responding to unanticipated end-of-day increases in the banking system's net demand for reserve balances.

¹¹ Goodfriend and King, p. 15.

¹² Huberto Ennis and Todd Keister, "Bank Runs and Institutions: The Perils of Intervention," Revised version of Federal Reserve Bank of Richmond Working Paper No. 07-02, April 2008.

¹³ See Marvin Goodfriend and Jeffrey M. Lacker, "Limited Commitment and Central Bank Lending," *Federal Reserve Bank of Richmond Economic Quarterly* 85 (4), 1-28, 1999; Goodfriend and King.

¹⁴ Goodfriend and Lacker, pp. 20-1.

¹⁵ Jeffrey M. Lacker, "How Should Regulators Respond to Financial Innovation?" Speech to the Philadelphia Fed Policy Forum, Philadelphia, Pa., December 2006.

¹⁶ Goodfriend and Lacker.

¹⁷ Goodfriend and Lacker, p. 23.