The Role of Central Banks in Credit Markets
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By now I'm sure the events of this past summer are very familiar to most financial market professionals.[1] Since these events form the backdrop for my discussion of the central bank's role in credit markets, I will begin with a quick review. As the housing downturn that began early in 2006 deepened, delinquencies, defaults, and loss rates rose on high-risk mortgages, particularly more recent vintages. In response to unfolding events – including rating agency downgrades and losses and insolvencies at various intermediaries – participants in markets for instruments with mortgage debt exposure revised downward their assessments of the likely future returns on the underlying assets. At times investors had difficulty discerning the magnitude of their counterparty's vulnerability and thus distinguishing among various instruments. This became particularly acute in early August following a suspension of fund redemptions by a large European intermediary, and for several days thereafter many markets were roiled as investors appeared to pull back from a broad range of asset classes.

As market participants sorted out the implications of these developments, concerns centered on the segment of the asset-backed commercial paper market with exposure to high-risk mortgage debt. Revised risk assessments gave rise to large portfolio shifts among money market mutual funds and Treasury bill markets, and significantly reduced many investors' willingness to pay for mortgage-backed securities and related asset-backed commercial paper. Many ABCP issuers were unable to refinance their positions on terms as advantageous as before. As a result, many banks that sponsored or provided back-up support to commercial paper conduits have faced large potential funding draws and the possibility of substantial hits if poorly performing assets come onto their balance sheets. Revised risk reassessments also affected markets for other structured finance products.

The substantial shift in some banks' funding outlooks has had tactical implications for their participation in the interbank money market and has led to increased rate volatility and heightened term lending spreads. In response, the Fed has acted to help ensure the smooth operation of the federal funds market. On August 10, a day of notable volatility, the New York Fed's open market desk engaged in larger than usual operations, intervening on multiple occasions and adding $38 billion that day, the largest amount since the days following September 11, 2001. Unusually high volatility in the federal funds market persisted, however, which complicated the desk's operations in the days thereafter. On August 17, the Fed reduced the discount rate, the rate on our collateralized loans to banks, cutting the spread between the lending rate and the federal funds target

rate in half from its typical 100 basis points. We usually look to the discount rate to provide a cap on the cost of overnight funds for sound institutions, so reducing the cap helped limit funds rate volatility. In addition, the Fed's August 17 action provided for term lending (up to 30 days) through the discount window, motivated by the elevated level of term premiums.

At times of market tumult, people look to the central bank to assure financial stability. But sometimes there is uncertainty about what actions, if any, the central bank can or will take in response to market events, and there are legitimate differences of opinion about the appropriateness of alternative responses. While several central banks were visibly adding unusual quantities of reserves this summer, the Bank of England stood out in its resistance to taking drastic actions in providing extraordinary credit to banks experiencing difficulties. Even there, however, the central bank did act when a large mortgage lender, Northern Rock, experienced a run by its depositors.

Using this summer's events as a test case, I'd like to discuss the role of the central bank in credit markets. In doing so, I'll suggest that central banks face a fundamental dilemma. The provision of central bank credit, for instance through the discount window, is typically understood as one of the means by which a central bank provides the financial system with *liquidity*, in this case meaning central bank account balances. One rationale for central bank credit provision is the notion that, absent sufficient liquidity, financial assets may trade at prices below their fundamental values. The dilemma is that when we see assets trading at prices that seem below normal, or when we see the volume of trading activity fall below what we think of as normal levels, we can almost never be sure whether these shortfalls reflect a shortage of liquidity or simply a re-evaluation of fundamental values by market participants. And these two different interpretations have very different implications for the appropriateness of central bank actions.

As I examine this dilemma, I'll take what might seem like a detour by talking about this year's Nobel Prize in economics, which was awarded to Leo Hurwicz, Eric Maskin, and Roger Meyerson for contributions to something called "mechanism design theory."[2] Given the way the press covered the award, this might seem like an abstruse subject, at best remotely connected to my main topic for today. But they are quite intimately connected because this field of economics really supplies the best tools we have for thinking coherently about financial institutions, financial innovation, and the incentives created by the complex and ever-changing array of financial contracts available to investors, businesses, and consumers. In fact, mechanism design is the theoretical foundation of the work of credit risk specialists like yourselves as you analyze the features of modern credit-related contracts. You might say that mechanism design is where one would find the tools to build a formal theory of what you actually do.

At its core, mechanism design is about determining what kind of contractual arrangements will work best in the situations that market participants might find themselves in. While these tools may not always provide definitive answers to important questions, they do provide a way of thinking systematically about the right questions. As I'll discuss, this seemingly arcane body of knowledge has important implications for how

to think about the dilemmas associated with the role of the central bank in credit markets, particularly during periods of market turmoil. This is when central banks are forced to make judgments about what impediments, if any, are interfering with the normal operation of credit market mechanisms, and how policy actions might or might not be capable of overcoming those impediments.

Financial Markets, Intermediaries and Innovation

Financial markets, instruments, and institutions play an essential role in the allocation of resources in a modern economy. By channeling funds from ultimate savers to ultimate borrowers, they facilitate the movement of resources to their highest-valued uses – from households and firms with relatively low demand for current resources (consumption or investment today) to households and firms whose present needs and wants are more pressing. At the same time, the financial system allocates the ultimate returns on those investments among the savers who contributed to them. Some savers may seek safe returns, while others may tolerate more risk. Hence, the allocation of returns serves to allocate the risks associated with investing resources.

The simple textbook model of the funds-channeling function envisions a supply curve representing the availability of funds from savers at different interest rates, and a demand curve representing people's willingness to borrow. The market-clearing interest rate is the one that equates the two. But this description assumes that financing flows directly from those firms and households that are savers to those that are borrowers. While this might be a reasonable abstraction for some types of financial transactions – such as the issuance of corporate bonds or equities – for others (and even for corporate obligations), the allocation of financial resources is facilitated by one or more types of intermediaries. The simple textbook approach is poorly equipped to handle questions about the structure of intermediaries or the source of their comparative advantage.

We usually think of intermediaries as solving problems associated with limited information – savers may have neither the ability nor the inclination to make granular distinctions regarding the credit risk associated with the widely varying borrowers seeking funds. So they place their funds with intermediaries – banks or investment funds – to whom they essentially delegate the responsibility for evaluating and monitoring borrowers. In this way, financial market intermediaries exist because they can improve upon the allocation of resources among savers and borrowers that can be achieved using a direct investment market alone. The harder it is for savers to get direct, reliable information about borrowers, the greater the role intermediaries will play in the financial system.

Mechanism design theory provides an approach for addressing precisely these questions about how institutions arise and adapt in response to incentive and information problems. This approach then allows us to study and compare the diverse institutions that exist in an economy and play a role in the allocation of resources – markets, firms, banks, clearing houses, and even central banks and governments. More precisely, these contractual and

institutional arrangements all constitute alternative *mechanisms* for allocating resources, and the approach is to study the properties of the best possible resource allocations that *any* mechanism is capable of achieving. For example, how well does it do at funding appropriate investments and allocating the attendant risk? One can then compare how close alternative mechanisms come to achieving those allocations. If one set of arrangements can achieve superior allocations, but others cannot, then one has a candidate explanation for why such an intermediary might exist.

Any set of institutional or contractual arrangements – any *mechanism* – will naturally be constrained by the initial availability of resources and technologies, but they also will be constrained by the degree to which information is limited and dispersed. For example, if you want to allocate credit to the highest quality borrowers, you need a way of determining who the highest quality borrowers are. If you want to share with a broad set of investors the risks associated with lending to a large pool of mortgage borrowers, someone needs to be able to keep track of the performance of the actual loans, and investors need to trust that that task will be performed effectively and honestly. These are examples of limited information in resource allocation problems.

Classical economics was based largely on the notion that markets were a particularly effective institution for efficiently allocating resources, and especially adept at aggregating the diverse information held by large numbers of widely dispersed market participants. An earlier Nobel laureate – George Ackerlof – described a specific informational problem that can hamper a market's effectiveness. He labeled this the "Lemons Problem," and it occurs when a good can come in varying qualities, and when sellers, but not buyers, can distinguish high from low quality prior to a transaction occurring.[3] Buyers of used cars can't easily distinguish good from bad, so higher quality cannot easily command a higher price and would-be sellers of higher quality cars keep their cars off the market. This is a specific example of a general phenomenon known as "adverse selection," which also applies to the credit market problem of figuring out who are the best borrowers. Other types of informational problems that can be relevant in the allocation of credit include "moral hazard" – the problem that a lender cannot always monitor or precisely prescribe the actions to be taken by a borrower – as well as the general problem that a borrower may be in a position to misrepresent the outcome of his use of funds.[4]

The constraints imposed on achievable outcomes by informational asymmetries should be common sense to this audience. An array of commonly observed contractual features appear aimed at limiting a debtor's moral hazard – for example, material adverse change clauses and other debt covenants limit the distortion to risk-taking incentives. More broadly, mechanism design supports our traditional understanding of banks as specialists in the information-intensive aspects of finance. The modern version of that understanding is that bank-like intermediaries are an efficient mechanism for the organization of credit markets in the face of adverse selection or other informational frictions. A number of advances in the economics of financial intermediation have taken this approach.[5]

It's important to realize that real-world financial institutions are much more complex than in the typical model studied by mechanism design. So this theory is not yet ready to give us precise answers about how to design institutions in practical applications. But as a set of theoretical tools it helps us to understand, in a careful and internally consistent way, how the institutional arrangements we actually observe arise as adaptive responses to important characteristics of real-world resource allocation problems.

Thinking about financial markets and institutions in terms of mechanism design also can help us understand the process of financial innovation. I have spoken elsewhere, as have many other observers, about the wave of innovation in financial instruments and practices that swept through the economy in recent decades.[6] Improvements in communications and computing technology lowered the cost of transmitting and analyzing information, and appeared to reduce informational constraints and expand the set of attainable outcomes. Achieving improved allocations required new economic mechanisms – new types of financial instruments and new types of financial institutions.

But finding the arrangements that reaped the benefits of the expanded opportunities made possible by new technologies required some experimentation in economic mechanisms. The realization of opportunities for improvement is rarely certain, because the use of mechanism design in actual financial market practice sometimes does not proceed as neatly as it might on the theorist's whiteboard. In order to know whether a new contractual form or institutional arrangement represents an improvement, it must be tried. Its success or failure provides information that will inform future efforts at innovation.

The Credit Market Tumult of the Summer of 2007

The story of how we got to where we found ourselves this summer – circumstances that induced the Federal Reserve to alter credit terms at the discount window – is a story about financial innovation, a story of experimentation in economic mechanisms. Application of information technology to the gathering and analysis of data on borrowers' financial histories resulted in finer assessments of credit risk and expanded access to home mortgage credit for borrowers with riskier credit profiles. The improved assessment of credit risk, along with other advances in information technology, also facilitated the broad development of markets in which individual loans are pooled and securitized, thus allowing these pooled exposures to be priced in active capital markets.

The decisions of participants in these innovative financial arrangements – including borrowers, originators, securitizers, funding providers, rating agencies, and of course investors – all embodied implicit judgments regarding the likelihood of success. As housing markets slowed beginning in early 2006, delinquencies and defaults on subprime and some nontraditional mortgages rose more rapidly than had been anticipated. With hindsight those original expectations appear to have been disappointed along several dimensions. Home price decelerations and downturns across a number of regions meant that many borrowers with little or no home equity at purchase would have an incentive to skip payments in the event of financial stress. And anecdotal reports suggest that the

ability of loan originators to contain the incentive of borrowers or mortgage brokers to falsify documentation on so-called “no-doc” or “low-doc” loans was overestimated.

The bottom line, then, was that aggregate conditions in the housing market had led to greater than anticipated losses on many of the new mortgage products. This meant inevitably that at least some of the securities derived from these products would underperform as well. But the complexity of the securitization process, as well as the process by which securities were re-intermediated in commercial paper programs or collateralized debt obligations, made it hard to sort out where that underperformance would surface. This opacity appeared to create a general distrust – a lemons problem – which often depressed trading activity in markets for mortgage-related instruments. This problem was particularly acute at times, such as in mid-August, when risks were being reassessed fairly rapidly.

Although the complex web of contractual financing arrangements in mortgage finance are somewhat beyond our ability to model formally, mechanism design theory does provide useful perspectives. For example, the strain experienced by many financial institutions suggests that one of the lessons from this recent experiment in applied mechanism design is that a mechanism that we expect to work well in normal circumstances may disappoint if the unexpected happens.

The Role of the Central Bank in Credit Markets: Regulating Credit

There are two related, but distinct roles that the Federal Reserve has to play in relation to credit market mechanisms. First, the Fed is a regulator with supervisory authority over significant parts of the financial system. A financial regulator has a fine line to walk regarding innovation and experimentation of the type recently seen in credit markets. We usually think of innovation and experimentation as being good things, and I believe this is true in financial markets as well. But the existence of the financial safety net for depository institutions does mean that there may be some contingencies to which private market participants pay less than optimal attention. Experimentation is a form of risk taking after all. And like any risk-taking activity, there is a legitimate supervisory interest in assessing the prudence with which institutions undertake innovative activities or products.

What makes striking this balance difficult is that, by its nature, assessing the risks associated with an innovative activity does not lend itself as neatly to quantitative risk measurement tools. Quantitative risk assessment requires data from reasonably comparable circumstances, which is often lacking when we are talking about a new activity or product. For example, there was no obvious historical parallel to the scale of subprime lending in recent years – certainly not over an entire cycle of expansion and contraction in housing market activity. Rather than resisting financial innovation wholesale, supervisors should look at this kind of activity in the broader context of an institution’s systems and processes for evaluating risks and making decisions, as well as the institution’s capital position.

Prudential regulatory regimes can exert an independent influence on the direction and character of financial innovation. Indeed, at times financial innovations appear to derive a portion of their benefits from their ability to bypass regulatory constraints and capital levies on the activities of covered intermediaries. This does not mean that such innovations are necessarily undesirable, but it does imply that supervisors need to assess the extent to which a particular innovation expands the set of allocations the financial system is capable of delivering, and should scrutinize such innovations to try to ensure consistent and uniform treatment of economically equivalent arrangements.[7]

The Role of the Central Bank in Credit Markets: Extending Credit

Beyond its role as a regulator, the Fed, like other central banks, also has the role of lender of last resort. Through their discount windows, the Federal Reserve Banks offer collateralized loans to qualified depository institutions. The traditional view of a central bank's role as a lender of last resort dates back 200 years to the English economist Henry Thornton. Later in the 19th century, his ideas were elaborated upon by Walter Bagehot, and it is from Bagehot that most modern thinking on the topic derives.[8] The prescription stemming from this tradition can be stated simply – in times of financial stress, the central bank should lend freely at a penalty rate, on good collateral, to sound institutions. Current Federal Reserve policy conforms well to classical lender of last resort doctrine; the discount rate is set at a fixed spread above the target federal funds rate, and solvent depository institutions are free to borrow up to the amount of the collateral they have pledged. Collateral haircuts are applied to provide cushion against loss, and to avoid distorting markets for the underlying collateral.

This traditional view of central bank lending aims for a balance between potential costs and benefits. The benefits stem from the central bank's ability to provide liquidity to financial markets. Without an adequate supply of reserves, financial markets might not function effectively, resulting in increased costs of credit and reduced economic activity. But in this regard, it is important to remember that 19th century observers wrote at a time when lending really was the only way the central bank provided liquidity. Indeed, when the Fed was founded in 1913, discount window lending was envisioned as the primary means of providing reserves to the banking system. Today, the Fed's primary means of supplying reserves is through open-market operations, which is how the federal funds rate is kept at the target rate. In fact the effect of discount window loans on the overall supply of liquidity is automatically offset, or "sterilized," to avoid pushing the federal funds rate below the target. So it is important to distinguish carefully a central bank's *monetary policy* function of regulating the total supply of reserves from central bank *credit policy*, which reallocates reserves among banks.[9]

There can be situations in which impediments prevent the market from effectively redistributing reserves among banks. In such situations, central bank lending can be useful because it can provide liquidity to specific institutions that would otherwise be unable to obtain it directly from other banks. A prime example is the period just after the

terrorist attacks of September 11, 2001, when operational problems constrained interbank funds transfers.[10]

The potential cost of central bank lending is that it can distort private credit markets. This cost can apply in both the short run and the long run. The potential long run cost is the familiar problem of moral hazard. That is, central bank lending, to the extent that it lessens the pain felt by institutions in a particular event, could reasonably create an expectation that similar relief would be forthcoming in similar events in the future. Such an expectation can affect the exposures that market participants are willing to take on in the future. This potential for a long run cost in the form of incentive distortions exists even if the central bank's action is beneficial on net in the short run.

Even in the short run, central bank lending can interact with private credit evaluation in a potentially costly way. A central bank that is willing to lend against a particular type of collateral on terms more favorable than are available in the market could raise the market value of that collateral above what it otherwise would be. Whether this effect is desirable depends on whether the market's price is "right." By right price, when talking about asset prices, we usually mean in line with fundamentals – that is, with an unbiased assessment of the risks and expected returns available from holding an asset.

To take a concrete example, this summer we saw a dramatic decline in the trading of mortgage-related assets, particularly those tied to subprime or other nontraditional mortgages. Market participants seeking to sell or borrow against such assets could do so only at steep discounts. One possible interpretation of these events is that the market for these assets was suffering from a loss of "liquidity" – the market froze up, and in effect, nobody was trading because nobody else was trading. Under this view, what trades did occur took place below the "fundamental value" of the assets. This view implies a potentially beneficial role for a credit policy intervention, in the form of central bank lending to help relax constraints on liquidity supply and allow prices to move toward fundamental values.[11]

An alternative interpretation of depressed asset prices is that the fundamentals had changed. Realizations of growing losses on the underlying class of mortgages caused the true economic value of these assets to fall. In this view, overall market liquidity was adequate, as evidenced by the significant amount of funds that had been shifted *out* of mortgage-related assets and in principle were available to reinvest at appropriate prices. In other words, prices weren't distorted by a lack of funds in the hands of informed investors. Under this view, central bank lending against the assets at above-market terms would risk undermining the private market's risk assessments.

This highlights the dilemma that I mentioned at the beginning of my remarks, namely, the difficulty of discerning in a meaningful way whether assets are trading below their "fundamental" values. The usual presumption in normal times is that an asset's market price is the best available estimate of its fundamental value, a presumption that flows from a robust understanding about the functioning of market mechanisms. In contrast, the notion of assets trading below fundamental values is based on alternative models in

which some impediments distort traded asset prices. Whether central bank lending would relax those constraints appears to depend delicately on the particular model in hand.

This illustrates a fundamental question, motivated by the insights of mechanism design, which is useful to keep in mind when contemplating central bank credit policy: *In what way would central bank lending improve the set of attainable resource allocations in financial markets*? For example, is the central bank any better than private market participants at distinguishing between good and bad assets? Is the central bank better able to discern the fundamental value of an asset?

It is possible that a central bank with a substantial supervisory role could have an informational advantage over market participants, but in many cases any such advantage is likely to be small, I think. The task of differentiating among mortgage-backed securities for example, would seem to require looking closely at the characteristics of the underlying mortgages. That's a costly process, and I'm not sure it would be any less costly for the Fed than for a private counterparty.

This discussion points back to my foray into mechanism design theory. Understanding the role of the central bank in credit market mechanisms starts with an understanding of just what it is that a central bank can do that other participants cannot. The central bank can increase the amount of reserves held by the banking system or by particular banks. One of the ways it can do this is by extending credit at terms at which private counterparties will not. Ultimately, the evaluation of a Fed action depends on why it is that lending from private counterparties was only available at less attractive terms. Was it a shortage of liquidity, or was it a change in fundamental valuations? This is a hard judgment to make in the crush of events and answers may only become apparent long after the fact. But this ambiguity is what makes the prudent, traditional prescription for central bank lending – lend freely at a penalty rate, on good collateral, to sound institutions – an attractive dictum. By standing ready to lend, and fixing a rate above the normal market rate, the central bank can limit the impact of market disruptions while also limiting its own need to make credit judgments. In effect, the central bank offers a line of credit to banking institutions. Just as the private provider of a line of credit imposes conditions and constraints on its customers, so should the central bank seek to provide such a credit facility in a way that avoids interference with private market risk assessments.[12]

As I said, it may be some time before we have a full understanding of this summer's events. But my reading of the evidence is that the episode was less about liquidity than it was simply about a dramatic change in the valuation of a class of credit exposures. Even with the Fed's reduction in the spread between its federal funds target and its primary credit discount window rates, and its encouragement to banks to come to the window, the amount of borrowing did not rise very much. So I think there's a good chance that, when all is said and done, we will be able to say that the Fed did the right thing. We stood ready to lend – on good collateral at a penalty rate – but did not interfere with the market's assessment of risks.

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[1] I am grateful for help from John Weinberg in preparing this speech.

[2] Prize Committee of the Royal Swedish Academy of Sciences, "Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel: Mechanism Design Theory," October, 2007, http://nobelprize.org/nobel_prizes/economics/laureates/2007/ecoadv07.pdf

[3] Akerlof, George, "The Market for Lemons: Quality Uncertainty and the Market Mechanism," Quarterly Journal of Economics, 84/3 (August, 1970), 488-500.

[4]Standard examples include Holstrom, Bengt, "Moral Hazard and Observability," Bell Journal of Economics, 10/1 (Spring 1979), 74-91; and Townsend, Robert, "Optimal Contracts and Competitive Markets with Costly State Verification," Journal of Economic Theory, 21/2 (October 1979), 265-93.

[5] Townsend, Robert, "Intermediation with Costly Bilateral Exchange," Review of Economic Studies, 45/3 (October 1978), 417-25; Boyd, John and Edward C. Prescott, "Financial Intermediary Coalitions," Journal of Economic Theory, 38/2 (April 1986), 211-32; Diamond, Douglas, "Financial Intermediation and Delegated Monitoring," Review of Economic Studies, 51/3 (July 1984), 393-414; and Diamond, Douglas and Phillip Dybvig, "Bank Runs, Deposit Insurance and Liquidity," Journal of Political Economy, 91/3 (June 1983), 401-419.

[6] Lacker, Jeffrey M., "The Evolution of Consumer Finance," Speech to the Conference of State Bank Supervisors, Norfolk, VA, May 18, 2007; "How Should Regulators Respond to Financial Innovation?" Speech at the Philadelphia Federal Reserve Policy Forum, Philadelphia, PA, December 1, 2006; and "Economic Outlook," Speech to the Charlotte Risk Management Association, Charlotte, NC, August 21, 2007.

[7] See, for example, "Stored Value Cards: Costly Private Substitutes for Government Money," Federal Reserve Bank of Richmond Economic Quarterly. 82/3 (Summer 1996), 1-25...

[8] Thornton, Henry. An Enquiry into the Nature and Effects of the Paper Credit in Great Britain. Augustus M. Kelley: Fairfield, NJ, 1991 (1802); Bagehot, Walter. Lombard Street. John Wiley & Sons: New York, 1999 (1873); Humphrey, Thomas and Robert Keleher. "Lender of Last Resort: A Historical Perspective." Cato Journal 4/1 (Summer 1984), 275-321.

[9] See Goodfriend, Marvin and Robert King, "Financial Deregulation, Monetary Policy, and Central Banking," Federal Reserve Bank of Richmond Economic Review, 74/3 (May/June 1988), 3-22.

[10] Lacker, Jeffrey M., "Payment System Disruptions and the Federal Reserve Following September 11, 2001," Journal of Monetary Economics, 51/5 (July 2004), 935-965.

[11]For a discussion of such a view, see chapter 9 in Allen, Franklin and Douglas Gale, Understanding Financial Crises, Oxford University Press, Oxford, 2007.

[12] Goodfriend, Marvin and Jeffrey M. Lacker, "Limited Commitment and Central Bank Lending," Federal Reserve Bank of Richmond Economic Quarterly, 85/4 (Fall 1999), 1-27.