

FINANCIAL DEREGULATION, MONETARY POLICY, AND CENTRAL BANKING

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EDITOR'S NOTE: *Among their other activities, members of the Federal Reserve Bank of Richmond's research department engage in exploratory research on broader issues of interest to the Bank and the Federal Reserve System. The results of such research are published in the Economic Review from time to time in order to stimulate discussion and debate. This article summarizes the results of such research. It must be emphasized strongly that the views do not represent in any way an official position of the Federal Reserve Bank of Richmond or the Federal Reserve System.*

INTRODUCTION

Financial deregulation is widely understood to have important economic benefits for microeconomic reasons. Since Adam Smith, economists have provided arguments and evidence that unfettered private markets yield outcomes that are superior to public sector alternatives. But financial regulations—specific rules and overall structures—are sometimes justified on macroeconomic grounds. This paper analyzes the need for financial regulations in the implementation of central bank policy. Dividing the actions of the Federal Reserve into monetary and banking policy, we find that financial regulations cannot readily be rationalized on the basis of macroeconomic benefits.

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There is a consensus among professional economists that monetary policy can be executed without supporting financial regulations. This consensus reflects an understanding of the central role of open market operations. There is, of course, substantial disagreement among economists concerning the nature and magnitude of monetary policy's influence on the price level and real activity, but this should not mask the broad agreement on the central role of open market operations in the management of high-powered money. Nor should it obscure the general agreement that there is an important, unique role for the public sector in the management of money.

Banking policy, as we define it, involves regular lending and emergency financial assistance to individual banks and other institutions. Many aspects of Fed lending resemble credit market relationships in the private sector. In particular, there is a useful analogy between private lines of credit and Fed discount window lending. Fed regulation and supervision support banking policy in much the same way as loan covenants and monitoring support private lending. The value of Fed regulation and supervision, then, depends on the need for banking policy. The Federal Reserve is only one of many competing entities in the credit market, however, and any rationale for Fed intervention in this market must involve evidence of a relative advantage for the public sector or a market failure deriving from inappropriate private incentives. Moreover, banking policy may influence outcomes in banking and financial markets by subsidizing certain economic activities, prompting the erosion of private arrangements for liquidity and encouraging risktaking. On the basis of such considerations we conclude that it is difficult to make a case for central bank lending policy and the supporting public financial regulation.

The paper is organized as follows. Section 1 provides definitions of monetary and banking policy. In Section 2, we consider financial deregulation and monetary policy. We begin by considering monetary policy in a deregulated environment and illustrate how a prominent feature of Fed monetary policy, interest

rate smoothing, is undertaken in such an environment. We conclude by pointing out the irrelevance for monetary policy of a well-known financial regulation, reserve requirements, given the Fed's preference for an interest rate as its monetary policy instrument.

Section 3 discusses deregulation and banking policy. Again, we begin by considering a deregulated environment. We first describe the character of private borrowing and lending transactions, and then discuss the provision of line of credit services through the Fed discount window. We conclude by developing the distinction between illiquidity and insolvency as a means of judging the appropriateness of public line of credit services.

In Section 4, we discuss how monetary and banking policy could react to systemwide banking crises. We conclude that monetary policy can effectively and desirably limit crises arising from a widespread demand to convert deposits into currency. In this connection, we interpret Walter Bagehot's "lender of last resort" rule as an irregular interest rate smoothing policy. Banking policy in contrast can do little to influence such events. Banking policy may have other roles to play in dealing with systemwide disturbances, however, and we explore these at the end of the section.

1. MONETARY AND BANKING POLICY

Our investigation requires that we distinguish between central bank monetary policy and what we have referred to as banking policy. By monetary policy we mean changes in the total volume of high-powered money (currency plus bank reserves). Banking policy, in contrast, involves (1) changes in the composition of the asset side of the central bank's balance sheet, holding the total fixed, or (2) regulatory and supervisory actions of the central bank.¹ These latter actions might be described as commercial policies. In the United States, however, central bank commercial policies focus largely on the banking sector, so we term them banking policy.²

¹ One can easily imagine central bank actions that combine both monetary and banking policy. An increase in bank reserve requirements, coupled with an increase in high-powered money sufficient for banks to finance it, is one important example. The possibility of combination policies in no way diminishes the usefulness of our distinction.

² Hodgman (1976) is a good survey of commercial policies executed by foreign central banks. In the United States, commercial policies executed through the credit market are extensive. See, for example, Bennett and DiLorenzo (1983), *Government Credit Allocation: Where Do We Go From Here?* (1975), U.S.

When the Federal Reserve was established, its principal goals, according to the Federal Reserve Act, were "to furnish an elastic currency, to afford a means of rediscounting commercial paper, and to establish a more effective supervision of banking in the United States." These primary objectives involve a mix of monetary and banking policy. The provision of an elastic currency is a monetary policy of sorts, since it involves varying the stock of currency in response to economic conditions. The other two objectives fall into the category of banking policy. For example, by allowing its inventory of government securities to vary, a central bank can accommodate variations in discounting without any change in the stock of high-powered money.

2. DEREGULATION AND MONETARY POLICY

Monetary policy entails the control of high-powered money by the central bank to manage nominal variables like the price level, the inflation rate, and the nominal interest rate, and possibly to influence temporarily real variables such as employment and output. This section explains why financial regulations are not needed to conduct monetary policy effectively, although their effects must be taken into account where they exist. Section 2.1 provides an overview of the argument. Section 2.2 discusses interest rate smoothing, which is an important feature of monetary policy in the United States, and shows that such smoothing does not require regulations. Indeed, the practice of smoothing interest rates essentially eliminates the need for reserve requirements. Finally, Section 2.3 explains that, once in place, financial deregulation would have only minor effects on the use of monetary policy for purposes of broad macroeconomic stabilization.

2.1 Why Regulations Aren't Necessary

There is a consensus among mainstream economists that monetary policy can be conducted without supporting financial regulations, in spite of the fact that there is not a consensus on the efficacy of monetary policy or on desirable patterns of behavior for the monetary authority. In this context most

Congress, *Federal Credit Activities* (1984), and "The Federally Sponsored Credit Agencies," in Cook and Rowe (1986). Federal deposit insurance, farm credit programs, and pension guarantees also fall into this category. In contrast to these activities Federal Reserve banking policy emphasizes availability on very short notice, through line of credit services at the discount window and through daylight overdrafts and float extended in the payments system.

economists think of a deregulated environment as being one in which the central bank has a monopoly on the issue of high-powered money, but in which private markets are otherwise unregulated.

This view is based on the fact that currency and bank deposits are not perfect substitutes in making transactions. For example, when payments are executed through bank deposits, costs are incurred in determining that the payor has sufficient wealth to cover the transaction. Also, costs are incurred when securities are sold and purchased to complete the desired wealth transfer. Bankers specialize in providing these transaction services. In a deregulated, competitive system they have incentives to provide payment services at cost, and to pay interest on deposits that reflects the net return on their earning assets.

In contrast, when payments are executed with currency, costs are lower because the value of currency is more easily verified than the value of a check written against a deposit. Also, the privacy provided by currency is an advantage for some transactions, since currency doesn't leave a paper trail. There is presumably a substantial set of payments for which the cost saving and other benefits from using currency rather than deposits more than offsets the inconvenience and interest foregone.

The fact that deposits are imperfect substitutes for currency is important for two reasons. First, it implies that the public has a determinate real stock demand for currency (C/P), where C is the aggregate nominal stock of currency supplied by the central bank and P is the currency price of goods (the price level).³ It follows that controlling the nominal stock of currency (C) and its growth rate is sufficient to control the price level (P), the inflation rate, and the level of the nominal interest rate (expected inflation plus the ex ante real rate).⁴ This, in turn, implies that

³ A brief survey of money demand theory may be found in McCallum and Goodfriend (1987).

⁴ This argument is due to Patinkin (1961). It was later emphasized by Fama (1980, 1983).

Patinkin pointed out that a central bank must fix both a nominal interest rate and a nominal quantity to make the price level determinate. These conditions are met if a central bank pays no interest on currency and controls its aggregate nominal quantity. The price level is determined as follows. Because currency earns zero nominal interest, the opportunity cost of holding it is the nominal interest rate on securities. It is efficient for people to hold a real stock of currency for which the marginal service yield just equals the interest rate. For a diminishing marginal service yield on currency with a sufficiently high initial threshold, there is a determinate real stock demand for currency and a determinate price level for any given nominal interest rate on securities. The nominal interest rate on securities is the sum of expected inflation plus a real interest rate component. The

the banking system can be completely deregulated without interfering with the ability of a central bank to control nominal magnitudes via monetary policy. Open market operations are sufficient to accomplish monetary objectives.⁵ To illustrate that banking regulations are not essential for monetary policy, consider how a central bank prevents a temporary increase in the real demand for currency from decreasing the price level. It simply acquires securities temporarily in the open market, providing sufficient nominal currency to satisfy the higher real demand without a price level fall. Alternatively, suppose a central bank wants to restore a lower price level after an inflationary period. It does so by selling securities in the open market to reduce the stock of currency.

Regulations influence the magnitude and timing of open market operations necessary to achieve specific objectives because they affect both the supply and the demand for currency.⁶ For instance, reserve requirements on bank deposits absorb high-powered money made available through open market operations, thereby influencing the effective quantity of currency supplied. Alternatively, by affecting the incentive to substitute between currency and bank deposits, a prohibition of interest on demand deposits influences the magnitude of open market operations necessary to minimize price level effects of changes in market interest rates.⁷

2.2 Interest Rate Smoothing

In the preceding section we emphasized that open market operations are sufficient for a central bank to manage the price level, inflation, and nominal interest rates. In practice the Federal Reserve has employed monetary policy throughout its history to smooth nominal interest rates against routine seasonal and cyclical variations in the demand for money and

central bank can control inflation and thereby expected inflation by choosing a desired rate of currency growth. For example, it can choose zero currency growth and zero inflation, so that the nominal interest rate is simply the real rate, and the price level is constant.

⁵ This point was emphasized by Friedman (1960). Related discussions may be found in Fama (1980, 1983) and McCallum (1985).

⁶ See, for example, the textbooks of Barro (1986), Darby (1976), Dornbusch and Fischer (1984), Gordon (1987), Hall and Taylor (1985), and Sargent (1979, 1987). A notable exception is the view emphasized by Wallace (1983) and Sargent and Smith (1987). McCallum (1983), who emphasizes the medium-of-exchange services of money, and King and Plosser (1986), who emphasize verification costs, may be read as responses to the arguments of Wallace, Sargent, and Smith.

⁷ See Mehra (1986), for an analysis of how recent financial deregulation has influenced the demand for money.

credit. This section begins by describing briefly the effect the Fed has had on nominal rates. Next, we discuss the mechanism by which the Fed has managed them, pointing out among other things that interest rate smoothing may be interpreted as the means by which the Fed has satisfied its mandate to provide liquidity to the economy. We also note that reserve requirements have not played a substantive role under this procedure, although there are other procedures under which they could play a role. We thereby suggest reserve requirements as a candidate for additional deregulation.

2.2.1 Evidence

The purpose of this section is to describe briefly the extent to which the Federal Reserve has succeeded historically in changing the character of nominal interest rate movements. Consider one measure of the short-term interest rate, the monthly average call money rate on short-term broker loans in New York.⁸ Prior to the creation of the Federal Reserve in 1914, this rate rose suddenly and sharply from time to time. For example, in October of 1867, after remaining between 4.3 and 7.2 percent for the prior three years, the call money rate rose suddenly from 5.6 to 10.8 percent. Although this change seems large by post-war U.S. standards, similar episodes of at least this magnitude occurred 26 times during the period between the end of the Civil War and the establishment of the Fed. Moreover, sudden changes of over 10 percentage points occurred with surprising frequency, on 8 occasions during the same 49-year period. In September 1873, the call money rate jumped from 4.6 percent in August to 61.2 percent before falling back to 14.9 percent in October and 5.5 percent in January 1874. Accompanying these sudden upward jumps in call money rates were similar—though much less severe—movements in 60- to 90-day commercial paper rates. These episodes were distinctly temporary, ranging from one to four months, with many lasting for no more than one month. Needless to say, such extreme temporary spikes are absent from interest rate behavior since the creation of the Fed.

Another distinctive feature of the period before the Federal Reserve was the large seasonal movement in short-term interest rates. For example, the average seasonal variation of the call money rate from 1890 to 1908 ranged from a peak of +4.6 percent in January to a trough of -1.39 percent in June.⁹

⁸ This series is reported in Macaulay (1938).

⁹ These numbers come from Miron (1986). See Clark (1986) and Kemmerer (1910) for particularly useful related material.

Generally speaking, rates were at their annual mean in the spring, below it in summer, and above it in the fall and winter. By the 1920s the prominent interest rate seasonal had virtually disappeared.

2.2.2 Definition and Mechanics

As just discussed, broadly speaking the Federal Reserve may be said to have smoothed nominal interest rates in two senses. First, it insulated rates from regular seasonal movements in money and credit markets. Second, it removed temporary spikes that were prompted by recurrent irregular tightness in money and credit markets. For purposes of this discussion, we may define interest rate smoothing as a deliberate effort by the Fed to reduce or eliminate temporary nominal interest rate fluctuations.¹⁰ We shall find the distinction between regular and irregular interest rate smoothing useful when we characterize Bagehot's lender of last resort rule in Section 4.2 below.

There has been considerable controversy about whether central bank interest rate smoothing is feasible in principle when the public understands policy, i.e., when the public has rational expectations. We can see that it is possible by drawing on the simplest possible model.¹¹ The model has three basic equations: (1) a money demand function, (2) a money supply function, and (3) an expression equating the expected real return on nominal securities, i.e., the nominal interest rate minus expected inflation, to the expected real rate that clears the credit market.

The model embodies two principles that are essential to understanding nominal interest rate smoothing. First, the price level is determined by a money supply rule, which provides a nominal anchor for the system. Second, the nominal rate is affected by expected inflation, which allows a central bank to translate price level and inflation policy into interest rate policy.

Nominal interest rate smoothing works as follows. The money supply rule pins down the expected future nominal stock of money, which together with the expected future real demand for money determines the expected future price level. In practice, central banks, including the Fed, have employed

¹⁰ There are actually a number of ways that one can define a nominal interest rate smoothing policy. It can mean eliminating deterministic seasonals, as emphasized by the authors listed in note 9 above. It can mean minimizing interest rate surprises, as studied by Goodfriend (1987a). Or it can mean using monetary policy to maintain expected constancy in interest rates as studied by Barro (1987). Regardless of what nominal interest rate policy is followed, however, the theoretical mechanism by which it works is basically as described in the text.

¹¹ See Goodfriend (1987a).

interest rate *instruments* to smooth interest rates, which amounts to running an adjustable nominal interest rate peg.¹² To illustrate the process, we describe the response to the following two disturbances. In each case we first ask what happens when the stock of high-powered money remains constant, and then we ask how high-powered money must change to be consistent with a nominal rate peg.

A temporary rise in real money demand. With high-powered money initially unchanged, the current price level would fall, raising both expected inflation and the nominal interest rate. By assumption, the expected real yield on nominal securities is unchanged. Therefore, under a nominal rate peg expected inflation must remain unchanged, which means the current price level must remain equal to the expected future price level. Hence, the Fed would merely provide enough high-powered money, through open market purchases, to satisfy the initial rise in money demand.

A temporary rise in the real rate. With high-powered money constant, the nominal rate would rise, real money demand would fall, and the current price level would rise. Under a nominal rate peg the necessary increase in the expected real rate on nominal securities would be achieved by a matching expected deflation due to a temporarily high price level. The Fed would merely provide enough nominal high-powered money to satisfy the unchanged demand for real money balances at the higher price level.¹³

¹² The method by which the Federal Reserve smooths interest rates has varied over the years. In the 1920s the Fed forced the banking system to be "in the window" for a portion of high-powered money demanded. Since there was relatively little non-price rationing, the discount rate tended to provide a ceiling for interest rates. The discount rate was raised or lowered to adjust the level of interest rates, with appropriate adjustments to non-borrowed reserves to keep banks marginally borrowing reserves. In the 1930s nominal rates were near their floor at zero, and in the 1940s they were pegged. In the 1950s and '60s the Fed used procedures similar to those it used in the '20s. See Brunner and Meltzer (1964). Explicit Federal funds rate targeting was used in the 1970s. Similarly, the nonborrowed reserve operating procedure employed from October 1979 to the fall of 1982 was in effect a noisy week-by-week funds rate peg. See Goodfriend (1987b), pp.40-41. Since then the Fed has employed a mixture of borrowed reserve and Federal funds rate targeting.

Goodfriend (1987b) contains theoretical, institutional, and historical discussion of the Federal Reserve's use of an interest rate policy instrument. For an analysis under rational expectations, see McCallum (1981) and "A Weekly Rational Expectations Model of the Nonborrowed Reserve Operating Procedure," in Goodfriend (1987b).

¹³ Empirical evidence on the high-powered money and inflation response associated with the elimination of nominal interest rate seasonals around 1914 may be found in Barro (1987) and Barsky et al. (1987).

A number of important practical points emerge from this theoretical discussion. First, nominal interest rate smoothing is monetary policy because the Fed's power to create or destroy high-powered money through open market operations is necessary and sufficient for it to smooth nominal interest rates. In particular, no financial or banking regulations are necessary. Second, interest rate smoothing is clearly feasible when the public understands policy, i.e., has rational expectations. Third, the mechanics of interest rate smoothing are the same regardless of whether the disturbances are seasonal or irregular in nature. Fourth, since the nominal interest rate is the private opportunity cost of holding high-powered money (as currency for hand-to-hand transactions or as bank reserves), the change in the seasonal and irregular pattern of nominal interest rates produces a corresponding change in the pattern of real money balances held by individuals and banks. Thus, interest rate smoothing is the means by which the Federal Reserve satisfied its statutory mandate to provide liquidity to the U.S. economy.

Finally, Federal Reserve interest rate smoothing has in practice made bank reserve requirements unnecessary for conducting monetary policy. The conventional view, of course, is that reserve requirements help the Federal Reserve control the stock of money. This is the view implicit in the 1980 Monetary Control Act, which extended reserve requirements beyond member banks to all depository institutions. If the Fed were operating with a total reserve instrument, reserve requirements would help determine how a change in high-powered money would influence the price level and the nominal interest rate. However, the Fed has chosen to operate with an interest rate instrument, i.e., to run an adjustable rate peg. As should be clear from the examples discussed above, under even a temporary peg the current price level is determined by the chosen level of the nominal interest rate, the credit-market-clearing real rate, and the expected future price level. The Fed simply uses open market operations to satisfy current money demand at the current price level. In such circumstances, reserve requirements merely help determine the volume of open market operations that the Fed must do to provide the accommodation. Reserve requirements do not help determine the money stock or the price level.¹⁴

¹⁴ This was true even under the Fed's post-October 1979 non-borrowed reserve operating procedure. See "A Historical Assessment of the Rationales and Functions of Reserve Requirements," in Goodfriend (1987b), pages 40-41.

2.3 Financial Deregulation and Stabilization Policy

Since the Employment Act of 1946, the Federal Reserve has had a mandate to use monetary policy to stabilize real economic activity. Thus, a major question about ongoing and prospective financial deregulation concerns its influence on stabilization policy. While macroeconomic textbooks show broad agreement on issues concerning the nature of the demand for money, there is little or no agreement on a number of central issues concerning monetary policy.

Traditional monetarist arguments originating with Milton Friedman and Karl Brunner hold that monetary policy has a powerful but frequently destabilizing impact on economic activity.¹⁵ From this perspective, monetary policy exacerbates cyclical volatility because (1) its effects are subject to long and variable lags, which makes the timing of monetary policy actions difficult, (2) it is difficult for policymakers to assess promptly the state of economic activity due to problems of inference about the dominant forces that drive the economy in a given period, and (3) the policymaker's focus on smoothing nominal interest rates against cyclical changes in real rates generally leads monetary aggregates to be procyclical.

Rational expectations monetarist arguments developed by Robert Lucas, Thomas Sargent and Robert Barro, stress the distinction between unpredictable policy actions (shocks), which exert a powerful influence on real economic activity, and predictable policy responses, which do not.¹⁶ This group argues that systematic monetary policy cannot influence real activity, such as employment, real gross national product, and real interest rates, because private agents rationally anticipate the systematic component of monetary policy and take actions that neutralize its potential effects, leaving it to influence nominal variables only.

Real business cycle analysts using a perspective initiated by Edward Prescott, John Long, and Charles Plosser deny any major influence of money, anticipated or unanticipated, on real economic activity.¹⁷ From the perspective of real business cycle analysis, variations in real activity arising, for example, from

¹⁵ See Darby (1976), Friedman and Schwartz (1963), and Poole (1978).

¹⁶ See Lucas and Sargent (1980).

¹⁷ See King and Plosser (1986) for a discussion of the relationship between money, credit, and real activity in a real business cycle model.

changes in technology, sectoral reallocations, energy shocks, or taxes and government spending drive the monetary sector, reversing the traditional macroeconomic view.

Modern Keynesian analysts led by Stanley Fischer, Edmund Phelps, and John Taylor see a powerful role for monetary policy, even with rational private anticipations, because the Federal Reserve can act after private agents have entered into wage and price agreements. From this perspective, monetary policy is a powerful stabilization tool that can offset potentially inefficient economic fluctuations arising from variations in the demand for money, autonomous changes in private spending, and supply shocks.

The disagreement about the feasibility and desirability of stabilization policy, however, should not obscure the consensus that is apparent among leading macroeconomists regarding the operation of monetary policy. Whether monetary policy influences real activity or only nominal variables, all agree that it involves manipulations of the stock of high-powered money. The major ongoing professional debates concerning monetary policy accept as common ground the perspective that open market operations are a necessary and sufficient policy instrument. Financial market regulations are not necessary for the conduct of stabilization policy irrespective of how it influences the cyclical component of economic activity. Not only is this the view of academic economists, it is also the view that the Fed itself takes in practice. In its early years the Fed relied extensively on the discount window as a means of managing the high-powered money stock, but it rapidly came to regard the method by which it did so as a tactical consideration of little fundamental importance. In the early 1920s the Fed substituted open market security purchases for discount window loans as the primary means of adjusting high-powered money.

3. DEREGULATION AND BANKING POLICY

Banking policy, as defined above, has three dimensions. It involves changing the composition of central bank assets holding their total fixed, it involves financial regulation, and it involves bank supervision. When executing banking policy, a central bank functions like a private financial intermediary in that its actions neither create nor destroy high-powered money. Banking policy involves making loans to individual banks with funds acquired by selling off other assets, usually government securities. In effect, the

primary dimension of banking policy is central bank provision of line of credit services to private banks. Regulatory and supervisory dimensions of banking policy may be understood in this regard. Private credit extension is accompanied by restrictions on the borrower to limit his ability to take risks and to protect the value of loan collateral. Private credit lines are accompanied by ongoing monitoring of borrowers by lenders. Efficient central bank line of credit provision likewise requires regulation and supervision of potential credit recipients.

The focus of this paper is deregulation. In Section 2 we argued that banking and financial regulations were not essential for the execution of monetary policy. Here we ask whether banking policy needs supporting regulation and supervision. The analogy between private and central bank credit extension drawn above, however, suggests that our inquiry into banking policy should be somewhat different. If a central bank provides line of credit services, the analogy suggests that it must follow up with supervision and regulation to safeguard its funds and make sure its commitment is not abused. Ultimately we must ask, therefore, whether central bank line of credit services to banks are really necessary and desirable in the first place.

Our analysis follows the strategy employed in discussing monetary policy in Section 2 by first considering a deregulated environment. We begin in Section 3.1 by motivating and describing restrictions voluntarily agreed to by borrowers in private credit markets. Section 3.2 explains the demand for line of credit services in general, and emphasizes that by their very nature credit lines must be accompanied by ongoing monitoring of potential borrowers. Section 3.3 takes up central bank lending and the particular issues that arise for public lenders such as the Federal Reserve. To keep things concrete, we discuss these issues in terms of Federal Reserve discount window lending practices. We emphasize how regulatory and supervisory actions taken by the Fed to safeguard its funds parallel those taken in private credit markets.

The Federal Reserve discount window functions most importantly as a source of emergency credit assistance. It is a temporary source of funds, available on short notice, for financially troubled individual banks. No one argues that the discount window should be used to prevent insolvent banks from failing, only that the window be used to aid solvent banks. The distinction between illiquidity and insolvency is therefore crucial to the management of the discount window. First of all, the feasibility of such selective lending depends on the Federal

Reserve's having an operational and timely means of distinguishing insolvent from illiquid banks. Moreover, understanding the economic distinction between illiquidity and insolvency is necessary to decide whether discount window lending is desirable policy at all. We address these fundamental issues in Section 3.4.

Our treatment of banking policy here in Section 3 is confined to routine credit assistance. We take up the feasibility and desirability of monetary and banking policy responses to systemwide banking and financial market crises in Section 4.

3.1 Private Lending and Private Regulation

Lenders face many potential problems because borrowers can take actions that affect the risk that loans will not be repaid. Thus, borrowers and lenders agree on sets of rules and restrictions to accompany loans. Consider for example, a car loan. The lender provides the borrower an initial amount of funds to purchase a car. The borrower agrees to a regular pattern of loan repayments. But the car loan involves more than these financial flows. Typically, the car is collateral against the borrower's ability to repay the loan, i.e., as part of the contract the borrower gives up the right to sell the car for the duration of the loan. Additional agreements may restrict other aspects of the borrower's behavior. For example, insurance against damage to the car is usually required, and the borrower may be prohibited from renting the car to others. These additional restrictions further protect the lender against damage to the loan collateral.

It is important to note that restrictions on the borrower's range of actions are ultimately in the borrower's interest, since they lower the cost of the loan. For example, suppose that one wanted to borrow funds for a vacation, and owned a car without any encumbering car loan. It would generally be cheaper to offer the car as security for the vacation loan, although to do so would require acceptance of a set of restrictions on use or transfer of the car.

Issues concerning incentives for borrowers become far more important and sophisticated when corporate lending is considered. For this reason, corporate loans typically involve complex covenants (restrictive agreements) that limit the borrower's range of actions.¹⁸ Covenants that limit risktaking are particularly important. For example, consider the naive policy of lending to a corporation that is engaged in a specific riskless line of business, at an appropriate

¹⁸ See Smith and Warner (1979).

rate of return for riskless loans, without any restrictions on how the funds are to be spent. Ultimately, the loan is a claim to the minimum of the stream of loan payments or the liquidation value of the corporation's assets. From the standpoint of the firm's shareholders the risky project would thus be a good idea: if it is a success, they will get the rewards; if it is a failure, the losses will be the lender's, i.e., the bondholder's. Thus, with managers of the corporation responsive to shareholders, the firm has an incentive to use the borrowed funds to take on risky projects. This difficulty could be circumvented with a covenant restricting the types of projects that the company could initiate.

3.2 Private Lines of Credit

Efficient lending involves the costly accumulation of detailed information about borrowers, both to sort borrowers into risk classes and for the purpose of designing covenants. Like many other economic activities, information production is highly costly when undertaken quickly without development of systems and experience. For this reason, lending is typically undertaken in the context of long-term relationships, in which information production can be undertaken in a less expensive manner.¹⁹

One form of long-term lending arrangement is commonly known as a line of credit. The demand for line of credit services arises because firms often need funds suddenly, as a result of unpredictable events. For example, a firm may discover a potentially lucrative investment opportunity which must be seized quickly. The firm may not have a sufficient inventory of readily tradable assets such as U.S. Treasury bills from which to raise the necessary funds. Furthermore, the delay involved may make a public security offering ineffective. In contrast, a line of credit arrangement is designed to make funds available on very short notice, possibly as a bridge loan until other arrangements can be made.

Alternatively, a firm might develop a sudden need for funds after suffering a bad shock such as a decline in sales or the unexpected failure of a project. Credit lines, of course, are specifically designed to make funds immediately available in such circumstances too. The extension of credit in response to bad outcomes, however, is more troublesome for lenders. Bad outcomes might provide information that a firm should be dissolved, in which case the credit should

not be extended. But credit lines are valuable precisely because they make funds immediately available. Therefore, lenders must protect themselves against such contingencies. For this reason, continuous monitoring of potential borrowers is a particularly important feature of the provision of line of credit services.²⁰

Lines of credit typically require the payment of a facility fee either on the full amount of the line or on the unused portion to cover the ongoing cost of monitoring incurred by the bank.²¹ Often the fee is paid by holding a compensating balance at the lending bank, i.e., a bank deposit that pays a below market rate of interest. Because the compensating balance allows the lender to observe the borrower's financial transactions, it helps reduce monitoring costs. In return for the fee, the line of credit recipient acquires an option to borrow funds, up to the amount of the line, at a predetermined interest rate spread above a market reference rate. The size of the fee and the rate spread are lowest for top borrowers and higher for worse credit risks. For the reasons outlined above, credit lines usually involve restrictions and covenants, as well as the specification of allowable collateral, if any is required, should a loan actually be taken down. Since such restrictions affect the riskiness of the credit, they influence the fee and spread: acceptance of more restrictions by the borrower generally reduces the cost of the line. Finally, monitoring costs vary. Monitoring a mom and pop grocery store is less costly than monitoring a firm with many employees, offices, and product lines. Higher monitoring costs would also be reflected in a higher fee and/or spread.²²

Individual banks position themselves to fund their credit lines in several ways. Most importantly, they maintain good credit ratings themselves so they can attract funds in the certificate of deposit market in a timely fashion and at relatively low cost.²³ To a lesser extent they hold inventories of readily

¹⁹ Haubrich (1986) provides a recent formal description of one set of gains from long-term relationships in financial intermediation. Benston and Smith (1976) discuss why bundling of financial products can be efficient in a world of costly information.

²⁰ A number of authors in recent years have emphasized monitoring as a key function of banks. See, for example, Diamond (1984), Fama (1985), Gorton and Haubrich (1987), and Haubrich (1986).

²¹ Berlin (1986), Crane (1973), Hanweck (1982), and Summers (1975) provide descriptions of various aspects of the market for lines of credit. Berlin documents substantial growth in the use of bank loan commitments since 1977.

²² Hawkins (1982), and Melnik and Plaut (1986a, 1986b) contain theoretical analyses of the economics of bank loan commitments.

²³ See the chapter on certificates of deposit in Cook and Rowe (1986), as well as the chapter on repurchase agreements, a related bank funding source.

marketable securities such as U.S. Treasury bills, which they can sell to acquire funds on short notice.²⁴ If the need is expected to be particularly short-lived, a credit line may be most economically funded by borrowing Federal funds.²⁵

3.3 Discount Window Lending²⁶

Discount window lending is essentially the provision of line of credit services by central banks. As such there are important similarities between discount window operations and private lines of credit. There is, however, a potentially important difference because a central bank's liabilities are high-powered money. We develop these points below by describing discount window procedures actually followed by the Federal Reserve. In particular, we explain that while the discount window is unnecessary for monetary policy, it plays an essential role in the execution of banking policy. We also indicate by analogy to private credit lines, why Federal Reserve regulation and supervision of eligible borrowers must be tied to discounting. We save our inquiry into the desirability of banking policy, executed through discount window lending, until Section 3.4.

Discount window lending is the extension of credit, virtually always secured by collateral, from a central bank to a private institution. In the United States, it is lending by Federal Reserve Banks through their discount windows to individual banks or other depository institutions in their respective districts. Reserve banks can finance discount window credit with high-powered money or with funds obtained from securities sold in the open market. We define discount window lending that is deliberately allowed to create high-powered money as unsterilized. Under our definition, unsterilized discount window operations are, in part, monetary policy. We say that discount window lending is sterilized when

²⁴ In recent years loan sales have apparently become more common. See Gorton and Haubrich (1987), Pavel (1986), and Pennacchi (1986). Though it is not clear whether they are being used as a funding source on short notice.

²⁵ See the chapter on Federal funds in Cook and Rowe (1986).

²⁶ The term "discount window" arose from the following historical circumstances. In the eighteenth and nineteenth centuries, much of international and interregional trade was financed with bills of exchange, which were short-term securities that did not pay explicit interest. When sold or used as collateral, a security was discounted—or valued at less than its face value—to provide a return to its holder. The discount window was so named because much of the Fed's lending in its early years was done by discounting. Hackley (1973) contains a thorough discussion of the legal history of Federal Reserve lending. For many years virtually all Federal Reserve lending has taken the form of advances rather than discounts. Hackley describes the shift, as well as the evolution of other aspects of Fed lending.

it is accompanied by an open market sale of equal value. Sterilized discount window operations are thus pure banking policy, with no monetary policy implications, since they leave high-powered money unchanged. In this case a loan to an individual bank is merely substituted for government paper on the books of the central bank, with no change in total central bank liabilities, i.e., high-powered money.

As we explained in Section 2, open market operations are sufficient for the execution of monetary policy. It follows that unsterilized discount window lending is redundant as a monetary policy tool.²⁷ In contrast, sterilized discount window lending plays a distinctive policy role apart from monetary policy. It allows a central bank to lend selectively to individual banks without affecting aggregate monetary conditions. In other words, it enables a central bank to offer line of credit services to individual banks in much the same way as private banks provide credit lines to their customers.

The 1984 report of the Bush commission on financial regulation put the rationale for Federal Reserve provision of discount window services as follows:

Operation of the FRB's discount window is a vital element in the public "safety net" supporting stability of the banking system. Particularly in the event of difficulties affecting a large financial institution, the FRB must remain available to provide potentially extremely large amounts of liquidity on extremely short notice, and it is the only government agency that is in a position to provide this type of support to the financial system. (*Blueprint for Reform: The Report of the Task Group on Regulation of Financial Services*, p. 49.)

Earlier a 1971 Federal Reserve report reappraising the discount window stated:

Under present conditions, sophisticated open market operations enable the System to head off general liquidity crises, but such operations are less appropriate when the System is confronted with serious financial strains among individual firms or specialized groups of institutions. At times such pressures may be inherent in the nature of monetary restraint, . . . [which often has] excessively harsh impacts on particular sectors of the economy. At other times underlying economic conditions may change in unforeseen ways, to the detriment of a particular financial substructure. And, of course, the possibility of local calamities or management failure affecting individual institutions or small groups of

²⁷ Nevertheless, over the years the Federal Reserve has employed unsterilized discount window lending extensively, together with discount rate adjustments, in the execution of monetary policy. See note 12. Though it remains puzzling, use of the discount window this way seems to be connected with the use of secrecy or ambiguity in monetary policy. See Cukierman and Meltzer (1986) and Goodfriend (1986). In a similar vein, Cook and Hahn (1986) provide extensive evidence that the discount rate has served as a monetary policy signal: specifically, a signal of permanent changes in the Federal funds rate.

institutions is ever-present. It is in connection with these limited crises that the discount window can play an effective role. . . . (*Reappraisal of the Federal Reserve Discount Mechanism*, volume 1, p. 19.)

The Federal Reserve discount window is understood and valued as a line of credit facility. Open market operations are seen as capable of handling aggregate monetary conditions; sterilized discount window lending is valued for its ability to direct potentially large quantities of funds to individually troubled firms on very short notice. Based on our discussion of private lending above, we would expect the Fed in its role as public provider of line of credit services to impose restrictions on potential borrowers and engage in monitoring as well. It does. In the public sector, however, these activities are known as regulation and supervision.

Like private lenders, the Fed too is concerned about pricing its loans according to risk.²⁸ In Regulation A, the Fed classifies discount window loans into short-term adjustment credit, seasonal credit, and extended or emergency credit assistance. Adjustment credit is temporarily employed by banks in good financial condition.²⁹ Seasonal credit is employed primarily by banks in agricultural areas. Its use is also rather routine. In contrast, emergency credit is longer-term borrowing by troubled banks.³⁰ The discount rates on adjustment and seasonal credit are lower than for emergency credit because the riskiness of a loan is generally lower on the former than the latter.

The riskiness of a discount window loan depends critically on the collateral. The Fed has considerable latitude as to what it will accept and the haircut it

²⁸ Notably, although the Monetary Control Act of 1980 directed the Federal Reserve to price many of its services, the discount window was exempted. There are some superficial similarities between Federal Reserve practices and private line of credit pricing. For instance, the noninterest earning required reserves at the Federal Reserve are like compensating balances. But there is little evidence that the Federal Reserve prices line of credit services according to each bank's circumstances with respect to supervision cost, risk of insolvency, or collateral.

²⁹ Since the early 1960s, the Federal Reserve has allowed the Federal funds rate to move above the discount rate for long periods of time. To limit borrowing the Federal Reserve has imposed a noninterest cost, which rises with the level and the duration of borrowing. In practice, higher and longer duration borrowing increases the likelihood of costly Federal Reserve consultations with bank officials. See Goodfriend (1983, 1987b) for discussions of how this means of administering the window has been employed in executing monetary policy.

³⁰ For example, Continental Illinois Bank borrowed extensively at the Federal Reserve discount window from May 1984 to February 1985. It was in the window for over 4 billion dollars during much of that period. See Benston et al., pp. 120-24.

will take.³¹ Fully collateralizing a loan with prime paper such as U.S. Treasury bills would make the value of a central bank's line of credit minimal, since a bank could acquire the funds by simply selling the bills in the private market. A central bank could still make its credit line attractive, however, by charging below market rates or taking less than a market haircut. Whatever a central bank might do in practice, the point of the current discussion is to analyze how a central bank providing line of credit services based on imperfect collateral would operate.

In addition to setting the terms on which a loan can be taken down, our discussion of private lines of credit emphasized the need for ongoing monitoring of potential borrowers by the lender. This is no less necessary for public provision of line of credit services by the Fed. A 1983 Federal Reserve position paper on financial regulation stated:

Central banking responsibilities for financial stability are supported by discount window facilities—historically a key function of a central bank—through which the banking system, and in a crisis, the economy more generally, can be supported. But effective use of that critically important tool of crisis management is itself dependent on intimate familiarity with the operations of banks, and to a degree other financial institutions, of the kind that can only be derived from continuing the operational supervisory responsibilities ("Federal Reserve Position on Restructuring of Financial Regulation Responsibilities," in U.S. Congress. House. Committee on Government Operations, House of Representatives, 99th Congress, 1985, p. 235.)

We interpret the term "effective use" in the above quotation to mean that the Fed must be able on short notice to discern the financial position of a bank requesting funds. Especially with respect to emergency credit assistance such information is necessary to price loans appropriately, and even more importantly, to determine that the borrower is still viable. If the Fed were too lax—in the sense of lending to excessively weak borrowers—it would risk supporting banks that should be dissolved. If it were too cautious, it would risk not supporting temporarily troubled but fundamentally sound banks, possibly allowing them to fail unnecessarily. Only by continually supervising banks to which it has credit com-

³¹ Hackley (1973) documents the history of legal collateral requirements in discount window lending. Although the Federal Reserve has wide discretion in what it can take, it has generally required very good collateral on its loans.

A "haircut" is a margin that is subtracted from the market or face value of a security for purposes of calculating its value as collateral in a loan transaction. For example, a 10 percent haircut off face value of a \$100 security would value it as \$90 for purposes of collateral.

mitments can the Fed hope to lend funds efficiently on short notice.³²

Beyond setting lending terms and associated supervisory requirements, the Fed needs to set eligibility rules. Unlike a private firm, the Fed cannot simply choose its customers. The logic of the quotations presented above suggests that the Fed ought to provide line of credit services to the entire economy as well as to banks. To do so, however, would obviously require an enormous allocation of resources for regulation and supervision. Hence, the Fed and Congress have to limit that commitment rather arbitrarily. Currently, only Federal Reserve member banks, or depository institutions holding transaction accounts or nonpersonal time deposits, are entitled to basic discount window borrowing privileges. This group corresponds closely to the institutions holding reserves at Federal Reserve banks.

If this logic is carried one step further, we can better understand the concerns of some policymakers for maintaining a separation between banking on one hand, and finance and commerce on the other, and for limiting access to the payments system.³³ We interpret the argument as recognizing the need to limit the Fed's line of credit commitments, and the regulation and supervision that must accompany them, to a manageable subset of the economy, namely, depository institutions. Blurring the line, for example, between banking and commerce would make it difficult for the Fed to do so. Without a clear delineation, the Fed would tend to be drawn into additional implicit commitments that it could not keep. Further, without the regulatory and supervisory resources to safeguard its funds, the Fed might have to withdraw from providing line of credit services entirely.

The argument for limiting access to the payments system is similar. In the process of making payments over its electronic funds transfer network, the Federal Reserve grants intraday credit to depository institutions in the form of daylight overdrafts on their

³² In fact, though Fed regulations apply to all banks, it directly supervises and examines only state-chartered Fed member banks and bank holding companies. The Comptroller of the Currency, for example, supervises and examines nationally chartered banks. The Federal Deposit Insurance Corporation does so for insured state-chartered non-Fed-member banks. Other agencies, however, make information available to the Fed. *Continental Illinois National Bank: Report of An Inquiry into its Federal Supervision and Assistance*, contains a good discussion of government supervision of banks.

³³ See Corrigan (1987).

reserve accounts.³⁴ Because they are imperfectly collateralized, daylight overdrafts create potential problems analogous to those associated with discount window lending. Though quantitatively much less significant, Federal Reserve float generated in the process of clearing checks creates similar problems.³⁵ Because the Fed does not eliminate or perfectly collateralize daylight overdrafts or float, it needs to limit access to the payments system to protect its funds.

In summary, efficient lending, whether by private firms or public institutions, necessarily involves restrictions. If banking policy in the form of discount window lending and the provision of payments system credit is desirable, then it must be accompanied by central bank regulation and supervision just as private line of credit services require restrictions and continual monitoring.

3.4 Illiquidity and Emergency Credit Assistance

The preceding discussion indicated that the Federal Reserve discount window is most important as a source of immediately available short-term credit to *individual* banks. As noted above, no one argues that the discount window should be used to rescue insolvent banks, only that it be used to aid temporarily illiquid banks. The familiar rule of thumb—lend only to illiquid but solvent banks—both protects public funds and safeguards the freedom to fail, which is vital to the efficiency of the economy.³⁶ The purpose of this section is twofold. First, it is to evaluate whether the rule of thumb can be feasibly implemented. Second, it is to see whether the public

³⁴ See Mengle, Humphrey, and Summers (1987) for a discussion of daylight overdrafts. They report total funds transfer daylight overdrafts of 76 billion dollars per day. This is an enormous number when one considers that total reserve balances with Reserve Banks are around 35 billion dollars. Daylight overdrafts are currently not priced. They are interest free loans. Therefore, depository institutions have little incentive to economize on their use. To limit somewhat the use of intraday credit the Fed monitors depository institutions according to "caps" and relatively informal guidelines, resorting to consultations with bank officials when necessary. This is reminiscent of administration of the discount window. See note 29.

³⁵ The Monetary Control Act of 1980 mandated that the Federal Reserve charge fees to recover the cost of providing check clearing and other services. In particular, the Federal Reserve was directed to charge for Federal Reserve float at the Federal funds rate. Consequently, check float has fallen from 7.4 billion dollars in the first half of 1979 to under 1 billion dollars today. See "The Tug-of-War Over Float," (1983), U.S. Congress, *The Role of the Federal Reserve in Check Clearing and the Nation's Payments System* (1983), and Young (1986).

³⁶ Todd (1987) documents in detail the establishment of the principle that the central bank should lend only to illiquid but not to insolvent institutions.

provision of line of credit services through the discount window can be rationalized as necessary to aid temporarily illiquid banks. The value of central bank regulation and supervision hinges critically on the answer to these questions.

To carry out the analysis we require an operational means of distinguishing between illiquid and insolvent banks. This distinction appears meaningful only in the presence of incomplete and costly information about the value of bank assets. If information were freely available about such assets, then private markets would stand ready to lend any bank the present value of the expected income streams from its assets, discounted at a rate appropriate for the risk. Thus, any bank would always be fully liquid, able to pay all claimants, as long as it was also solvent.

If information is incomplete and costly to obtain, then it becomes possible to imagine the following situation, which could be described as involving an illiquid but solvent bank.³⁷ Suppose that a disturbance arises which adversely affects the returns to some existing bank loans. If the private market cannot distinguish between strong and weak banks, then it will only lend to any individual bank at a rate appropriate for the entire pool of borrowing banks. For any strong bank needing to borrow funds, then, the private market will charge a higher rate under incomplete information than under complete information because the rate takes into account a probability that the bank is bad, even though it may not be. Faced with a need for funds, a strong bank may find itself in a dilemma: its loans may be able to support the borrowing rate under full information, but not the higher rate prevailing under incomplete information. More precisely, at the full information borrowing rate, the bank might have positive economic net worth, but at the higher rate under incomplete information its net worth may be negative. We would describe such a bank as potentially illiquid though solvent.

The higher rate that prevails in the market is an outcome of costly information. It is a result of pooling diverse risk groups, as discussed above, made necessary by the costliness of auditing the underlying assets of the bank. Timely auditing over very short periods can be so costly that individual banks might not find it feasible to engage in "last minute" auditing as part of a program for raising funds.

³⁷ The analysis here relies on the substantial work on private information economies stimulated by Rothschild and Stiglitz (1976). However, since we consider costly evaluation, our treatment of private information economies is closer to Boyd and Prescott (1986).

Credit lines exist to deal with precisely this situation. As described above, these involve an ongoing relationship with periodic credit evaluation so that the lender can distinguish illiquidity from insolvency in the event of a request for funds. The ongoing relationship develops because evaluation costs are lower, as with many other economic activities, when they are distributed over time.

In operating a discount window, the government faces the same problem as a private lender when there is incomplete and costly information. It has the same range of choices. It can lend to a pool of undifferentiated risks. If it were to pursue such a strategy, then to break even it would have to lend at a penalty rate equal to the private market pooled rate. However, if the discount window had to compete with private lines of credit, such a pricing policy would only attract insolvent banks. Hence, indiscriminate lending would be undesirable.

Alternatively, a central bank could supervise, i.e., evaluate, banks and selectively lend based on the information that supervision actually generates. Distinguishing among banks on this basis, a central bank selectively aids illiquid banks, but it incurs supervision costs to discriminate between types of banks. From this perspective, it is not an accident that discount window lending and bank supervision are jointly included in the primary rationales for the Federal Reserve. If these supervision costs are taken into account and they are at least as great as those of the private sector, then banking policy breaks even or subsidizes illiquid banks. It could not penalize illiquid banks which have the option of using competitive private credit lines.

As with many other areas of government intervention, then, the efficacy of discount window lending turns on the relative efficiency of the government and the private sector in undertaking a productive activity. We know of no analysis that establishes the relative advantage of central banks in this area, though more research is needed before any definitive conclusions can be reached. Indeed, in view of political pressure to support large banks, it is possible that the private market is inherently superior because it may be difficult for a government agency to lend only to illiquid but not to insolvent banks.³⁸ From this perspective, selective discount window lending and

³⁸ Sprague (1986) and Todd (1987) report numerous instances of government support for insolvent institutions. The Federal Reserve minimizes the risk of supporting insolvent banks by making discount window loans only on the best collateral. However, by doing so it greatly reduces the value of its line of credit services too. For example, it took the best collateral when lending to Continental Illinois Bank in 1984-85. See note 30.

necessary supervision of banks fulfill the second objective of the framers of the Federal Reserve Act. But, in contrast to the provision of an elastic currency, it is less clear that this is an appropriate government intervention.³⁹

We are now in a position to consider more fully whether regulation and supervision are essential for central banking. We emphasized in Section 2 that regulations were not essential for the execution of monetary policy. In sharp contrast, we have argued here that banking policy needs supporting regulation and supervision.⁴⁰ The reason for the difference is that monetary policy can be carried out with open market operations in government securities. But by its very nature, banking policy involves a swap of government securities for claims on individual banks. Just as private lenders must restrict and monitor individual borrowers, so must a central bank. As indicated above, however, we know of no compelling rationale for public provision of line of credit services to individual banks through a central bank discount window. The fiat monetary system we currently have requires central bank management of high-powered money. But today's financial markets provide a highly efficient means of allocating credit privately. On the basis of such considerations, we find that it is difficult to make a case for central bank lending and the regulatory and supervisory activities that support it.

This conclusion must, however, be qualified in two ways. First, it is beyond the scope of this paper to analyze the benefits of Federal Reserve credit generated by the payments system. Provision of imperfectly collateralized daylight overdrafts and float also requires regulation and supervision. Second, we have so far only discussed banking policy with

³⁹ There is an additional reason why government emergency credit assistance might be necessary. Private markets would only make arrangements to protect themselves against liquidity problems if they believed that the government would not offer such services. Yet it might be impossible for the government to make credible its intention not to intervene in future crises. To do so, the government would have to precommit itself not to provide emergency credit assistance. The worst possible case would be one where the government announced its intention not to provide emergency credit assistance in the future, but the banks believed that in fact it would. Then if a liquidity problem arose, banks would not have prepared for it by holding sufficient capital and by arranging lines of credit. If the government remained true to its policy, widespread insolvency could prevail. Bulow and Rogoff (1986) provide an interesting analysis of this sort of problem with respect to international debt.

⁴⁰ If the Federal Reserve always perfectly collateralized its banking policy loans, then in principle it could need very little supporting regulation and supervision. However, if it lent at below market rates, it would still need regulation and supervision to see that its policy was not abused.

respect to individually troubled banks. We must also ask whether banking policy has a useful role to play in response to aggregate, i.e., systemwide, disturbances.

4. SYSTEMWIDE BANKING AND FINANCIAL MARKET CRISES

Distinguishing between monetary and banking policy, the previous two sections of the paper have analyzed central bank policy in routine circumstances. Policy was analyzed as it might be undertaken in response to normal macroeconomic disturbances and in response to individual bank problems. Here we address questions concerning central bank policy with respect to systemwide banking and financial crises.

We begin the discussion in Section 4.1 by describing the nature of banking crises in the United States before the establishment of the Federal Reserve, with particular attention to the measures taken privately by clearinghouses to protect the banking system. This discussion is then used in Section 4.2 to develop the idea that monetary policy (provision of high-powered money) and not banking policy (provision of sterilized discount window loans) is both necessary and sufficient for a central bank to protect the banking system against such crises. We proceed to characterize Walter Bagehot's famous lender of last resort policy prescription as an irregular nominal interest rate smoothing policy. We show how Bagehot's rule would automatically trigger high-powered money responses to protect against the sort of banking system crises experienced before the establishment of the Federal Reserve. Finally, we compare Bagehot's proposed rule to regular interest rate smoothing procedures practiced by the Fed. Having pointed out that monetary policy has an important role to play in response to systemwide banking or financial crises, in Section 4.3 we ask whether banking policy has a useful role to play in such circumstances.

4.1 Banking Crises Before the Federal Reserve

In his *History of Crises under the National Banking System*, O. M. W. Sprague identified five banking crises between the end of the Civil War and the creation of the Federal Reserve.⁴¹ Sprague's crises occurred in 1873, 1884, 1890, 1893, and 1907. Each

⁴¹ Kemmerer (1910), pp. 222-23, contains a more extensive classification of financial panics including more moderate episodes.

of these crises was accompanied by interest rate spikes of the sort described earlier, although not all interest rate spikes were associated with banking crises.

All of these banking crises involved an incipient, widespread desire on the part of the public to convert bank liabilities into currency. They were also accompanied by a defensive effort on the part of banks to build up their reserve-deposit ratios.⁴² Under the fractional reserve system without a central bank, this widespread demand for currency could not be satisfied. Organized around clearinghouses, the banking system responded in two ways.⁴³ First, clearinghouses coordinated general restrictions of convertibility of deposits into currency while maintaining banks' ability to settle deposit accounts among themselves and to undertake lending. Second, clearinghouses issued temporary substitutes for cash, known as clearinghouse loan certificates. These notes were issued against acceptable collateral as clearinghouse liabilities rather than individual bank liabilities. In this way, clearinghouse certificates facilitated the settlement of accounts among banks that were mutually suspicious of each other. The clearinghouse certificates were issued in each of the crises discussed by Sprague and remained outstanding for as little as four months in 1890 and as long as six months in 1907. Convertibility restrictions, however, accompanied the issue of clearinghouse certificates only in 1873, 1893, and 1907.

Because convertibility restrictions prevented satisfaction of the increased demand to convert deposits into currency, they involved temporary periods in which currency sold at a premium relative to deposits. For example, during the restriction in 1907, the premium on currency over deposits ranged as high as 4 percent. Taken together, the actions of the clearinghouses allowed member banks both to accommodate a higher private demand for currency—by using certificates in place of currency for clearing purposes—and frustrated it—by temporarily increasing the relative price of currency to deposits.

How well did these measures contain the harmful effects of banking crises? As calculated from data

⁴² See Cagan (1965).

⁴³ Clearinghouses were associations of commercial banks initially established to clear checks and settle accounts among member banks. Given their central position in the clearing process, they subsequently assumed responsibility for overseeing individual banks and protecting the banking system as a whole. In addition to O. M. W. Sprague (1910), see Cannon (1908), Gorton and Mullineaux (1987), Timberlake (1978, 1984) on the behavior of clearinghouses.

reported in *Historical Statistics of the United States* the mean annual bank failure rate was less than 1 percent during the period 1875 to 1914. Moreover, this rate was comparable to a nonbank business failure rate which was only slightly higher. The annual bank failure rate exceeded 2 percent in only three years, 1877, 1878, and 1893. It exceeded 4 percent only in 1893, when it was 5.8 percent. Notably, the failure rate was 1.7 in the 1884 crisis year and only .5 and .4 percent in the 1890 and 1907 crisis years, respectively.

The 1940 *Annual Report* of the Federal Deposit Insurance Corporation reports data on losses to bank depositors over the period 1868 to 1940. The estimated average rate of loss on assets borne by depositors in closed banks was \$.06 per year per \$100 of deposits from 1865 to 1920, \$.19 from 1865 to 1880, \$.12 from 1881 to 1900, and \$.04 from 1901 to 1920.

The relatively small losses borne by depositors reflected, in part, the high capital-asset ratios of banks, which cushioned depositors against loss in the event of a bank failure. Lindow (1963, p. 2) reports ratios of total bank capital to risk assets from 1863 to 1963. The ratio falls from a high of 60 percent in 1880 to approximately 20 percent at the turn of the century, then rises to about 30 percent in the 1930s and '40s, and falls to under 10 percent by the 1960s.⁴⁴

This discussion is not meant to suggest that bank failures before the creation of the Fed were not potentially very harmful to those involved. It does suggest, however, that even at their worst they were roughly of the same order of magnitude as nonbank business failures. Their aggregate effects appear to have been reasonably well contained by the private provision of bank capital and by the collective protective behavior of the banking system by clearinghouses.

4.2 Banking Crises, Monetary Policy, and the Lender of Last Resort

Our review of the banking crises prior to the Fed, and the clearinghouses' response to them, contains these important lessons. From a systemwide point of view, banking crises were dangerous because they were accompanied by a widespread demand to convert deposits into currency that could not be satisfied under the fractional reserve system without a cen-

⁴⁴ Lindow defines total capital to include total equity, reserves for losses on loans and securities, and subordinated notes and debentures. Risk assets are defined as total assets, less cash, less government securities issued by the U.S. Treasury Department.

tral bank. The clearinghouses responded in two ways. First, they made more currency available to the nonbank public by using certificates in place of currency for clearing purposes. Second, they organized restrictions on cash payments which reduced the quantity of currency demanded by temporarily raising its price relative to deposits. These measures were clearly monetary in the sense that they responded to temporarily high real demands for currency with actions that changed the terms under which currency was supplied to the nonbank public. The evidence that the aggregate effects of banking crises appear to have been relatively small supports the view that the aggregate difficulties were monetary in nature, since policies focusing on currency supply seem to have been sufficient to contain them.

The preceding remarks lead us to conclude that central bank monetary policy would have been both necessary and sufficient to prevent the pre-Fed banking crises. Banking policy, on the other hand, would have been neither necessary nor sufficient, because the policy problem was to satisfy a temporary increase in currency demand, and only monetary policy could do that. Importantly, the effectiveness of monetary policy in this regard does not depend on whether the Fed makes high-powered money available by accepting bank assets as collateral at the discount window or by purchasing securities in the open market. By extension, it seems clear that the Fed's power to create currency remains sufficient today to contain any aggregate disturbances due to sudden sharp increases in currency demand, whether they result from banking problems or other difficulties.

We can make this point more concrete by using it to interpret Walter Bagehot's famous recommendation that a central bank should behave as a lender of last resort.⁴⁵ Bagehot's (1873) policy prescription—summarized as lend freely at a high rate—was to fix the discount rate at a level suitably above the normal range of market rates. The discount rate would then provide an interest rate ceiling, and therefore an asset price floor, which would allow banks, in the event of crises, to liquidate their assets while remaining solvent. The proposal amounts to providing a completely elastic supply of currency at the fixed ceiling rate. Put still another way, it amounts to a suggestion for smoothing nominal interest rates when market rates reach a certain height.

An important point about “lender of last resort” policy in banking crises is that in our nomenclature

⁴⁵ Humphrey and Keleher (1984) provide a historical perspective on the concept of the lender of last resort.

it is not banking policy at all. It is monetary policy because it works by providing an elastic supply of high-powered money to accommodate precautionary demands to convert deposits into currency. Further, central bank lending, in the sense of advancing funds to particular institutions, is not essential to the policy since it can be executed by buying government securities outright.

One aspect of Bagehot's rule deserves additional comment. He argued that the last resort lending rate should be kept fixed above normal market rates, making central bank borrowing generally unprofitable, and minimizing any government subsidies that might accrue to individual banks. He counted on nominal interest rate spikes accompanying banking crises to hit the ceiling rate and thereby automatically trigger the injection of currency into the economy.

Bagehot's advice in this regard, has not been followed by the Fed. Rather, as discussed in Section 2.2 above, the Fed has chosen to regularly smooth interest rates. It has done so either by using a Federal funds rate policy instrument directly, or by using objectives for unsterilized borrowed reserves together with discount rate adjustments to achieve a desired Federal funds rate path.⁴⁶ In principle, regular interest rate smoothing could satisfy Bagehot's concerns. First, it could be free of subsidies to individual banks if carried out by purchases and sales of securities in the open market. Second, it provides lender of last resort services which are automatically triggered at the current central bank interest rate. Of course, routine seasonal and cyclical increases in currency demand are also accommodated at the same rate.

Thus, Federal Reserve lender of last resort policy and the routine provision of an elastic currency are functionally equivalent. Both are directed at insulating the nominal interest rate from disturbances to the demand for currency. Both can be executed by using open market operations to create and destroy high-powered money. Since both are monetary policy we may extend our conclusion from Section 2.1 to make the point that banking and financial regulations are neither necessary or sufficient for a central bank to pursue effective last resort lending.

4.3 Banking Policy and Credit Market Crises

In Section 3.4 we described how banking policy could provide line of credit services to enable illiquid

⁴⁶ See notes 12 and 27.

but solvent banks to continue operating. Implicitly, we assumed that the source of the trouble was limited. At worst only a few banks were insolvent, so when line of credit services sorted the strong banks from the weak, there was a negligible effect on interest rates. We now ask whether banking policy has a role in general credit market crises when interest rates rise. If banking policy is to have a role it will be in response to real interest rate increases, since banking policy is clearly an inappropriate response to nominal interest rate increases caused by monetary disturbances.

The real rate is determined by macroeconomic conditions, including anticipated changes in the state of the economy and uncertainty in future prospects. It adjusts to equate aggregate supply and demand for output, or what is the same thing, to equate the aggregate supply and demand for credit. For example, an increase in future prospects which raises current consumption demand causes a rise in the real rate to induce consumers both to save more out of current income and to produce more, thereby restoring goods market equilibrium. Likewise, an increase in investment demand resulting from a perceived increased profit opportunity induces a real rate rise to maintain goods market equilibrium.

To investigate whether there is a role for banking policy in general credit market crises, we consider an unexpected rise in the real interest rate. Even a temporarily high real rate could cause previously profitable investment projects to become unprofitable.⁴⁷ This, in turn, would generate a rise in nonperforming bank loans, which could create insolvencies. The role for banking market intervention in such circumstances is usually formulated as "lend only to illiquid but solvent banks," as discussed in Section 3.4 above. But it was argued there that illiquidity arises only when financial markets cannot readily determine the status of a particular financial institution. However, unlike firm or bank-specific shocks a general increase in interest rates would be observable in financial markets. If all firms were alike on the one hand and all banks were alike on the other, the distinction between illiquidity and insolvency would surely be irrelevant for real interest rate shocks. A real interest rate spike per se could not make banks

⁴⁷ Many investment projects involve the purchase of inputs—fuel, intermediate goods, and labor—today, but only yield output in the future. Production is profitable if the current value of future output discounted back to the present at the real interest rate is greater than the current cost of inputs. By pushing the present discounted value of output below its cost of production, even a temporarily high real interest rate could cause a project to be shut down temporarily.

illiquid unless it also made them insolvent. In so far as its effects were distributed unevenly across firms and banks, of course, a real rate rise could cause some individual banks to be illiquid but solvent. Thus aggregate disturbances can affect individual bank liquidity in addition to factors specific to a bank. But the fact that an aggregate disturbance is the source of the trouble does not alter the relative advantages of the central bank and private markets in providing liquidity. Central banks and private markets continue to face problems of screening strong from weak banks that we discussed in Section 3.4. Practically, the rule of thumb—lend only to illiquid but solvent banks—could rule out the use of banking policy entirely. But if banking policy did not respect this rule, then it could well have important negative effects by subsidizing risktaking.

We are somewhat uneasy about the implications of our result. While we think the familiar rule of thumb makes sense, we wonder whether discount window lending could be rationalized under a different criterion: to prevent the disruption costs of widespread insolvencies associated with temporary real interest rate spikes. If such aggregate disruption costs were large enough, temporary transfers to the banking system that could avoid such costs might be in society's interest. It should be pointed out, however, that a similar argument could be made for avoiding disruption costs of temporary insolvencies anywhere in the economy. Therefore, acceptance of the criterion for banking policy alone would need to be based on a demonstration that disruption costs are much larger in the banking sector than elsewhere.

In any case, because it would have no effect on goods supply or demand, banking policy could not reverse a real rate rise. Of course, a central bank's interest income could change as a result of banking policy, i.e., exchanging government securities for claims on private banks. But that fiscal effect, per se, would have no implications for the real interest rate.⁴⁸

What banking policy could do is support otherwise insolvent banks by temporarily swapping government securities for nonperforming bank loans. If the disturbance were temporary, and the loans earned nothing for the central bank, then the size of the subsidy would be the lost interest on government securities that has been diverted to bank depositors. Alternatively, if the loans defaulted, the subsidy

⁴⁸ If a central bank's remittances to the Treasury changed as well, and the Treasury adjusted its goods purchases accordingly, then there could be a goods market effect. But this would involve more than banking policy.

would be the entire face value of the loans purchased by the central bank. The Treasury, in turn, would have to finance the loss by cutting back goods purchases, raising current taxes, or borrowing, i.e., raising future taxes. Banking policy of this sort is clearly redistributive in nature, a contingent tax and transfer fiscal policy. It need not, however, represent a subsidy to the banking system as a whole if banks are taxed during normal times to finance any transfers during periods of high real rates. Importantly, to be effective at reducing insolvency risk, the tax and transfer policy would need supporting regulations. Otherwise banks might simply restore the risk of insolvency to its initially optimal level by reducing capital accordingly, or by restructuring contingent liabilities to offset the transfers.⁴⁹ Thus we have another example of how banking policy needs supporting regulation and supervision to be effective.

It must be emphasized that we are by no means advocating the use of banking policy to rescue insolvent banks or, more generally, the use of tax and transfer policies to rescue insolvent firms in other industries. In fact, we think there are serious problems with such a policy. It requires costly regulation and supervision. It opens the door to bank rescues, which might be extremely difficult to limit in practice. It would be difficult to choose when to intervene. And there would be political pressure to abuse the policy. Moreover, it is far from clear that disruption costs associated with widespread temporary insolvencies are large. Last, the potentially perverse incentive effects of systematic banking policies are a matter of concern. Designed to promote financial market stability, they encourage risktaking and lead to the deterioration of private liquidity provision. Thus, they are likely to lead to more severe financial market crises, particularly if political conditions arise where the anticipated public provision of financial support does not materialize.

⁴⁹ This argument is analogous to those that arise in consideration of the "Ricardian Equivalence Proposition," which states that under certain conditions a substitution of public debt for taxation will have no effects on prices or quantities. Robert Barro's *Macroeconomics* (1986) provides an accessible introduction to Ricardian analysis. Chan (1983) provides a proof of Ricardian neutrality under conditions of uncertainty, stressing the analogy to Modigliani-Miller propositions in finance.

The ineffectiveness of credit policy, of which banking policy is an example, is well-illustrated by the student loan program. Student loans need not result in increased expenditure on education. A loan may reduce the extent to which families draw down their own financial saving or sacrifice expenditure on other goods and services to pay for a student's education. Because loan funds are fungible, they cannot assure a net increase in expenditure in the targeted area. The targeted effect would require provisions in the program to prevent substitution for private outlays and to restrict access to other credit sources.

CONCLUSION

This paper has analyzed the need for financial regulations in the implementation of central bank policy. To do so, it has emphasized that a central bank serves two very different functions. First, central banks function as monetary authorities, managing high-powered money to influence the price level and real activity. Second, central banks engage in regular and emergency lending to private banks and other financial institutions. We have termed these functions monetary and banking policies. Our analytical procedure was to investigate how a minimally regulated system would operate and then to consider the consequences of various forms of public intervention. The analysis drew on contemporary economic knowledge in the areas of finance, monetary economics, and macroeconomics.

Our conclusions regarding the need for supporting financial regulation were radically different for monetary and banking policy, respectively. We emphasized that regulations were not essential for the execution of monetary policy. The reason is that high-powered money can be managed with open market operations in government bonds. By its very nature, however, banking policy involves a swap of government securities for claims on individual banks. Just as private lenders must restrict and monitor individual borrowers, a central bank must regulate and supervise the institutions that borrow from it.

Virtually all economists agree that there is an important role for public authority in managing the nation's high-powered money. In contrast, there is little evidence that public lending to particular institutions is either necessary or appropriate. Banking policy has been rationalized as a source of funds for temporarily illiquid but solvent banks. To assess that rationale we developed the distinction between illiquidity and insolvency in some detail, showing the distinction to be meaningful precisely because information about the value of bank assets is incomplete and costly to obtain. Nevertheless, we saw that the costliness of information per se could not rationalize the public provision of line of credit services. Even if central bank lending served a useful purpose earlier in the century, today's financial markets provide a highly efficient means of allocating credit privately. On the basis of such considerations, we find it difficult to make a case for central bank lending, either through the discount window or the payments system, and the regulatory and supervisory activities that support it.

Consideration of the use of monetary and banking policy in response to systemwide crises led us

to modify our conclusion only slightly. We saw that monetary policy could play an important role in banking crises by managing the stock of high-powered money to smooth nominal interest rates. Moreover, it could do so without costly regulation and supervision. Banking policy, on the other hand, directly influences neither high-powered money nor the aggregate supply and demand for goods. So banking policy could not influence either nominal or real interest rates. We recognized, however, that a role for banking policy in preventing banking crises might arise in response to real interest rate spikes, which

could cause widespread insolvencies against which monetary policy would be ineffective. Such banking policy actions could have social value if the temporary disruption costs associated with widespread insolvencies were large. But central bank transfers to troubled financial institutions redistribute wealth between different classes of citizens at best. And inappropriate incentives for risktaking and liquidity management might lead to more severe and frequent financial crises at worst. Hence, it is by no means clear that there is a beneficial role for banking policy even in this case.

REFERENCES

- Bagehot, Walter. *Lombard Street* (1873). New York: Arno Press, 1978.
- Barro, Robert J. "Interest Rate Smoothing." University of Rochester, February 1987.
- . *Macroeconomics* (2nd edition). New York: John Wiley, 1986.
- Barsky, Robert, Greg Mankiw, Jeffrey Miron, and David Weil. "The Worldwide Change in the Behavior of Interest Rates and Prices in 1914." University of Michigan, May 1987.
- Bennett, James and Thomas DiLorenzo. *The Underground Government: The Off-Budget Public Sector*. Washington, DC: Cato Institute, 1983.
- Benston, George J., et al. *Perspectives on Safe and Sound Banking*. Cambridge, MA: MIT Press, 1986.
- Benston, George and Clifford Smith. "A Transaction Cost Approach to the Theory of Financial Intermediation." *Journal of Finance* 31 (May 1976): 215-31.
- Berlin, Mitchell. "Loan Commitments: Insurance Contracts in a Risky World." Federal Reserve Bank of Philadelphia *Business Review* (May/June 1986): 3-12.
- Blueprint for Reform: The Report of the Task Group on Regulation of Financial Services*. Washington, DC: Government Printing Office, 1984.
- Board of Governors of the Federal Reserve System. *Federal Reserve Board Rules and Regulations*. Regulation A (12c FR 201). Washington, Board of Governors of the Federal Reserve System.
- Boyd, John H. and Edward C. Prescott. "Financial Intermediary Coalitions." *Journal of Economic Theory* 38 (April 1986): 211-32.
- Brunner, Karl and Allan H. Meltzer. *Some General Features of the Federal Reserve's Approach to Policy*, in Report prepared for the Subcommittee on Domestic Finance of the House Committee on Banking and Currency. Washington: DC: Government Printing Office, 1964.
- Bulow, Jeremy I. and Kenneth Rogoff. "A Constant Recontracting Model of Sovereign Debt." The Hoover Institution, Stanford University, December 1986.
- Cagan, Phillip. *Determinants and Effects of Changes in the Stock of Money 1875-1960*. Cambridge, MA: National Bureau of Economic Research, 1965.
- Cannon, James G. *Clearing-Houses*. New York: D. Appleton and Company, 1908.
- Chan, Louis. "Uncertainty and the Neutrality of Government Financing Policy." *Journal of Monetary Economics* 11 (May 1983): 351-72.
- Clark, Truman A. "Interest Rate Seasonals and the Federal Reserve." *Journal of Political Economy* 94 (February 1986): 76-125.
- Continental Illinois National Bank: Report of An Inquiry into its Federal Supervision and Assistance*. Staff Report to the Subcommittee on Financial Institutions Supervision, Regulation, and Insurance of the Committee on Banking, Finance and Urban Affairs. Washington, DC: Government Printing Office, 1985.
- Cook, Timothy and Thomas Hahn. "The Information Content of Discount Rate Announcements and Their Effect on Market Interest Rates." Working Paper 86-5. Federal Reserve Bank of Richmond, September 1986.
- Cook, Timothy Q. and Timothy D. Rowe, editors. *Instruments of the Money Market*, 6th ed. Richmond, VA: Federal Reserve Bank of Richmond, 1986.
- Corrigan, E. Gerald. "Financial Market Structure: A Longer View." Federal Reserve Bank of New York *Annual Report*, February 1987.
- Crane, Dwight B. *Managing Credit Lines and Commitments*. Chicago, IL: Association of Reserve City Bankers, 1973.
- Cukierman, Alex and Allan H. Meltzer. "A Theory of Ambiguity, Credibility, and Inflation Under Discretion and Asymmetric Information." *Econometrica* 54 (September 1986): 1099-1128.
- Darby, Michael R. *Macroeconomics: Theory of Income, Employment, and the Price Level*. New York: McGraw-Hill, 1976.
- Diamond, Douglas. "Financial Intermediation and Delegated Monitoring." *Review of Economic Studies* 51 (July 1984): 393-414.

- Dornbusch, Rudiger and Stanley Fischer. *Macroeconomics*, 3rd edition. New York: McGraw-Hill, 1984.
- Fama, Eugene. "Banking in a Theory of Finance." *Journal of Monetary Economics* 6 (January 1980): 39-57.
- . "Financial Intermediation and Price Level Control." *Journal of Monetary Economics* 12 (July 1983): 7-28.
- . "What's Different About Banks?" *Journal of Monetary Economics* 15 (January 1985): 29-39.
- Federal Deposit Insurance Corporation. *Annual Report*, 1940. Washington, DC: Federal Deposit Insurance Corporation, 1941.
- Friedman, Milton. *A Program for Monetary Stability*. Bronx, NY: Fordham University Press, 1960.
- Friedman, Milton and Anna Jacobson Schwartz. *A Monetary History of the United States 1867-1960*. Cambridge, MA: National Bureau of Economic Research, 1963.
- Goodfriend, Marvin. "Discount Window Borrowing, Monetary Policy, and the Post-October 1979 Federal Reserve Operating Procedure." *Journal of Monetary Economics* 12 (September 1983): 343-56.
- . "Monetary Mystique: Secrecy and Central Banking." *Journal of Monetary Economics* 17 (January 1986): 63-92.
- . "Interest Rate Smoothing and Price Level Trend-Stationarity." *Journal of Monetary Economics* 19 (May 1987a): 335-48.
- . *Monetary Policy In Practice*. Richmond, VA: Federal Reserve Bank of Richmond, 1987b.
- Gordon, Robert J. *Macroeconomics*, 4th edition. Boston, MA: Little, 1987.
- Gorton, Gary and Donald J. Mullineaux. "The Joint Production of Confidence: Endogenous Regulation and 19th Century Commercial-Bank Clearinghouses." *Journal of Money, Credit, and Banking* 19 (November 1987): 457-68.
- Gorton, Gary and Joseph Haubrich. "Bank Deregulation, Credit Markets and the Control of Capital." In *Bubbles and Other Essays*. Carnegie-Rochester Series on Public Policy, Vol. 26, edited by Karl Brunner and Allan Meltzer. Amsterdam: North Holland, 1987, pp. 289-334.
- . "Loan Sales, Recourse, and Reputation: An Analysis of Secondary Loan Participations." Department of Finance, University of Pennsylvania, May 1987.
- Government Credit Allocation: Where Do We Go from Here?* Center for Research in Government Policy and Business of the Graduate School of Management, The University of Rochester, November 1975. San Francisco, Institute for Contemporary Studies, 1975.
- Hackley, Howard H. *Lending Functions of the Federal Reserve Banks: A History*. Washington, DC: Board of Governors of the Federal Reserve System, 1973.
- Hall, Robert E. and John B. Taylor. *Macroeconomics: Theory, Performance, and Policy*. New York: Norton, 1985.
- Hanweck, Gerald A. "Bank Loan Commitments." In *Below the Bottom Line*, Staff Study, no. 113. Washington, DC: Board of Governors of the Federal Reserve System, 1982, pp. 103-30.
- Haubrich, Joseph. "Financial Intermediation, Delegated Monitoring, and Long Term Relationships." Wharton School, October 1986.
- Hawkins, Gregory D. "An Analysis of Revolving Credit Agreements." *Journal of Financial Economics* 10 (March 1982): 59-81.
- Hodgman, Donald R. *Selective Credit Controls in Western Europe*. Chicago, IL: Association of Reserve City Bankers, 1976.
- Humphrey, Thomas M. and Robert E. Keleher. "The Lender of Last Resort: A Historical Perspective." *Cato Journal* 4 (Spring/Summer 1984): 275-318.
- Kemmerer, E. W. *Seasonal Variations in the Relative Demand for Money and Capital in the United States*. Washington, DC: National Monetary Commission, 1910.
- King, Robert G. and Charles I. Plosser. "Money as the Mechanism of Exchange." *Journal of Monetary Economics* 17 (January 1986): 93-115.
- . "Money, Credit, and Prices in a Real Business Cycle." *American Economic Review* 74 (June 1984): 363-80.
- Lindow, Wesley. "Bank Capital and Risk Assets." *The National Banking Review*, Comptroller of the Currency, U.S. Treasury Department, September 1963, pp. 29-46.
- Lucas, Robert E., Jr. and Thomas J. Sargent. *Rational Expectations and Econometric Practice*. Minneapolis, MN: University of Minnesota Press, 1980.
- Macaulay, Frederick R. *Bond Yields, Interest Rates, and Stock Prices*. Cambridge, MA: National Bureau of Economic Research, 1938.
- McCallum, Bennett. "Bank Deregulation, Accounting Systems of Exchange, and the Unit of Account: A Critical Review." In *The New Monetary Economics, Fiscal Issues, and Unemployment*. Carnegie-Rochester Series on Public Policy, Vol. 23, edited by Karl Brunner and Allan H. Meltzer. Amsterdam: North Holland, Autumn 1985, pp. 13-45.
- . "The Role of Overlapping Generations Models in Monetary Economics." In *Money, Monetary Policy, and Financial Institutions*. Carnegie-Rochester Conference Series on Public Policy, Vol. 18, edited by Karl Brunner and Allan H. Meltzer. Amsterdam: North Holland, Spring 1983, pp. 9-44.
- . "Price Level Determinacy with an Interest Rate Policy Rule and Rational Expectations." *Journal of Monetary Economics* 8 (November 1981): 319-29.
- McCallum, Bennett and Marvin Goodfriend. "Money: Theoretical Analysis of the Demand for Money." In *The New Palgrave: A Dictionary of Economics*, edited by S. Eatwell, P. Newman, and M. Milgate, 4 volumes. London: Macmillan Press, 1987, Vol. 1, pp. 775-81.
- Mehra, Yash. "Recent Financial Deregulation and the Interest Elasticity of M1 Demand." Federal Reserve Bank of Richmond *Economic Review* (July/August 1986): 13-24.
- Melnik, Arie and Steven E. Plaut. "The Economics of Loan Commitment Contracts: Credit Pricing and Utilization." *Journal of Banking and Finance* 10 (June 1986a): 267-80.
- . "Loan Commitment Contracts, Terms of Lending, and Credit Allocations." *Journal of Finance* 41 (June 1986b): 425-35.

- Mengle, David L., David B. Humphrey, and Bruce J. Summers. "Intraday Credit: Risk, Value, and Pricing." Federal Reserve Bank of Richmond *Economic Review* (January/February 1987): 3-14.
- Miron, Jeffrey A. "Financial Panics, the Seasonality of the Nominal Interest Rate, and the Founding of the Fed." *American Economic Review* 76 (March 1986): 125-40.
- Patinkin, Don. "Financial Intermediaries and the Logical Structure of Monetary Theory." *American Economic Review* 51 (March 1961): 95-116.
- Pavel, Christine. "Securitization." Federal Reserve Bank of Chicago *Economic Review* (July/August 1986): 16-31.
- Pennacchi, George. "Loan Sales and the Cost of Bank Capital." Department of Finance, University of Pennsylvania, November 1986.
- Poole, William. *Money and The Economy: A Monetarist View*. Reading, MA: Addison-Wesley, 1978.
- Reappraisal of the Federal Reserve Discount Mechanism*. Volumes 1-3. Washington, DC: Board of Governors of the Federal Reserve System, 1971.
- Rothschild, Michael and Joseph Stiglitz. "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information." *Quarterly Journal of Economics* 90 (November 1976): 629-50.
- Sargent, Thomas J. *Dynamic Macroeconomic Theory*. Cambridge, MA: Harvard University Press, 1987.
- . *Macroeconomic Theory*. Boston, MA: Academic Press, 1979.
- Sargent, Thomas J. and Bruce D. Smith. "Irrelevance of Open Market Operations in Some Economies with Government Currency Being Dominated in Rate of Return." *American Economic Review* 77 (March 1987): 78-92.
- Smith, Clifford W., Jr. and Jeroold B. Warner. "On Financial Contracting: An Analysis of Bond Covenants." *Journal of Financial Economics* 7 (June 1979): 117-61.
- Sprague, Irvine H. *Bailout: An Insider's Account of Bank Failures and Rescues*. New York: Basic Books, 1986.
- Sprague, O. M. W. *History of Crises Under the National Banking System*. Washington, DC: National Monetary Commission, 1910.
- Summers, Bruce J. "Loan Commitments to Business in United States Banking History." Federal Reserve Bank of Richmond *Economic Review* (September/October 1975): 115-23.
- Timberlake, Richard H. "The Central Banking Role of Clearing Associations." *Journal of Money, Credit, and Banking* 16 (February 1984): 1-15.
- . *The Origins of Central Banking in the United States*. Cambridge, MA: Harvard University Press, 1978.
- Todd, Walker F. "Outline of an Argument on Solvency." Federal Reserve Bank of Cleveland, March 1987.
- "The Tug-of-War Over 'Float'." *The Morgan Guaranty Survey*, December 1983, pp. 11-14.
- U.S. Congress. House. Subcommittee of the Committee on Government Operations. *Bush Task Group Report on Regulation of Financial Services Blueprint for Reform (Part 1)*. Hearings before the Subcommittee of the Committee on Government Operations. 99th Congress, 1st session, 1985.
- U.S. Congress. House. Subcommittee on Economic Stabilization of the Committee on Banking, Finance and Urban Affairs. *Federal Credit Activities*. Hearings before the Subcommittee on Economic Stabilization of the Committee on Banking, Finance and Urban Affairs. 98th Congress, 2nd session, 1984.
- U.S. Congress. House. The Subcommittees of the Government Operations and Banking, Finance and Urban Affairs Committees. *The Role of the Federal Reserve in Check Clearing and the Nation's Payments System*. Joint Hearings before Subcommittees of the Government Operations and Banking, Finance and Urban Affairs Committees. 98th Congress, 1st Session, 1983.
- U.S. Department of Commerce. *Historical Statistics of the United States*. Washington, DC, 1975.
- Wallace, Neil. "A Legal Restrictions Theory of the Demand for 'Money' and the Role of Monetary Policy." Federal Reserve Bank of Minneapolis *Quarterly Review* 7 (Winter 1983): 1-7.
- Young, John E. "The Rise and Fall of Federal Reserve Float." Federal Reserve Bank of Kansas City *Economic Review* (February 1986): 28-38.