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## Member Bank Borrowing and the Fed's Contractionary Monetary Policy during the Great Depression

The influence of the reserve banks upon the volume of credit is felt not directly, but indirectly through the member banks. The reserve banks do not "push" credit into use.  
Benjamin Strong, U.S. House of Representatives, 1926

### INTRODUCTION

THE CONTRIBUTION OF "INEPT" FEDERAL RESERVE monetary policy to the length and severity of the Great Depression is now well understood. In their *Monetary History of the United States*, Friedman and Schwartz (1963) demonstrate the importance of monetary forces in the Depression. And recent studies by Bermanke (1983), Field (1984a,b), and Hamilton (1987) emphasize further the importance of restrictive monetary policy on economic activity from 1929 to 1933. However, the reasons why the Fed failed to respond vigorously to the Depression are not so clear. Were the Fed's failures the product of leadership or other organizational changes? Or, were they caused by the pursuit of a flawed strategy, and thus independent of the System's structure?

Friedman and Schwartz (1963, pp. 407–19) contend that the death of Benjamin Strong, Governor of the Federal Reserve Bank of New York, in 1928, and a subsequent reorganization of the Open Market Committee caused a major change in the Fed's responsiveness to economic conditions. They argue that under Strong's

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leadership in the 1920s the Fed had used open-market operations effectively to limit fluctuations in economic activity. But those officials who gained power after Strong's death did not understand the role of monetary policy and permitted widespread bank failures and collapse of the stock of money during the early 1930s.

Two aspects of the Friedman and Schwartz interpretation of Federal Reserve behavior have been challenged. Their view that monetary policy was used effectively during the 1920s has been challenged by Miron (1988), Toma (1989), and Wheelock (1989). Miron shows that output was less stable following the Fed's founding in 1914 than it had been previously. Wheelock finds evidence that the Fed did attempt to stabilize output, but that its operation had no impact on the volume of Federal Reserve credit outstanding. And Toma demonstrates that the Fed's open-market operations had no effect on the supply of money. Since these studies suggest that the Fed's policies were not successful during the 1920s, they imply that the failure of monetary policy to revive the economy during the Depression might not have resulted from a substantial change in Fed behavior.

Wicker (1966) and Brunner and Meltzer (1968) argue that indeed Fed errors during the Depression are traceable to policy during the 1920s. Wicker contends that the Fed had little understanding of how monetary policy should be used to stabilize economic activity. He argues also that the Fed's operations in the 1920s were made in response to international events, not to stabilize the domestic economy (Wicker 1966, pp. 77–94, 106–16). Brunner and Meltzer (1968) and Meltzer (1976) argue that the Fed did not respond vigorously to the Depression because officials believed that low nominal interest rates and little member bank borrowing signaled exceptional monetary ease. Brunner and Meltzer contend that the Fed had been guided similarly by interest rates and bank borrowing during the 1920s and hence that there was no change in Fed behavior.

During the 1920s the Fed developed a reserve position strategy in which it used open-market operations to “target”<sup>1</sup> borrowed reserves. The current Fed procedure of using borrowed reserves as an operating target is quite similar. And, as Thornton (1988, p. 33) describes, “strict adherence to the borrowings procedure will not provide effective money stock control.” In this paper I argue that during the 1920s and early 1930s the System's operating tactics caused monetary policy to be ineffective, even destabilizing. The Fed's strategy did not lead to effective money stock control. And the borrowed reserves procedure was particularly inappropriate during the Depression because of instability in borrowed reserve demand induced by financial crises. The Fed failed to account for these shifts, and continued to interpret little borrowing as a sign of exceptional monetary ease. So, despite widespread bank failures and deflation, Fed officials saw little need for vigorous open-market purchases.

The next section describes the Fed's tactics, focusing especially on its theory of borrowed reserve demand. The following sections analyze empirically the demand

<sup>1</sup>I put the word target in quotes since the Fed did not generally specify a quantity target for borrowed reserves. It used the variable more as an indicator of monetary conditions, determining the specific volume of open-market operations needed to achieve its ultimate goals.

for borrowed reserves during the Depression, and illustrate the impacts of the decline in economic activity and the financial crises on that demand. Like Brunner and Meltzer, I conclude that there was no significant change in Fed procedures between the 1920s and early 1930s, and that the Fed's mistakes during the depression can be attributed to its failure to interpret monetary conditions correctly.

#### THE FED'S STRATEGY AND THEORY OF MEMBER BANK BORROWING

During the early 1920s the Fed observed that when it purchased government securities in the open market the volume of member bank borrowing tended to fall by a like amount. But, despite this apparent inability to change the total volume of Federal Reserve credit outstanding, the Fed observed that market interest rates did seem to respond to its operations. The Fed inferred that

Various monetary factors—such as gold movements, changes in currency demand, and open-market operations by the [R]eserve [B]anks . . . determine the volume of indebtedness (of member banks to the Federal Reserve) . . . and changes in this indebtedness appear to be the initiating force in corresponding changes in money rates. (Riefler 1930, p. 27)

Thus, largely exogenous flows of nonborrowed reserves were seen as the principal cause of member bank borrowing. And changes in member bank borrowing were thought to produce changes in market interest rates. The Fed inferred that open-market purchases stimulated economic activity by reducing borrowed reserve demand and interest rates. And, similarly, that sales increased member bank borrowing and led to higher rates which would slow economic activity.

Fed publications and statements by System officials during the 1920s make the Fed theory of member bank borrowing clear. The classic statement of the theory was made by Riefler (1930). According to Riefler (1930, p. 28), “member banks are in general reluctant to borrow from the [R]eserve [B]anks, (and) when they do borrow they are in most cases motivated by necessity rather than profit.” For an individual bank, deposit outflows produce the necessity. But for the system as a whole, the need for borrowing comes from open-market sales, gold outflows, or any other reduction in nonborrowed reserves.

Although he argued that in general banks do not borrow to exploit profit opportunities, Riefler (1930, p. 34) accepted that bank decisions to borrow were influenced by the differential between the yield on short-term securities and the discount rate:

[I]t seems highly probable that member banks when they borrow and when they adjust their operations to repay their borrowing are affected to a certain extent by its cost in relation to money rates in the market.

The notion that banks are reluctant to borrow reserves, and do so only when forced to, is fundamental to the Fed's use of borrowed reserves as a policy guide. If this theory is correct, then the level of borrowing will indicate accurately the degree of monetary ease or restraint. Relatively heavy borrowing will reflect pressure on

bank reserve positions and tight money, while little borrowing will reflect monetary ease. But, if the Fed's theory is incorrect, and banks do borrow to expand their loans and investments, the level of borrowed reserves will not reflect monetary conditions accurately. Since loan demand increases during economic expansions and declines during recessions, a specific level of borrowed reserves might reflect monetary ease during an expansion and tight money during a recession. Moreover, if the Fed targets a specific level of borrowed reserves, the money supply will tend to increase during expansions and decrease during recessions. For example, during a recession member bank borrowing tends to decline since loan demand falls. If borrowed reserves fall below the Fed's target, the Fed will be tempted to sell securities. The worse a recession, the greater the decline in borrowed reserves, and, paradoxically, the more restrictive the Fed is likely to be. The Fed actually contributes to economic instability by exacerbating procyclical swings in the supply of money.

The Fed did not have an inflexible borrowed reserves target during the 1920s or early 1930s, and it did not sell securities during recessions. However, the Fed did interpret relatively heavy borrowing by banks as a sign of tight money, and little borrowing as a sign of ease. Moreover, from the level of borrowed reserves the Fed determined the appropriate volume of open-market operations necessary to achieve its goals. Benjamin Strong made this clear in a statement to the Governors Conference in 1926 (Chandler 1958, pp. 239–40):

Should we go into a business recession while the member banks were continuing to borrow directly 500 or 600 million dollars . . . we should consider taking steps to relieve some of the pressure which this borrowing induces by purchasing Government securities and thus enabling member banks to reduce their indebtedness . . . Future changes in our loan account are especially significant as a guide . . .

As a guide to the timing and extent of any purchase which might appear desirable, one of our best guides would be the amount of borrowing by member banks in principal centers . . . .

This statement suggests that Strong would have judged money to be quite easy in 1930–31, since member bank borrowing averaged just \$243 million from January 1930 through September 1931 (Board of Governors, 1943, p. 371).<sup>2</sup> It is not evident from Strong's statement that policy would have been more expansionary in 1930–31 had he lived. It suggests also why the Fed made relatively large open-market purchases during minor recessions in 1924 and 1927, but made few purchases in 1930–31. The sharp economic downturn in 1930–31 led to a greater decline in borrowed reserves than in 1924 or 1927. Consequently, the Fed inferred that money was already quite easy, and that few open-market purchases were necessary.<sup>3</sup> Unfor-

<sup>2</sup>Member bank borrowing increased sharply in the final week of September 1931 because of heavy deposit withdrawals brought on by Great Britain's break with the gold standard. However, the Fed did not buy securities in response, supposedly because it lacked sufficient gold reserves to back increased liabilities. Friedman and Schwartz (1963, pp. 399–406) and Wicker (1966, pp. 169–71) dispute this reason, but Epstein and Ferguson (1984, pp. 964–65) argue that the Fed was so constrained.

<sup>3</sup>The Fed bought some \$440 million of securities from March through September 1924. Member bank borrowing averaged \$620 million in the three months prior to the beginning of these purchases, and did not fall below \$250 million during the purchase months. The Fed bought \$300 million of securities from March through December 1927. Borrowing averaged \$514 in the three months prior to March, and never

tunately, as Friedman and Schwartz (1963, pp. 340–41) show, the Fed’s failure to offset the decline in bank borrowing in 1930–31 allowed the stock of money to decline.

Friedman and Schwartz argue that Strong’s death and the subsequent reorganization of the Open Market Committee led to the failures of monetary policy during the Depression. Therefore, it is important to know precisely Strong’s understanding of the transmission process and of the behavior of borrowed reserves. His statement to the Governors Conference indicates he viewed borrowed reserves as an important guide to monetary conditions. And his testimony that the “Reserve Banks do not ‘push’ credit into use” (Strong 1926) is significant since it implies a view that expansionary operations are appropriate and effective only if there is an increasing demand for Federal Reserve credit.

Strong’s understanding of borrowed reserve demand is less clear. In a speech to the Harvard Graduate Economics Club in 1922 he stated (Chandler 1958, pp. 196–97):

Practically all borrowing by member banks from the Reserve Banks is *ex post facto*. The condition which gives rise to the need for borrowing had already come into existence before the application to borrow from the Reserve Bank was made, and experience has shown that large borrowings in New York City have in the past usually been explained by the member bank as caused by the borrowing operations of the Treasury, by seasonal demands, but more frequently because of the withdrawal of deposits.

Moreover, Strong said (Chandler 1958, p. 196):

[I]n the long run, it is my belief that the greatest influence upon the member bank in adjusting its daily position is the influence of profit or loss . . . It may, therefore, be safely stated that as business expands . . . member banks will borrow from the Reserve Banks to make good deficient reserves caused by the expansion of their loans . . . [I]f borrowing at the Reserve Bank is profitable beyond a certain point, there will be strong temptation to use surplus reserves when they arise for the purpose of making additional loans rather than for repaying the Reserve Bank.

And Strong testified before the House Banking Committee in 1926 (United States House of Representatives 1926, p. 345):

When the country banks borrow of the reserve banks and continue to borrow for a long period, we generally try to find out what the occasion of the borrowing is. It may be that they are borrowing from us just to buy securities . . . It frequently occurs that member banks who have stock exchange loans have to borrow from us for at least one day . . . They frequently borrow for longer periods before calling their stock exchange loans.

Thus, while Riefler’s theory recognized that the decision to borrow further or reduce outstanding discounts depended upon the relative cost of doing so, it did not

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fell below \$400 million during the year. From January 1930 through September 1931 the Fed bought \$290 million of securities. Although borrowed reserves totaled \$500 million in January 1930, they declined sharply and averaged \$243 million through September 1931. Moreover, major banks in New York City were entirely out of debt throughout much of this period, and had accumulated excess reserves. Thus to the Fed, money appeared much easier in 1930–31 than it had in either 1924 or 1927.

recognize that banks would borrow expressly to increase their earning assets. Strong seems to make this link, however. But Brunner and Meltzer (1968) contend that Strong's view of member bank borrowing was consistent with Riefler's.<sup>4</sup> A statement by Strong to the Governors Conference in 1926 supports their contention (Chandler 1958, p. 239):

Experience in the past has indicated that member banks when indebted to the Federal Reserve Bank of New York . . . constantly endeavor to free themselves from the indebtedness, and as a consequence such pressure as arises is in the direction of curtailing loans.

Although these statements are somewhat contradictory, it does seem that Strong was aware that banks borrowed reserves to extend new loans and to pursue profitable investments. But he also viewed member bank borrowing as an appropriate policy guide and as central to the transmission of monetary policy to credit markets. Apparently Strong did not reject the use of borrowed reserves as a policy guide, despite the implication that if banks do borrow to extend new loans, then the level of borrowing will not reflect monetary conditions accurately.<sup>5</sup>

The Real Bills Doctrine, upon which the Fed's founders intended the System to operate, implies that member bank borrowing should decline during recessions since a lower level of economic activity requires less Federal Reserve credit to sustain it. Most Fed officials believed it was appropriate that Federal Reserve credit contract during recessions. Indeed a minority of these officials argued for open-market sales to hasten the decline.<sup>6</sup> Strong believed that open-market purchases should be made during recessions, but he did not advocate increases in total Federal Reserve credit outstanding.

Was the Fed's theory of the transmission process and its interpretation of member bank borrowing during the depression consistent with that of 1924–29? An answer to this question would provide considerable evidence for the debate over policy consistency.

Wicker (1966) and Brunner and Meltzer (1968) argue that there was no inconsistency in Fed behavior between the 1920s and early 1930s. Referring to open-market policy in 1930, Wicker writes (1966, p. 156):

[T]he New York (Federal Reserve) Bank did not . . . contemplate substantial purchases of government securities. Its objective was limited in scope and did not go beyond the goal set out by . . . Strong in the nineteen-twenties—that is, to eliminate the indebtedness of the New York and Chicago banks.

However, Schwartz (1981, p. 42) and Epstein and Ferguson (1984, p. 961) contend that officials of the Federal Reserve Bank of New York understood that member bank borrowing was not an appropriate policy guide, but since they do not provide

<sup>4</sup>Brunner and Meltzer refer to this view as the "Riefler-Burgess Doctrine." Meltzer (1976) calls it the "Riefler-Burgess-Strong" analysis.

<sup>5</sup>Of course, I have had to be selective in my quotations. See Strong's testimony in United States House of Representatives (1926), Chandler (1958), Friedman and Schwartz (1963, chapter 6) and Wicker (1966) for more extensive evidence on Strong's views.

<sup>6</sup>See United States Senate (1931) for an interesting compilation of the views of the various Reserve Banks.

direct quotes it is difficult to know precisely the views of these officials. Friedman and Schwartz (1963, p. 370) cite a July 1930 statement by George Harrison, who became Governor of the Federal Reserve Bank of New York after Strong's death, which suggests that he understood this error: "An even small amount of borrowing under present conditions is as effective a restraint as substantially a greater amount was a year ago." But Wicker (1966, pp. 156–57) shows that Harrison ceased to advocate open-market purchases after member bank borrowing by money center banks had been eliminated.

Another official of the Federal Reserve Bank of New York, W. Randolph Burgess, was among the strongest proponents of open-market purchases during the Depression. But in his book, Burgess (1946, p. 250) indicated clearly that there was no change in Fed behavior between the 1920s and early 1930s:

From 1922 through 1927 the response of the economic organism to relatively small changes in Federal Reserve policy was extraordinary. But in 1928 and 1929 and later in the depression even the most vigorous measures taken by the Reserve System had relatively little effect. Member bank borrowing, interest rates, and the growth of bank credit did indeed respond in a measure but these in turn failed to influence the country's economy.

To Burgess, there was no inconsistency in the use of monetary policy, only in the economy's response to it.

Burgess (1946, pp. 54, 61) also restated Riefler's model of member bank borrowing:

Banks usually borrow because their reserves have become impaired; that is, they borrow after the event which makes it necessary. Only rarely do they borrow specifically to lend again . . . (but) There were usually some banks, however, which tended to overuse the borrowing privilege . . . .

His (1946, pp. 220–21) explanation of the relationship between member bank borrowing and interest rates was again the classic Fed theory presented by Riefler:

When the member banks find themselves continuously in debt at the Reserve Banks, they take steps to pay off that indebtedness. They tend to sell securities, call loans, and restrict their purchases of commercial paper and other investments. The consequence is that when a large number of member banks are in debt, money generally becomes firmer . . . and rates increase. Conversely, when most of the member banks are out of debt . . . money rates . . . become easier. This relationship rests largely on the unwillingness of banks to remain in debt at the Reserve Banks.

Moreover, Burgess (1946, p. 195) argued, "interest rates are a sensitive index of changing credit conditions. They are perhaps the best available measure of the adaptation of the credit supply to the country's needs."

Chandler (1971, pp. 133–59) analyzes the policy views of several Fed officials during the Depression. It is clear from his study that during the early 1930s most believed that money was exceptionally easy since market interest rates and borrowed reserves were low.<sup>7</sup> Federal Reserve publications, such as the *Bulletin*, also

<sup>7</sup>In fact, as Chandler and Epstein and Ferguson (1984) show, some Fed officials argued that open-market purchases would have been harmful, interfering with a process of "liquidation," necessary before

indicate that the Fed believed money was easy during 1930 and during the first eight months of 1931. For example, the October 1930 *Bulletin* (p. 613) states:

Easy credit conditions at the present time are general throughout the country, as indicated by the small volume of indebtedness of member banks to the reserve banks in all Federal Reserve Districts.

The Fed's use of a free reserves strategy in the 1950s and 1960s was an extension of the strategy developed during the 1920s, and it seems unlikely that the Fed abandoned the strategy during the depression.<sup>8</sup> Undoubtedly the Fed would have been more expansionary, particularly in early 1930, had the Federal Reserve Bank of New York retained its role as System leader. But it does seem that the Fed's failures during the Depression were due largely to its flawed strategy. The central flaw in that strategy was the use of borrowed reserves as a policy guide. The following sections illustrate empirically the errors in the Fed model of the demand for borrowed reserves. The results demonstrate the inadequacies of the Fed's theory and suggest further the causes of monetary policy errors during the Great Depression.

#### AN ALTERNATIVE MODEL OF THE DEMAND FOR MEMBER BANK BORROWING

The first challenge to the theory of member bank borrowing described by Riefler was from Turner (1938). While Riefler concluded that member bank borrowing was generally unresponsive to the discount rate, or to the difference between the discount rate and market interest rates, Turner reached the opposite conclusion, and went on to describe how banks were responsive to the alternative costs of acquiring reserves. Modern theoretical and empirical studies of member bank borrowing, such as Goldfeld and Kane (1966), Dutkowsky (1984), and Dutkowsky and Foote (1985) derive from Turner's pioneering work.

In the Goldfeld-Kane model a bank is faced with an uncertain reserve need, perhaps due to deposit withdrawals or to the bank's own expansionary activities, which is met either by selling a short-term security or by borrowing from the Fed. The reserve need is assumed to be composed of permanent and transitory components. For the empirical analysis, the bank's expected permanent reserve need is measured as a weighted sum of current and past flows of nonborrowed reserves and the intercept, reflecting the bank's desire to expand its earning assets. Given these flows the bank chooses between selling a security and borrowing, depending upon the spread between the yield on the security and the discount rate. Finally, lagged borrowed reserve levels are included in the model to capture stock adjustment. The Goldfeld-Kane model is thus:

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the start of a business recovery. For example, Governor James McDougal of the Federal Reserve Bank of Chicago argued against open-market purchases in 1930, claiming, "it would be inadvisable to force additional credit into an already oversupplied market." In 1931 McDougal advocated open-market sales, arguing that the Fed's policies had created artificially easy monetary conditions.

<sup>8</sup>Free reserves equal excess reserves less borrowed reserves. See Meigs (1962) for a discussion of the flaws in a free reserves strategy.

$$B_t = a_0 + a_1(r_m - r_d)_t + \sum b_i \Delta R^u_{t-i} + \sum c_j B_{t-w_j} + e_t . \quad (1)$$

$B$  = the level of borrowed reserves ;

$r_m$  = market interest rate ;

$r_d$  = Federal Reserve Discount Rate ;

$R^u$  = the level of nonborrowed reserves<sup>9</sup> ;

$\Delta$  = first difference operator ;

$e$  = random error with zero mean and constant variance.

The principal difference between this model and that of Riefler (1930) is the explicit incorporation of bank desires to expand their asset portfolios, although Goldfeld and Kane do it rather crudely. This paper uses the Goldfeld-Kane model, but, like Goldfeld (1966), I estimate the change in borrowing ( $\Delta B$ ), rather than the level. This equation is derived simply by subtracting  $B_{t-1}$  from each side of the Goldfeld-Kane model. Ignoring lagged changes in nonborrowed reserves and those of more than one period in the level of borrowed reserves, the basic model of the flow of borrowed reserves is thus (time subscripts suppressed):

$$\Delta B = a_0 + a_1 (r_m - r_d) + b_0 \Delta R^u + (c_0 - 1) B_{-1} + e . \quad (2)$$

Dutkowsky (1984) and Dutkowsky and Foote (1985) have recently extended the Goldfeld-Kane model to account for nonlinearity in the relationship between bank borrowing and the market interest rate–discount rate spread. In addition to the discount rate (and transactions costs), Dutkowsky's model incorporates bank reluctance to borrow from the Fed and Fed surveillance of borrowing banks as additional borrowing costs. These latter costs increase with the level of borrowing, and do so at an increasing rate. Dutkowsky derives a switching model of borrowing in which member bank borrowing is zero below some (positive) rate spread. At higher spreads borrowing is positive, but since the implicit cost of borrowing rises as the level of borrowing increases the relationship between borrowing and the rate spread is nonlinear. Finally, at a sufficiently high rate spread, all of the bank's reserve need will be satisfied by borrowing from the Fed and borrowing will be invariant with respect to the rate spread.

Following Dutkowsky, I incorporate switching behavior and nonlinearity in my econometric analysis of borrowed reserve demand for the 1920s and early 1930s. However, the extent to which the Fed discouraged bank borrowing varied consider-

<sup>9</sup>Goldfeld and Kane did not adjust for changes in required reserves until Aigner and Bryan (1968) noted that such an adjustment should be made. From 1924 through 33 there were no changes in required reserve ratios, but because of flows between different bank classes and types of deposit accounts, there were effectively changes in the required reserve ratio. Unfortunately, the data on types of deposits by bank classes do not exist before 1929 which would allow me to correct nonborrowed reserves for these changes.

ably during these years, and hence the applicability of the reluctance/surveillance costs depends on the specific years studied.

During World War I and in the immediate postwar months, the Federal Reserve encouraged member banks to purchase U.S. government obligations by offering a preferential discount rate on borrowings against these securities. Bank borrowing increased substantially in these years, from \$134 million in August 1917 (when monthly data are first available) to a peak of \$2,780 million in October 1920 (Board of Governors 1943, p. 369).<sup>10</sup> Although the Reserve Banks initiated significant discount rate increases beginning in November 1919, the preferential rate on borrowings secured by government obligations was not eliminated by all Banks until November 1921 (Board of Governors 1943, p. 423). Thus, at least during the war and for some months after, Fed surveillance and bank reluctance to borrow probably had little, if any, effect on borrowing.

By 1920 the Fed's attitude toward member bank borrowing had begun to change. Although the principal reason for discount rate increases in 1919 and 1920 was to limit further declines in the System's reserve position, Fed officials also hoped to control inflation and stock market speculation by curtailing discount loans (Wicker 1966, pp. 32–45). Debate within the Fed centered on how to provide sufficient credit for Treasury financing operations and other "legitimate" needs, without simultaneously encouraging the use of Fed credit for speculation (Chandler 1958, pp. 153–69).

Throughout the 1920s Fed officials became increasingly concerned with limiting the use of Federal Reserve credit to finance stock market speculation. The disagreement within the Reserve System in 1928 and 1929 about how to control this usage is well known (see Friedman and Schwartz 1963, pp. 254–68, and Wicker 1966, pp. 129–43). The Federal Reserve Board called on the Reserve Banks to refuse loans to any bank carrying stock market loans. Although the Reserve Banks generally favored discount rate hikes to limit borrowing, instead of "direct pressure," they did monitor borrowing banks closely.<sup>11</sup> Certainly Fed surveillance was a non-negligible borrowing cost in these years, and it is appropriate to incorporate this cost in the empirical analysis of member bank borrowing.

In contrast to the Fed's theory of member bank borrowing described by Riefler, Goldfeld and Kane argue that banks might borrow reserves to accommodate customer loan demand.<sup>12</sup> During the 1920s and early 1930s the Fed observed that flows of nonborrowed reserves, generated primarily by open-market operations, gold and currency flows, led to opposite changes in borrowed reserves. System officials inferred that the pressure on bank reserve positions generated by these flows was the principal determinant of bank borrowing. But despite the tendency of member bank borrowing to offset changes in nonborrowed reserves, total banking system reserves

<sup>10</sup>For comparison, total member bank reserves equaled \$1,141 million in August 1914 and \$1,815 million in October 1920.

<sup>11</sup>In response to a Senate Banking Committee survey in 1931, most of the Reserve Banks indicated that they discouraged continuous borrowing by member banks (United States Senate 1931, pp. 790–92).

<sup>12</sup>Earlier, Hodgman (1961) had argued that bank desires to accommodate customer loan demand is a principal determinant of member bank borrowing. And, Goldfeld (1966) found loan demand to be a significant explanatory variable in his member bank borrowing regression.

were not constant in these years. Member bank borrowing declined during the economic downturns in 1924, 1927, and 1929–31, suggesting that as output fell and the demand for loans declined, banks borrowed less from the Federal Reserve. If not offset, total reserves and perhaps the money supply would have fallen.<sup>13</sup>

The substantial decline in borrowed reserves in the early 1930s was likely due in part to decreased loan demand as output and stock market activity declined. I include changes in bank debits (*Debits*) to capture the influence of economic activity on borrowed reserve demand. Suitable monthly data on loan demand are unavailable for the interwar period, as are estimates of national income. Bank debits have often been used as a proxy for income; moreover, they capture financial transactions and other transfers that are sources of loan demand but are not part of current national income. It is expected that increasing debits meant greater loan demand and hence led to increased member bank borrowing from the Federal Reserve.

A second major flaw in the Fed's model was its failure to account for possible instability in borrowed reserve demand induced by financial crises. Friedman and Schwartz (1963) show that banking panics during the Depression produced sharp declines in the deposit-reserve and deposit-currency ratios. Banks became more conservative and were probably less willing to borrow reserves. Describing the failure of borrowing to increase sufficiently to replace outflows of nonborrowed reserves in late 1931, Friedman and Schwartz (1963, pp. 318–19) write:

The aversion to borrowing by banks, which the Reserve System had tried to strengthen during the twenties, was still greater at a time when depositors were fearful for the safety of every bank and were scrutinizing balance sheets with great care to see which banks were likely to be the next to go . . . .

The Fed seems to have been oblivious to the effects of these crises, and continued to interpret little borrowing as a sign of extreme monetary ease. I include a dummy variable (*D*) set equal to 1 during the Depression and to 0 before to test the hypothesis that a downward shift occurred in the borrowed reserve demand function. The complete model of borrowed reserve demand estimated here is thus:

$$\begin{aligned} \Delta B = & \alpha_0 + \alpha_1(r_m - r_d) + \alpha_2\Delta R^u + \alpha_3B_{-1} + \alpha_4\Delta Debits + \alpha_5D \\ & + e_1 \end{aligned} \quad (3)$$

where  $(r_m - r_d) \leq (r_m - r_d)^*$  ;

$$\begin{aligned} \Delta B = & \beta_0 + \beta_1 \ln(1 + r_m - r_d) + \beta_2\Delta R^u + \beta_3B_{-1} + \beta_4\Delta Debits \\ & + \beta_5D + e_2 \end{aligned} \quad (4)$$

where  $(r_m - r_d) > (r_m - r_d)^*$  .

<sup>13</sup>As noted above, it is probably extreme to argue that Fed officials were unaware of the procyclical nature of borrowed reserves. However, it is clear that they did view borrowing as an appropriate policy guide and, moreover, that there was no reason to offset declines in borrowed reserves during recessions.

The rate differential  $(r_m - r_d)^*$  is the spread at which switching occurs. When the spread is less than or equal to  $(r_m - r_d)^*$  borrowing will not be the least-cost means of acquiring reserves, and discount loans will be minimal. In this regime borrowing should not be affected by the particular level of the rate spread, or by the bank's desire to accommodate loan demand. Hence the  $\alpha$  coefficients should equal zero. Nevertheless, because the model is estimated with aggregate data these variables are included in equation (3). The particular differential at which switching occurs will differ across banks, so in the aggregate borrowing will likely be somewhat responsive to these variables.<sup>14</sup> Equation (4) models borrowing when the rate spread is above the switchpoint. Following Dutkowsky (1984), I assume the relationship between borrowing and the rate spread is log-linear in this region.<sup>15</sup> The coefficients  $\beta_1$  and  $\beta_4$  are expected to be positive, while  $\beta_2$ ,  $\beta_3$ , and  $\beta_5$  are expected to be negative.

#### ECONOMETRIC RESULTS

Tables 1 and 2 report regression estimates of the demand for member bank borrowing for January 1924–February 1933.<sup>16</sup> Separate results are presented for all member banks in the New York Federal Reserve district (Table 1), and for reporting member banks in New York City (Table 2). On average, the New York district accounted for 25 percent of the borrowing of all U.S. member banks during this period. Moreover, only in this district was the discount rate below the market rate of interest, measured here as the commercial paper rate, during the Depression, and then only through May 1932.

Equation (1.1) is an OLS estimate of the basic Goldfeld-Kane model incorporating bank debits and the Depression dummy variable as additional independent variables, but ignoring the possibility of switching or nonlinearity in the rate spread-borrowing relationship.<sup>17</sup> The Depression dummy is set equal to 0 from January 1924 through November 1929, and equal to 1 from December 1929 through February 1933.<sup>18</sup> All of the regression coefficients have the anticipated signs, and those

<sup>14</sup>See Dutkowsky (1984) and Dutkowsky and Foote (1985) for thorough discussions of the problems of estimating a micro-switching regression model with aggregate data. The latter paper considers the consequences of temporal aggregation in which the interest rate differential varies over the course of the month while the monthly average is used in estimation.

<sup>15</sup>Also like Dutkowsky (1984), I do not attempt to estimate the upper switchpoint, that is, the spread at which banks satisfy all of their reserve needs by borrowing and the demand for borrowed reserves is completely inelastic. Dutkowsky argues that the log-linear form captures adequately the leveling out of borrowing at higher rate differentials.

<sup>16</sup>According to Chandler (1958, p. 199) the Fed had begun to use open-market operations to achieve a variety of policy objectives by January 1924, and was inferring the impact of its operations by observing member bank borrowing. Moreover, the Fed had eliminated the preferential discount rate on borrowing secured by government obligations, and had begun to discourage banks from continuous borrowing. Thus it seems appropriate to use this date as the starting point here. I end with February 1933 since the Banking Panic of March 1933 and subsequent institutional changes greatly affected the environment in which banks operated. In addition, there was little bank borrowing after that date.

<sup>17</sup>Seasonal dummy variables also were included in a second set of estimations which are not reported. They had little explanatory power, and in no way altered qualitatively the results presented in Tables 1 and 2.

<sup>18</sup>The initial break in the stock market occurred in late October 1929 but was followed by other significant declines in November. Thus, I chose to set the dummy equal to 0 in November, rather than

TABLE 1  
 THE DEMAND FOR MEMBER BANK BORROWING, NEW YORK DISTRICT,  
 JANUARY 1924–FEBRUARY 1933

Dependent Variable: $\Delta B$			
Equation	(1.1)	(1.2)	(1.3)
Intercept	14.40 (6.52)*	15.93 (8.18)	2.24 (8.82)
$(r_m - r_d)$	13.66 (6.52)*	6.31 (8.95)	
$\ln(1 + r_m - r_d)$			52.51 (17.38)**
$B_{-1}$	-0.11 (0.03)**	-0.17 (0.09)	-0.11 (0.03)**
$\Delta R^u$	-0.46 (0.04)**	-0.06 (0.03)	-0.64 (0.04)**
$\Delta Debits$	0.99 (0.53)	1.72 (0.62)*	1.12 (0.46)*
$D$	-10.51 (5.81)	-1.60 (7.38)	-18.60 (5.34)**
ADJ. $R^2$	.57	.45	.77
S.E.R.	24.93	10.59	19.96
Observations	109	20	89
Switchpoint <sup>a</sup>		0.13	0.13

NOTES: Standard errors in parentheses. Adj.  $R^2$  is the  $R^2$  adjusted for degrees of freedom. S.E.R. is the standard error of the regression. \*\* indicates statistically significant at the .01 level. \* indicates statistically significant at the .05 level.  
<sup>a</sup> estimate of  $(r_m - r_d)^*$ .  
 Sources and variable definitions: see appendix.

on rate differential, lagged borrowing, and the flow of nonborrowed reserves are statistically significant.

Equations (1.2) and (1.3) incorporate switching behavior and nonlinearity in the relationship between bank borrowing and the rate differential. The rate spread at which switching occurs,  $(r_m - r_d)^*$ , is estimated using a search procedure to locate that spread that maximizes the value of the log-likelihood function.<sup>19</sup> Once determined, OLS is used to estimate the upper- and lower-regime regressions. The estimate of  $(r_m - r_d)^*$  is 0.13, and the null hypothesis of no switching can be rejected at the .01 level.<sup>20</sup> Further, a test of the hypothesis that the switchpoint equals zero also can be rejected (at the .02, but not .01, level).<sup>21</sup> This suggests that

equal to 1. The results reported in Tables 1 and 2 are qualitatively unaffected by setting the dummy equal to 1 beginning in October, November, or December 1929, or in December 1930, at the end of the first major banking crisis.

<sup>19</sup>Specifically, I searched for the value of  $(r_m - r_d)$  that maximizes the sum of the log-likelihood values from estimates of equations (3) and (4). See Johnston (1984, pp. 407–409) and Dutkowsky (1984, pp. 417–18) for a further discussion of this procedure.

<sup>20</sup>The specific null hypothesis is a joint hypothesis of no switching and of the presence of a linear relationship between the rate spread and member bank borrowing. That is, it is a test of the equality of all of the coefficients of equation (1.2) with those of (1.3), with a further restriction that the coefficient on  $\ln(1 + r_m - r_d)$  in equation (1.3) equals 0. The likelihood ratio statistic equals 73.812; the chi-square statistic with 7 degrees of freedom equals 18.475 at the .01 level.

<sup>21</sup>The null hypothesis is that the switchpoint equals zero, against the alternative that it equals 0.13. The likelihood ratio statistic equals 5.876; the chi-square statistic with 1 degree of freedom equals 6.635 at the .01 level, and 5.412 at the .02 level.

TABLE 2  
THE DEMAND FOR MEMBER BANK BORROWING, NEW YORK CITY,  
JANUARY 1924–FEBRUARY 1933

Dependent Variable: $\Delta B$			
Equation	(2.1)	(2.2)	(2.3)
Intercept	16.36 (6.48)*	13.37 (4.36)**	5.42 (10.49)
$(r_m - r_d)$	12.27 (7.17)	0.57 (5.13)	
$\ln(1 + r_m - r_d)$			44.81 (21.24)*
$B_{-1}$	-0.19 (0.05)**	-0.20 (0.07)*	-0.18 (0.05)**
$\Delta R^u$	-0.41 (0.05)**	0.01 (0.02)	-0.60 (0.05)**
$\Delta Debits$	1.05 (0.60)	0.52 (0.41)	1.42 (0.58)*
$D$	-16.96 (7.12)*	-12.97 (5.87)*	-22.81 (7.18)**
Ajd. $R^2$	.45	.24	.64
S.E.R.	27.26	6.83	24.41
Observations	109	20	89
Switchpoint <sup>a</sup>		0.13	0.13

NOTES: See Table 1.

banks were reluctant to borrow from the Fed even at small positive rate differentials, as Dutkowsky's (1984) model predicts.

Equation (1.2) is an estimate of the borrowed reserve demand function when the rate spread is less than or equal to 0.13 [that is, an estimate of equation (3)]. The coefficient estimates from this regression have the anticipated signs, but only that on bank debits is statistically significant. The general lack of significance is not surprising since at rate spreads below the switchpoint borrowing from the Federal Reserve will not be the least-cost means of obtaining reserves. Equation (1.3) is an estimate of borrowed reserve demand when the rate spread is greater than 0.13 [equation (4)]. All the coefficients, except the intercept, have the correct signs and are significant. The results suggest that for rate spreads above 0.13 bank borrowing was responsive to changes in the rate spread, to the lagged level of borrowing, and to flows of nonborrowed reserves. Moreover, they also indicate that member bank borrowing was related positively to economic activity. As economic activity, and hence loan demand, increased, bank borrowing increased. When economic activity declined, as in the early 1930s, member bank borrowing fell.

The coefficient on the Depression dummy variable suggests that there was a significant down-shift in the borrowed reserves demand function following the stock market crash. As the shocks to the financial system worsened, banks probably became even less willing to borrow reserves. Because of the change in bank willingness to borrow from the Federal Reserve, the level of borrowed reserves became an increasingly inaccurate measure of monetary conditions. Nevertheless, Fed officials continued to interpret little borrowing as a sign of exceptional monetary ease.

Table 2 presents regression estimates of the demand for borrowed reserves by weekly reporting member banks in New York City from January 1924 to February 1933. The rate spread at which switching occurs is again estimated to be 0.13, and the null hypothesis of no switching is rejected at the .01 level.<sup>22</sup> Above this spread, the coefficient estimates all have the anticipated signs and are statistically significant [equation (2.3)]. The results suggest further that borrowing was positively related to changes in economic activity, and that a down-shift in the demand for borrowed reserves occurred during the Depression. And they indicate that the failure of Fed officials to interpret the behavior of borrowed reserves correctly contributed to their belief throughout the Depression that monetary conditions were easy.

## CONCLUSION

Despite the economic decline which began in mid-1929, and which accelerated following the stock market crash, the Federal Reserve failed to undertake significant expansionary policies until 1932. Friedman and Schwartz (1963) contend that this inaction during the Depression contrasted sharply with the Fed's prompt and vigorous expansionary policies during recessions in 1924 and 1927. However, this paper argues that the apparent change in Fed behavior might actually have resulted from the System's consistent use of member bank borrowing as a policy guide. Fed officials believed that the decline in borrowed reserves following the stock market crash implied that money and credit were plentiful. So, despite the economic contraction, they saw no need for vigorous action. Fed officials believed that their policies were as responsive to changes in economic activity as they had been during the 1920s.

The Fed's borrowed reserves strategy resulted in procyclical monetary policy. Fed officials judged monetary conditions from the level of bank borrowing. They interpreted relatively heavy borrowing as a sign of tight money, and little borrowing as a sign of ease. As a result, the Fed tended to purchase *fewer* securities the *worse* an economic downturn. During mild recessions, as in 1927, member bank borrowing fell little. The Fed responded with relatively heavy purchases of securities, however, interpreting monetary conditions as tight. But during severe downturns, as in 1930–31, member bank borrowing declined substantially. This caused the Fed to interpret monetary conditions as relatively easy, however, and hence to make comparatively few open market purchases.

As Fed officials observed, this study finds that flows of nonborrowed reserves were a principal determinant of changes in borrowed reserves during the 1920s and early 1930s. However, member bank borrowing did not offset these flows precisely.

<sup>22</sup>The likelihood ratio test statistic equals 74.978, while the chi-square statistic with seven degrees of freedom is 18.475 at the .01 level. It was not possible to test the null hypothesis that the switchpoint equals zero because the only month prior to December 1929 when the rate spread was less than or equal to zero also happened to be the only month when New York City banks borrowed from the Fed at an unfavorable rate spread. Thus the lower regime regression could not be estimated in the case where the switchpoint is set equal to zero.

The Fed's theory failed to consider that banks borrow to meet investment and lending opportunities, and hence it did not capture the procyclical nature of borrowed reserve demand. The evidence presented here indicates that economic activity, as measured by changes in bank debits, did have a significant impact on bank borrowing. As economic activity declined during the Depression, loan demand and investment opportunities shrank, and bank reserve demand fell. Because the Fed failed to replace the decline in reserves, the money supply fell.

This study also finds evidence of a downward shift in borrowed reserve demand during the Depression. Financial crises made banks cautious and less willing to borrow reserves. The Fed's failure to recognize this change in bank willingness to borrow contributed to its failure to interpret monetary conditions accurately. Fed officials continued to believe that low levels of bank borrowing signaled easy money. Thus, the failures of monetary policy during the Depression seem attributable largely to flaws in the Fed's strategy, and especially to its use of member bank borrowing as a policy guide. That strategy appeared to work well during the relatively tranquil 1920s, but failed terribly in the environment of crisis and severe contraction of the Depression.

#### APPENDIX: VARIABLE DEFINITIONS AND DATA SOURCES

Unless noted otherwise, all of the data are from Board of Governors (1943). Page numbers are for that volume. Data are monthly averages of daily figures and are in \$ millions, except for bank debits, which are monthly totals and are in \$ billions.

*B*: Member Bank Borrowed Reserves, pp. 169–78 (New York City reporting banks); Federal Reserve Board *Annual Report* (various years) for New York district member banks.

*Debits*: Debits to Deposit Accounts in New York City, pp. 234–35; Federal Reserve Board *Annual Report* and *Bulletin* (various issues) for New York district.

$r_m$ : Commercial Paper Interest Rate, pp. 450–51.

*D*: Dummy variable set equal to 0, January 1924–November 1929, and equal to 1, December 1929–February 1933.

$r_d$ : Federal Reserve Bank of New York Discount Rate, pp. 439–41.

$R^u$ : Member bank nonborrowed reserves. Constructed as the difference between total and borrowed reserves, pp. 169–78 (New York City reporting banks); Federal Reserve Board *Annual Report* (various years) for New York district member banks.

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