Making Reserve Targets Work

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"As part of its anti-inflationary program announced on October 6, 1979, the Federal Reserve changed its open market operating procedures to place more emphasis on controlling reserves directly so as to provide more assurance of attaining basic money supply objectives."[1] This announcement seemed to herald the Fed's realization that it must control the growth of reserves if it wants to control money. Apparently, the Fed believes that monetary control is necessary for its "anti-inflationary program," but the central bank was silent about wanting to attain "basic money supply objectives" when it is pursuing anti-recessionary or other programs. Be that as it may, I shall assume that the Fed wants to use reserve targets in all seasons, not just anti-inflationary ones.

There was growing awareness both within the Federal Reserve System, and without, that the old operating procedure in which " . . . the reserve supply had been passively determined by what was needed to maintain . . . a particular level of the federal funds rate . . . "[2] was an ineffective way to control the monetary aggregates. The problem was not so much that the Fed used the federal funds rate as its instrument for controlling the monetary aggregates, but rather that the FOMC did not allow that interest rate to change sufficiently to achieve control over the aggregates.

In a paper prepared for the second conference on Controlling Monetary Aggregates, Pierce and Thomson (1972) showed for the certainty equivalent case that the choice between reserves and the federal funds rate as the more effective instrument for controlling a monetary aggregate depends upon the variance and covariance of money demand and supply. This result had little practical significance, however, because the range of tolerance for the federal funds rate was narrow and the level of the range changed slowly. The range for the federal funds rate was a constraint that frequently prevented control over the monetary aggregates. With that constraint, neither the federal funds rate nor the volume of reserves could be varied actively to achieve "basic money supply objectives."

The real significance of the change in operating procedures was to allow the federal funds rate to vary much more widely from week to week and month to month than had previously been the case. This was understood by the Fed: "Thus, the new procedures entail greater freedom of movement for

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[1] This quote is taken from Appendix B, page B-1 of "The New Federal Reserve Technical Procedures for Controlling Money" in the Federal Reserve's *Monetary Policy Report to Congress Pursuant to the Full Employment and Balanced Growth Act of 1978*, February 19, 1980.

[2] *Ibid.*, p. B-1.

interest rates to change over the short run in response to market forces."[3] Short-term interest rates were allowed much greater freedom of movement by significantly widening the range of allowable federal funds rates. At the FOMC meeting of September 18, 1979 the range of tolerance for the federal funds rate was only 50 basis points, i.e., 11.25–11.75 percent. At the meeting of October 6, the range was 400 basis points, i.e., 11.5–15.5 percent. Since that time, the range has been as wide as 850 basis points.[4]

Allowing interest rates to fluctuate more freely has, I believe, widespread support among economists. Monetarists support the move because it allows closer control over the supply of money. Many economists who put less emphasis on the quantity of money also welcome the policy shift because it allows interest rates to fluctuate procyclically and, hence, to act as built-in stabilizers in the economy, reducing the growth of aggregate demand during booms and stimulating demand during recessions. Thus, one does not have to be a hard-core monetarist to approve of the change in policy procedures.

The extent to which the Federal Reserve has allowed short-term interest rates to vary since October 1979 can be seen by comparing Charts 1 and 2. Chart 1 shows the weekly average values for the federal funds rate during 1974. In that year, the Fed also declared war on inflation and pursued an increasingly restrictive monetary policy designed to reduce growth of the monetary aggregates. From March through July of that year, the federal funds rate rose from about 8.75 percent to over 13.5 percent. The rise in interest rates was considered, at the time, to be very rapid. Beginning in July 1974, as the recession hit and money growth slowed sharply, the federal funds rate declined rapidly and by the end of the year was below 8.5 percent. Evidence of the use of a range of tolerance for the federal funds rate can be seen in the smooth pattern of interest rates from week to week. The funds rate did wobble around a bit from week to week, but within a narrow band.

Chart 2 shows the behavior of the weekly average federal funds rate from August 1979 through August 1980. From August through the first week of October 1979, the funds rate rose but not as rapidly as it had during the first half of 1974. Furthermore, the rise was very smooth indicating the operation of a narrow constraint on fluctuations in the federal funds rate. Then came the shift of policy on October 6, and all hell broke loose. The funds rate rose 122 basis points in a single week and in three weeks rose by 360 basis points from 12 percent to 15.6 percent. Since that time, the federal funds rate has fluctuated widely from week to week, but massive swings have also occurred. From the first week of March through the first week of April 1980, the interest rate rose from 14.6 to 19.4 percent. This rise of nearly 500 basis points over five weeks was unprecedented in size and speed. Even more impressive was the decline in the federal funds rate from its peak of April 5. Over the next five weeks the funds rate fell by approximately 640 basis points

[3] *Ibid.*, p. B-1.

[4] It shall be argued below, however, that at times ceilings and floors have been placed on the federal funds rate and the stated ranges of tolerance were not very meaningful at those times because the funds rate was near, or at, the ceiling or floor.

Chart 1 Weekly Average Federal Funds Rate 1974

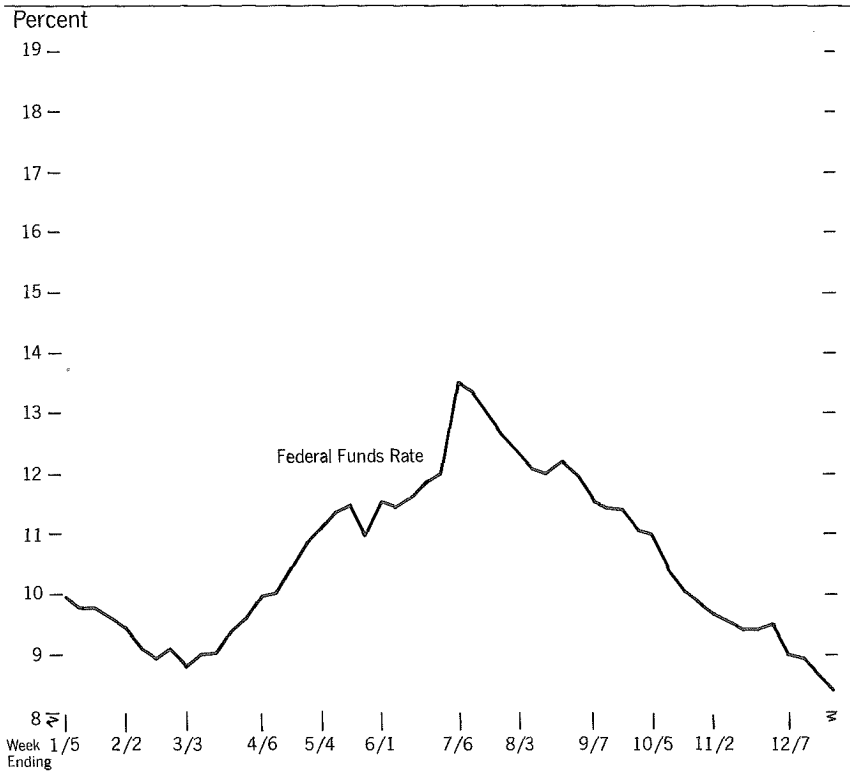
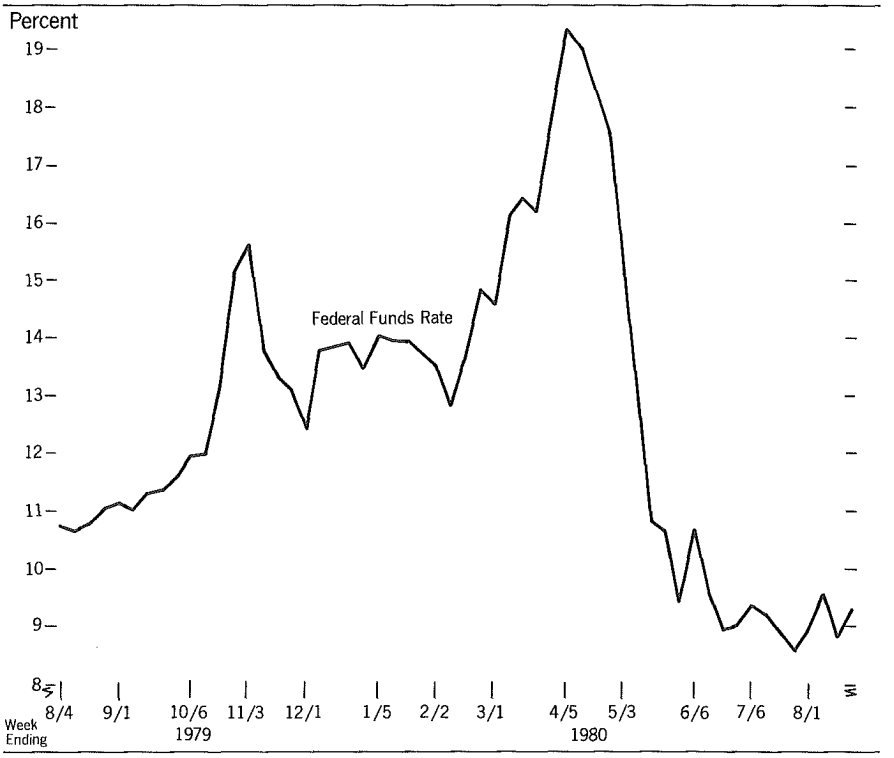


Chart 2

Weekly Average Federal Funds Rate
August 1979 - August 1980



and by the end of March had fallen by nearly 10 percentage points from its April peak.

The behavior of the federal funds rate since October 6, 1979 clearly demonstrates that the Fed abandoned its old habit of limiting movements in that interest rate. It is interesting to observe, however, that during December and January and again in July and August, the federal funds rate varied week to week over a narrow range. This behavior of the funds rate may have been fortuitous or it may indicate a tendency, when conditions allowed, for the Fed to return to the practice of stabilizing the money market. Even if these periods represent lapses from the "new policy," Chart 2 certainly shows that, by and large, the policy is truly new.

By effectively removing the federal funds rate constraint, the Federal Reserve established a necessary, but not a sufficient, condition for closer control over the monetary aggregates. Use of reserves as the policy instrument and adoption of a wide band for the funds rate are not sufficient, however, for close control over the monetary aggregates. Close control also requires a predictable link between reserves and the monetary aggregates.[5] This link is affected by the portfolio choices of depository institutions and of the public, and these choices cannot be closely controlled by the central bank. Before turning to the link between reserves and money, it is necessary to define more carefully the reserve and money concepts that are involved in the policy process.

The Family of Reserve Aggregates

In its domestic policy directive issued to the Federal Reserve Bank of New York, the FOMC is vague concerning the reserve targets that the trading desk should follow. The language in the directive of the meeting for July 9, 1980 makes the point.

> In the short run, the Committe seeks expansion of reserve aggregates consistent with growth of M-1A, M-1B, and M-2 over the third quarter of 1980 at annual rates of about 7 percent, 8 percent, and 8 percent respectively, provided that in the period before the next regular meeting the weekly average federal funds rate remains within a range of 8½ to 14 percent.

The numbers in the short-term directive often change from meeting to meeting, but the same vague language concerning "expansion of reserve aggregates consistent with growth of M1-A, M1-B and M-2" is always present. Furthermore, the discussions at the FOMC meetings summarized in the Record of Policy Actions provide no elaboration on how the trading desk should carry out the directive.

[5] The Fed must also want to improve its performance in achieving closer control over the monetary aggregates. Later on in this paper, the case against intermediate targets such as the monetary aggregates is summarized.

Fortunately, the Federal Reserve has elaborated a little on how it pursues reserve targets.[6] The FOMC first determines the growth in the monetary aggregates that it wants to achieve. After these objectives are set, reserve paths expected to achieve the desired growth in the monetary aggregates are established for a "family" of reserve measures. These measures consist of total reserves, the monetary base and nonborrowed reserves. While never explicitly stated, it appears that the reserve paths themselves are not discussed by the FOMC, but rather calculation of the paths is left to staff technicians.

The methods used by the staff to estimate reserve paths are discussed below, but before turning to that topic, it is necessary to point out that the instructions to the trading desk in New York make it difficult to evaluate the new procedures. The FOMC establishes desired growth rates for M-1A, M-1B and M-2. The staff then calculates the paths for total reserves, the monetary base and nonborrowed reserves that are expected to achieve the desired growth in these monetary aggregates. Given a set of reserve aggregates and a set of monetary aggregates, there is no single measure of how well the new operating procedures work. The various reserve aggregates are hardly independent of each other, so we cannot associate different reserve concepts with different monetary aggregates. Furthermore, it will be argued below that nonborrowed reserves are an instrument of policy and the other measures are either predetermined or affected by the same sorts of portfolio decisions as are the monetary aggregates themselves. Thus, there is one instrument and three targets to hit for the monetary aggregates. Since M-1A, M-1B, and M-2 are not scalar multiples of each other, the three targets cannot be achieved simultaneously. In this situation it is not clear how to evaluate errors, because errors are implicit in the mismatch of instruments and targets. It is possible to describe a vector of errors for the three monetary aggregates, but this vector gives little information in the absence of some scale for evaluating errors among the various aggregates. The FOMC may have preferences concerning the tradeoffs among the various aggregates when misses occur but no evidence is available in published sources. In the absence of objective criteria for evaluating how well reserve targets work, this paper must deal with generalities concerning control over the monetary aggregates.

The Reserve Aggregates

Total reserves, RT, are composed of required reserves, RR, plus excess reserves, RE. Total reserves are also defined as nonborrowed reserves, RNB, plus borrowed reserves, RB. These definitions give the identities RT = RR + RE = RNB + RB. With lagged reserve accounting, required reserves in any week are based on the deposits and other liabilities two weeks in the past. Thus, RR is predetermined and the quantity of excess reserves is simply the difference between the total reserves in the system and the predetermined

[6] See "The New Federal Reserve Technical Procedures for Controlling Money."

quantity of required reserves. Reserves are provided through the discount window and through open market operations. The Federal Reserve restricts access to the discount window, but the volume of borrowed reserves varies with the demand for loans from the Fed. Thus, of all the reserve measures, only RNB is under direct control of the Fed.

Rearranging terms in the identity given above we have, RNB = RR + RE – RB = RR + RF, where RF = RE – RB is commonly called free reserves. Because RR is predetermined in any week, changes in RNB can only affect RE and RB, i.e., can only affect free reserves. In the context of lagged reserve accounting, a target for RNB is equivalent to a target for RF. Lagged reserve accounting forces the Fed to adopt free reserves as its instrument for affecting the monetary aggregates. The monetary base, MB, is simply total reserves plus currency, C. Currency holdings cannot be controlled directly by the Fed so we have MB = RT + C = RR + RE + C = RNB + RB + C and, again, RNB = RR + RE – RB.

The Discount Window

In a world of certainty, the Federal Reserve could always follow reserve paths that are consistent with the desired growth of the monetary aggregates. In this world, the Fed would know the "multiplier" relationships between the family of reserve measures and the monetary aggregates and, therefore, desired money growth could always be achieved. The world in which the Fed operates is highly uncertain. The various multipliers are subject to random variation and the true structure of the relationships between reserves and money is not known. All this uncertainty implies that the Fed cannot hit its monetary targets exactly and that surprises do occur.[7]

In the real world, the discount window performs the function of buffering the effects of stochastic variations in the relationship between reserves and money. This function implies that variations in the use of the discount window affect the relationship between nonborrowed and total reserves. If, for example, the demand for money and credit is stronger than anticipated, given the Fed's paths for nonborrowed and total reserves, interest rates will rise. Given the discount rate, the rise in interest rates induces depository institutions in increase their borrowing at the discount window. Given nonborrowed reserves, the rise in borrowed reserves increases total reserves and with it the volume of money and credit in the economy. Thus, there is more money for a given volume of unborrowed reserves and the multiplier for NBR rises. Now, the Fed must decide whether the unexpected rise in the demand for money and credit is transitory or if it signals a systematic error in the expected relationship between nonborrowed reserves and money. If the rise in demand is transitory, the best strategy is to adhere to the old nonborrowed path. If the rise in demand is more permanent, then the Fed must react if it

[7] It is argued below that use of more modern techniques for forecasting and for controlling money would probably help, but errors would still remain.

wants to achieve its targets for the monetary aggregates. Two reactions are possible. First, the Fed can reduce the path for nonborrowed reserves. This will induce further borrowing at the discount window, but the offset is relatively small and to some degree predictable. Thus, total reserves can be brought back to their original path. Alternatively, the Fed can raise the discount rate, reduce borrowing and reduce total reserves while adhering to the original nonborrowed reserve path. This second method is not used frequently because the Fed has elected to avoid short-term variations in the discount rate.

A similar story can be told for an unexpected rise in the multiplier relationship between RNB and the monetary aggregates coming from an unexpected rise in deposit liabilities. In this case, the higher volume of required reserves that materializes two weeks later produces a rise in interest rates given the path for nonborrowed reserves. Again depository institutions will increase their use of the discount window. The Fed will have the same sort of decision as before concerning whether or not to change the RNB path or the discount rate. In this case, however, it may be impossible to return to the original path for total reserves. The Fed has two weeks notice that a bulge in RR will occur, but sufficient total reserves must be supplied to allow institutions to meet their reserve requirements.[8] This could force the Fed off of its path for total reserves and the monetary base.

It might appear that because the Fed changes the discount rate infrequently, large changes in borrowing occur and these changes greatly complicate the use of reserve targets. This conclusion is not warranted, however. The discount window is heavily "administered" and depository institutions cannot use the window at will. Changes in market interest rates tend to induce relatively small changes in borrowing when market interest rates exceed the discount rate. It is true, however, that the greater the excess of market interest rates over the discount rate the greater the amount of borrowing. Even given heavy administration of the discount window, the higher the profit incentive for institutions to borrow, the more imaginative they are in gaining access to this form of credit. Quantitatively, however, the effects are small. For example, in March of 1980 borrowing at the Fed reached a peak of $2.8 billion. In March, the federal funds rate was over 17 percent and the discount rate was 13 percent. Thus, a differential of 400 basis points produced only $2.8 billion of borrowing. In March, total reserves were $43.4 billion, so borrowing constituted only 6 percent of total reserves, and this percentage is high by historical standards. Tight administration of the discount window implies, however, that a rise in the demand for reserves has a relatively large effect on the federal funds rate. If the upper band of that interest rate is achieved, the desk will supply more RNB and reserve targets will be overshot. If the discount rate were kept in line with market interest rates, the upward pressure on the funds rate would probably be reduced.

[8] There is some flexibility in the system, however, because depository institutions can, to a limited degree, carry reserve deficiencies forward to the next week.

Family Feud

Required reserves, total reserves and the monetary base cannot be controlled in any operating sense, i.e., day-by-day and week-by-week, by the trading desk. Required reserves are determined by events two weeks in the past, and total reserves and the monetary base are affected by the degree of use of the discount window. Nonborrowed reserves can be closely controlled in an operating sense. The control is not perfect, however, because the desk must respond to variations in currency demand, float and other factors that affect reserves. These various factors are observed both frequently and quickly, however, so the desk can engage in open market operations to offset movements in the factors that would make RNB deviate from its target path. The degree of control over nonborrowed reserves is sufficiently close that this reserve measure can be thought of as an operating instrument of monetary policy.

It might appear that similar stories could be told to explain why total reserves or the monetary base can be operating targets. After all, the Fed knows how much institutions borrow from it every day, so if variations in RB cause RT and MB to deviate from their target paths, the desk can offset the effect by engaging in appropriate open market operations. To some extent this can be done, but lagged reserve accounting and inconsistencies among reserve targets get in the way. If RB, RT and MB are growing more rapidly than desired, the desk can offset the effect but only to the extent that there are sufficient reserves in the system to cover the predetermined level of required reserves. This level of RR constrains the minimum values of RT and MB. There is no constraint on the up side because, by definition, total reserves in excess of required reserves simply become excess reserves.

Even if the predetermined volume of required reserves does not pose a binding constraint, the Fed can only have one independent reserve instrument. For example, if it attempts to control RT and MB, the Fed must offset changes in borrowed reserves with changes in RNB. Nonborrowed reserves become endogenous and move inversely with borrowed reserves. Furthermore, at times it is impossible to adhere simultaneously to paths for total reserves and the monetary base. For example, if there is an unexpected increase in the public's holdings of currency, the monetary base is unaffected. The reserves of depository institutions decline but currency rises by the same amount.[9] Total reserves fall, however. If the Fed adheres to its path for the monetary base, the system of fractional reserve requirements will produce a multiple effect on the deposit components of the monetary aggregates, and these aggregates will fall relative to their desired paths. If the Fed adheres to its path for RT, RNB must rise to ward off the contraction in the monetary aggregates, so the monetary base and the monetary aggregates rise by the amount of the rise in currency holdings and, hence, rise above their target paths. Under these circumstances the Fed must, again, decide what to do. As

[9] Assuming depository institutions replace their depleted vault cash.

a practical matter, it tends to accommodate unexpected shifts in currency holdings with offsetting movements in RNB. This at least avoids the exaggerated movements in the monetary aggregates that come from adhering to a path for the monetary base in a world with fractional reserve requirements. If currency shifts prove to be more than transitory, however, the Fed must alter the paths for all the members of the family of reserve aggregates if it wants to achieve its goals for the monetary aggregates.

The use of a family of reserve measures may not be confusing to the Federal Reserve, but it is to me. In a stochastic world, the paths for the family members are not consistent with each other. The Fed can only adhere to one path at a time and must abandon the others when the world proves to be different from the one assumed when the paths were initially set. The system is overdetermined. In practice, the Fed may solve the problem of inconsistent reserve targets by adhering to its target for nonborrowed reserves and occasionally using the behavior of total reserves and other measures to modify that path. This is just a guess, however, there is insufficient evidence available to reach a more definitive conclusion.

Lagged Reserve Accounting

The practice of assessing reserve requirements against the levels of deposits and other liabilities two weeks in the past was instituted as an aid to banks (mainly small ones) that had difficulty keeping track of the composition of their deposits and, hence, their required reserves. The two-week lag apparently gives them time to sort out their affairs and to determine their required reserves. Lagged reserve accounting may be helpful to these banks but it complicates life for the Federal Reserve in its pursuit of reserve targets. For example, if there is a bulge in the amount of deposits or other liabilities during any week, required reserves do not rise in that week but two weeks later. With contemporaneous reserve accounting, the immediate rise in required reserves would inhibit the growth of deposits and other liabilities. With lagged reserve accounting, there is no inhibiting factor and two weeks later there must be sufficient reserves to cover the full expansion of deposits and other liabilities.

This is not to say that the Fed is helpless in offsetting the bulge in deposits. By sticking to a nonborrowed reserve path, it can put upward pressure on interest rates and force banks into the discount window. Because the discount window is heavily administered, banks will retard future expansion of assets and deposits in order to repay their borrowing from the Fed. The higher the value of net borrowed reserves (negative free reserves), the greater the upward pressure on market interest rates as institutions work to retire their borrowing, and the greater the retarding influence on deposit expansion. This is the classic case of using free reserves as a method of achieving monetary control. With contemporaneous reserve accounting the weight of adjustment would not fall totally on borrowed reserves. The initial expansion of

assets and deposits would be less and, therefore, the rise in interest rates would be less.

Lagged reserve accounting also produces exaggerated declines in interest rates when there is an increase in reserves. For example, if the public unexpectedly reduces its currency holdings, there will be an unexpected increase in deposits. These deposits will not have reserve requirements imposed against them for two weeks. Thus, the entire deposit increase goes into excess reserves. These reserves can be used by depository institutions to purchase additional assets, but the deposit expansion does not increase required reserves for two weeks. The only way that the banking system can get rid of its excess reserves is to repay its borrowing from the Fed. The same sort of reaction would occur if there is an expansion of reserves as a result of open market operations. Irrespective of the source of the increase in reserves, there is an expansion of deposits and a reduction in interest rates that is greater than would be the case under contemporaneous reserve accounting.

Lagged reserve accounting caused no real difficulties back when the Fed was in the business of stabilizing the federal funds rate. In that situation sufficient reserves were supplied or removed to maintain the federal funds rate. Under a reserve strategy the situation is different. Adherence to a path for total reserves can at times be impossible and adherence to a nonborrowed reserve path can produce sharp changes in interest rates. If the change in interest rates is sufficiently great, even the widened federal funds rate band can be hit and policy forced off of its reserve paths.

It is curious that the Federal Reserve, which historically has shown so much concern for short-run stability of interest rates, should have a reserve requirement scheme that exacerbates the fluctuations in interest rates. The Fed is apparently aware of the problem and has recently announced that "The Board is disposed toward returning to contemporaneous reserve account, possibly by September 1, 1981, if further investigation indicates that such a system is operationally practical."[10] The operational practicality apparently refers to the problems that some banks have in determining their mix of deposits and other liabilities, not to the practicality of conducting monetary policy under contemporary reserve accounting.

It is possible, however, to make too much of lagged reserve accounting. Its elimination would make the execution of policy somewhat easier and the desk would have to stray less often from the established reserve paths. Week-by-week adherence to the paths, particularly for total reserves and the monetary base, could be closer, but so long as the Fed is willing to tolerate wide fluctuations in the federal funds rate and so long as it keeps use of the discount window under control, the FOMC should be able to achieve its monetary objectives. If the Fed were willing to keep the discount rate more in line with market interest rates, the problems of operating under lagged reserve accounting would probably be reduced.

[10] "Federal Reserve Press Release on Regulation D," Board of Governors of the Federal Reserve System, August 15, 1980, p. 9.

Relating Reserves to the Monetary Aggregates in Practice

The Federal Reserve has provided a description of how it establishes and pursues target paths for the various reserve measures.[11] At each meeting, the FOMC establishes its targets for the monetary aggregates over the interval (usually monthly) until the next meeting. These short-run objectives are selected to be consistent with the annual growth targets for the monetary aggregates. Because the monetary aggregates behave erratically from month to month, the short-term targets are set with the expectation that, if achieved, they will "promote" the desired growth over the year. At each meeting, a range for the federal funds rate is also set.

Based on the short-term targets for the growth of the monetary aggregates established by the FOMC, the staff constructs paths for nonborrowed reserves, total reserves and the monetary base that it expects to be consistent with the short-term paths for the monetary aggregate. As a first step, estimates are made of all the factors that will absorb reserves over the period. Thus, estimates are made of total reserves absorbed by private demand deposits, interbank demand deposits, U.S. government demand deposits, large CDs, savings deposits, other time deposits, nondeposit items subject to reserve requirements, and by excess reserves.[12] In making these calculations, estimates are made of the distribution of deposits by member vs. nonmember, by size of bank, and by maturity of time deposits. In these calculations, account is taken of lagged reserve accounting. Estimates are also made of currency outside banks because this measure of currency is a component of all the Ms and also is added to estimates of currency at depository institutions to construct the figures for the monetary base.

In a sense, the staff attempts to determine the growth in reserves required to support the deposit components of a particular monetary aggregate, for example, M-1B, given all the estimated claims on required reserves by items that are *not* in M-1B. Thus, the reserves for the monetary aggregate are determined as a residual, i.e., as an amount in excess of the estimated required reserves against items that are not included within a particular monetary aggregate.

The next step is to estimate the mix of reserves between borrowed and nonborrowed reserves, i.e., use of the discount window is estimated. Total reserves less borrowed reserves gives nonborrowed reserves. The estimated growth of nonborrowed reserves provides a basis for establishing the amount of open market operations the trading desk in New York can expect to make over the period. It is only a basis for establishing an operating target, however, because other calculations must be made. First, the estimate for nonborrowed reserves is deseasonalized. The FOMC makes its decisions based

[11] See "The New Federal Reserve Technical Procedures for Controlling Money."

[12] The story in the text describes current practices. The Fed will presumably make similar calculations of reserves absorbed by the liabilities of all depository institutions as reserve requirements for these institutions are phased in.

on seasonally adjusted values of the monetary aggregates, but the desk must operate in the real seasonal world.

The next step is to estimate the seasonally unadjusted values of all the other factors that will affect reserves over the period (e.g., float). These factors less borrowing give the estimated amount of open market operations that must be conducted over the period. The final steps, which probably receive more attention in New York than in Washington, involve estimation of the weekly and daily patterns of open market operations that are expected to achieve the estimated growth of nonborrowed and total reserves over the interval until the next meeting of the FOMC. These calculations in turn require estimation of the weekly and daily factors expected to affect reserves.

There is no source available that describes how all these estimates are made. It is my impression that many of them are "judgmental," i.e., informed guesses, based on past patterns of the various components. There is no evidence to suggest that the effects of changes in the general level of interest rates or in relative interest rates are taken into account in the various estimates. The only possible exception is the volume of borrowing at the discount window which is apparently assumed to be sensitive to interest rates.

It should be pointed out that the procedures for setting paths for the various reserve measures described by the Fed have been in operation for years. Long before the FOMC switched to reserve targets, the staff prepared reserve estimates that were thought consistent with the short-run targets for the monetary aggregates adopted by the FOMC. One set of estimates was supplied in an official document prepared by the staff, commonly called the Blue Book,[13] and another set of estimates was prepared by the Federal Reserve Bank of New York. The various estimates for the reserve aggregates were used by the trading desk in New York as well as by those within the Fed who monitored the course of open market operations. The estimates were probably of some value, but the reserve paths were not closely adhered to because of the narrow band for the federal funds rate. Reserves were simply determined endogenously as the desk maintained the funds rate within its prescribed band.

It is my impression that the same procedures for estimating reserve paths are used today. If this impression is correct, it means that the techniques hardly represent the culmination of exhaustive research on how best to estimate the relationships between various reserve measures and the monetary aggregates. Perhaps my impression is wrong and the techniques described by the Fed are "best," but there is no way to tell from available sources.

There is no way to compare the estimated reserve paths that come out of the Federal Reserve's complicated process with alternative methods because the Fed does not divulge the estimated paths. Furthermore, there is no way to determine whether or not the Fed has found its estimation procedures to be superior to other techniques. It seems quite possible, for example, that rather

[13] See Lombra and Moran (1980) for a description of this and other colored books.

than trying to impute required reserves to all the judgmentally estimated values of the items that have reserve requirements imposed against them, lower prediction errors would be achieved by simply estimating statistically the relationship between a particular monetary aggregate and the various reserve measures. There is no way to determine if this is the case, however,

The implications of prediction errors of the various "money multipliers" may not be as serious as they appear for making reserve targets work. According to the Fed's description of its new operating procedures, it employs "negative feedback" to correct for errors in the multipliers. Thus, if incoming data suggest that the assumed multipliers are seriously in error, the estimates of the multipliers are revised and paths for the reserve aggregates adjusted accordingly. For example, if the mix of deposits in the "nonmoney" liabilities subject to reserve requirement differs from expectations, the paths for the various reserve aggregates are adjusted to compensate. In practice, these adjustments apparently have been infrequent, however. Given the frequency with which the FOMC meets, it is apparently not necessary to make frequent changes in the reserve paths between committee meetings. At the next committee meeting a new set of paths is developed and any multiplier errors can be taken into account at that time.

It is not clear, however, how the multiplier errors are taken into account either between FOMC meetings or from one meeting to the next. One has the impression that the negative feedback is built somehow into the judgmental process used to construct reserve paths. As the Federal Reserve describes the process: "Given the naturally large week-to-week fluctuations in factors affecting the reserve multiplier, deviation from expectations in one direction over a period of several weeks would be needed before it would be clear that a change in trend has taken place."[14] This statement is not very helpful for understanding the process.

It does appear that the construction of reserve paths and the modifications of these paths are *ad hoc*. This may be the best method available, but that seems unlikely. A large literature has developed in recent years on optimal control, feedback rules, optimal forecasting and filtering techniques that could be applied to the construction of reserve paths and to adjusting the paths over time. These methods are practical — after all, it is possible to land on the moon *and* return — and seem particularly applicable to reserve targeting. Unlike most economic problems where there are long lags between changes in instrument variables and changes in target variables, the lags for reserves are relatively short. Furthermore, a great deal of information pours into the Fed everyday on deposits, reserves, and interest rates that help guide the process. It is surprising that the Fed does not use modern techniques, but rather apparently clings to ancient methods. The penchant for judgmental projections is particularly surprising because several Federal Reserve economists have been leaders in developing the modern techniques. Perhaps these methods have been tried and proved to be inferior to judgment. This is pos-

[14] "The New Federal Reserve Technical Procedures for Controlling Money," p. B-6.

sible. Sometimes old-fashioned methods are superior to high-technology applications, as your neighborhood acupuncturist will attest. At least with acupuncture, however, we have some evidence. With Fed operating procedures, there is no publicly available evidence so there is no means of assessing the quality of the work that goes into constructing and modifying reserve paths.

Do Reserve Targets Work?

The ultimate test of how well the Federal Reserve does with its new operating procedures lies with the degree to which these procedures have helped the Fed to achieve its objectives. Here, there is insufficient evidence to allow any strong conclusions.

In October 1979 the Fed decided it was time to declare war on inflation. Part of the war effort involved slowing the growth of money and credit. Clearly, slower reserve growth and sharply higher interest rates were required to achieve these goals. Pursuit of target paths for the reserve aggregates produced the desired result; interest rates shot up and money growth slowed. In September 1979 the federal funds rate was 11.4 percent; in April 1980 the average for the month was 17.6 percent. The growth of the monetary aggregates fluctuated from month to month during the period, but the growth trend was clearly downward. For example, the growth of M-1B during the first half of 1979 was over 10 percent at an annual rate. The growth from the third to the fourth quarter was 5 percent, from the fourth quarter of 1979 to the first quarter of 1980 M-1B grew at 6 percent, and from the first to the second quarter of 1980, M-1B fell at an annual rate of over 2 percent. M-1B fell sharply in February, March, and April of 1980 and then rose rapidly in May, June, and July.

It is not clear that the sharp fluctuations in money growth from month to month or even quarter to quarter are consistent with successful application of reserve targets to achieve closer control over the monetary aggregates. It is probably unreasonable to expect the adoption of reserve targets to allow the Fed to "fine-tune" the growth of the monetary aggregates. But the degree of fluctuation in money growth, including the procyclical decline in the second quarter, appears to be little different from what was experienced in the past, prior to the adoption of reserve targets. The use of reserve targets does not necessarily imply smooth money growth. After all, the Fed might want an erratic pattern. It is not clear, however, from the numbers or from the Records of Policy Actions that the Fed has achieved closer control over the monetary aggregates. It is clear that adoption of reserve targets allowed the Fed to push interest rates sharply upward and to slow money growth. Once the growth of money slowed, it then shrank before starting to expand rapidly. At this writing, it simply is not obvious that the growth of the monetary aggregates is under control.

It is exceedingly difficult to interpret the behavior of bank reserves or the monetary base since October 1979 because of marginal reserve requirements

and because of the behavior of deposits and other liabilities not included in the conventional monetary aggregates, but subject to reserve requirements. The series for total reserves and the monetary base, adjusted for reserve requirements, published by the Federal Reserve Bank of St. Louis show erratic movement in reserves and the monetary base from month to month with a slowing of reserve growth occurring only in the first and second quarters of 1980. The series grew more rapidly in July and August. Judging by the behavior of M-1A, M-1B, and of market interest rates, the Fed was crunching the financial system fairly hard in the fourth quarter of 1979, but the adjusted reserve series do not show this until early 1980. One price paid for operating through reserves is the problem of interpreting actual growth in reserves.

The Federal Reserve certainly demonstrated that it could get the economy's attention, but in what sense did reserve targets "work"? Money growth slowed and interest rates shot up. Isn't this proof enough? If it were not for the experience of 1974, the answer would probably be yes. But in 1974, the Fed was using the federal funds rate rather than a reserve path for monetary policy. Yet in that year interest rates also rose dramatically and money growth declined appreciably. The movements were not so great as in 1980, but they were sizable for the times. It is not clear that the Fed had better control over the monetary aggregates in 1979–1980 using reserve targets that it had in 1974 using targets for the federal funds rate. The major difference between the credit crunches of 1974 and 1979–1980 involved the speed with which interest rates fell following the start of the economic decline. Interest rates declined much more rapidly in 1980 than in 1974. For this we apparently can thank the FOMC and the use of a reserve target.

Yet despite the unprecedented decline in short-term interest rates, the monetary aggregates actually shrank in February, March, and April of 1980. How could this happen using a reserve target? The answer seems to be that the Fed seriously overestimated reserve multipliers. These errors in turn were probably the result of underestimating the effects of record high interest rates on money demand and supply.

It appears that the Fed has on at least two occasions abandoned reserve targets in favor of a federal funds rate constraint. Following its policy shift of October 6, 1979 the Fed maintained a range of tolerance for the federal funds rate of 11½–16½ percent. In March the lower and upper limits were raised to give a range of 13–20 percent and in April the range was made 13–19 percent. The federal funds rate peaked at 19.4 percent for the week of April 5, so the funds rate was at its upper limit. In May the lower limit was lowered to 10 percent and the federal funds rate was at or below this limit during the month. In June the lower limit was reduced to 8½ percent. The behavior of the federal funds rate relative to its ranges of tolerance suggests that the Fed placed a ceiling on interest rates in April, albeit a very high one, and a floor on interest rates in May and June, albeit a low one. If these ceilings and floors were in fact operative, it follows that the Fed was increasing reserves relative to path in April and decreasing reserves relative to path in May and June. In

light of the collapse of money growth that occurred in April and the expansion of money growth in June and July, the federal funds constraints apparently helped to reduce the fluctuations in the growth of the monetary aggregates. Perhaps the Fed's feedback rule is more elaborate than it appears in the written document. Be that as it may, the erratic behavior of money growth since October 1979 does not suggest high marks for the use of reserve aggregates as operating targets. Perhaps if the economy encounters more tranquil times, the task will be easier. Unfortunately, a host of institutional and legal changes are underway within the financial system that will tend to make the Fed's job harder rather than easier during the next several years.

New Complications for the Future

Recent changes in the financial system have complicated the execution of monetary policy. These changes have weakened the character of the monetary aggregates and have led to a whole new set of definitions of these quantities.[15] We no longer have good old M-1, M-2, M-3, . . ., M-n; we now have M-1A, M-1B, a new M-2, and so on. The redefinitions resulted from the spread of NOW, ATS and share draft accounts, money market mutual funds, repurchase agreements, overnight dollar deposits held at Caribbean branches of banks, and a number of other factors. The redefinitions suggest, among other things, that the behavior of the old definitions of the monetary aggregates will not be reliable guides for judging the behavior of their newly defined counterparts.

Legislative changes in the Depository Institutions Deregulation and Monetary Control Act of 1980 will make the situation even more confused in coming years. On December 31, 1980 all depository institutions will be authorized to issue NOW accounts. It will be difficult to predict the speed and extent of growth of NOW accounts in future years. The behavior of these accounts in New England will provide some guidance, but economic conditions in various other areas of the country could lead to a different pattern of growth nationwide. In addition, interest rate ceilings on accounts at depository institutions will be phased out and removed over the next six years. As these ceilings are raised and then removed, the portfolio choices of the public concerning checking and savings accounts, time deposits and other liabilities offered by depository institutions will be affected by the interest rates paid on these various assets. The interest rates in turn will, over time, become increasingly influenced by market forces. These forces have not been allowed to operate in the past, and so there is little experience to guide predictions of how the public will respond.

The same legislation also provides the Federal Reserve with sweeping powers to assess reserve requirements on depository institutions that are not

[15] See "The Redefined Monetary Aggregates," Appendix A of *Monetary Policy Report to Congress Pursuant to the Full Employment and Balanced Growth Act of 1978*, Board of Governors of the Federal Reserve System, February 19, 1980.

members of the Federal Reserve System.[16] Thus, nonmember banks, savings and loan associations, mutual savings banks and credit unions all become subject to reserve requirements. More specifically, any depository institution has reserve requirements assessed against its transactions accounts and its nonpersonal time deposits. These changes are to be phased in over time for nonmember institutions that currently have such liabilities outstanding. Furthermore, the first $25 million of transactions accounts is exempt from reserve requirements with future exemptions tied to the total volume of transactions accounts outstanding. The reserve requirements for member banks are reduced for transactions accounts and eliminated for personal time deposits. Finally, the Federal Reserve is granted authority to impose supplemental reserve requirements on transactions accounts of all depository institutions under certain special circumstances.

On top of all this, the Fed is required by September 1981 to put into effect a charge system for its various services including check clearing, wire transfers, and the supply of float. These charges will affect the costs of transactions to depository institutions and their customers. Thus, the pricing scheme will affect the supply and demand of transactions accounts and the behavior of float.

Finally, all depository institutions are allowed access to the discount window. The Fed's administration of the window and its willingness to change the discount rate will be put to the test by this change. It probably will take time to explain the rules of the game to nonmember depository institutions, i.e., that they should be "reluctant" to use the Fed's lending facilities.

The Act represents a great stride forward in removing regulatory constraints on depository institutions, promises significant benefits to consumers and greater competitive equity among depository institutions. It also gives the Fed its long sought after authority to impose universal reserve requirements. There can be little doubt, however, that the provisions of the Act will complicate the execution of monetary policy for years to come. The demand for various monetary aggregates will be difficult to predict as the public adjusts to the wider range of choice of assets and as interest rates on these assets move increasingly with market conditions. The "supply" side of the monetary aggregates will also be difficult to predict. The sweeping extension of reserve requirements to nonmember institutions and the complex phase-in of new reserve requirements will make it difficult to predict the relationship between reserve paths and the growth of the various monetary aggregates.

It is not clear how one makes reserve targets "work" in this environment. It appears that prediction errors will be substantial in the relationships between reserves and the monetary aggregates as well as between the monetary aggregates and economic activity. It does appear that over the next few years the Fed will have to be clever in its use of targets for reserves and the monetary aggregates. Old relationships will no longer hold and information

[16] For a description of the actual reserve requirements in all their complexity, see the Federal Reserve Press Release on Regulation D, August 15, 1980.

from a variety of sources, such as interest rates, prices, and data about real economic activity will have to be used in divining and modifying reserve paths over time.

The Inefficiency of Using the Monetary Aggregates as Objectives of Policy

The comments about the implications of changes in the financial system for the execution of monetary policy, serve to introduce a related issue. It has been shown under quite general assumptions that the use of so-called intermediate targets such as the monetary aggregates is counterproductive to achieving ultimate policy objectives.[17] Monetary policy involves the setting of certain policy instruments, such as nonborrowed reserves, with the objective of achieving desired values of certain target variables such as inflation and real output. This policy process has implications for a host of endogenous variables in the system including the monetary aggregates and interest rates. The behavior of these variables can provide information on how well policy is working to achieve its ultimate objectives. In particular, this information is valuable for determining the extent to which the path of the instruments of policy should be changed. Thus, for example, if the monetary aggregates are growing more rapidly than anticipated, given the paths of the instruments of policy, this rapid growth may be a signal that economic activity is stronger than anticipated and that the reserve paths should be lowered. Whether or not rapid growth of monetary aggregates signals a need to reduce the paths for reserves depends upon a host of stochastic factors in the economy. Only in the trivial case where the aggregates are perfectly correlated with the target variables is it appropriate to use the instruments to control the monetary aggregates. In all other cases, the behavior of the monetary aggregates provides one source of information on how to adjust the instruments to achieve the ultimate targets.

Recent work by Tinsley, Spindt and Friar (1978) demonstrates the benefits of using the monetary aggregates as sources of information concerning the current and future state of the true targets of monetary policy. They demonstrate, however, that more can be learned about these target variables by examining components of the monetary aggregates rather than by using the aggregates themselves. This result is not surprising considering the heterogeneous and rather arbitrary composition of the monetary aggregates. The components of M-1A, M-1B and M-2 are not perfect substitutes and information is lost by simply adding the components together.[18]

[17] For a formal analysis see Kareken, Muench and Wallace (1973) and for a summary of the issues involved, B. Friedman (1977).

[18] Barnett and Spindt (1980) have shown that simple addition of the components of the various monetary aggregates is inappropriate. They demonstrate that by weighting each component by the degree of "money services" it provides, an index is obtained that provides significantly more information than the conventional monetary aggregate.

Recent financial innovations have forced a redefinition of the monetary aggregates, but the new definitions do not provide a solution to the low-information content in aggregations of financial assets. For example, M-1B includes currency and "checkable" deposits at all depository institutions, but excludes overnight repurchase agreements, overnight Eurodollar deposits and money market mutual funds shares. These items, which are very close substitutes for checking accounts, are put into M-2. This practice is harmful to obtaining information because M-2 also includes small (under $100,000) time deposits with fixed maturities, ranging from six months to eight years. It seems unlikely that RPs, Eurodollars or even money market mutual funds shares are close substitutes for small time deposits. M-3 compounds the problem by adding large time deposits of all maturities and "term" RPs.

This is not the place to criticize the new definitions of the monetary aggregates. The purpose of this discussion is to stress the low information content of the aggregates that the Fed is attempting to control. Repurchase agreements, overnight Eurodollar deposits, and money market mutual funds have been major elements in affecting the demand and supply of checking accounts and of short-term time deposits, both large and small. Unfortunately, RPs and other elements are lumped into the heterogeneous category called M-2. Thus lumped, they can provide little information on substitution among assets in the public's portfolios.

The current and prospective situation suggests that the monetary aggregates will not be reliable information variables and that the relationship between reserves and the ultimate targets of policy will be subject to substantial prediction errors. To make reserve targets work in this environment, the Federal Reserve will have to downgrade the importance of the monetary aggregates. The Fed will have to adjust its reserve targets in response to information from a variety of sources, not just from "money."

The structural changes that are underway for depository institutions and the financial system in general suggest that the degree of uncertainty about the relationships between the instruments and targets of policy will be increased in coming years. This uncertainty involves not only the "level" of relationships, i.e., additive errors, but also parameters of the system. Uncertainty about parameters has serious implications for how policy should be conducted. Milton Friedman (1955) has argued forcefully that the growth of the money stock should be constant because the lags in the effects of policy are sufficiently long and variable that a more active policy can be destabilizing. Friedman's proposal appears to be based, at least in part, on the assertion that the parameters of the system linking instruments to targets is highly uncertain. Following Brainard's (1967) pioneering work on policy-making in a world of uncertain parameters, there has been very little work on the problem. When parameters are uncertain, the analytically convenient condition of certainty equivalence is lost and the analysis is difficult for a dynamic model. Some recent work on the problem, both in unpublished form by Tinsley and others of the Federal Reserve Board's staff, and in published form by Craine (1979), shows the implications of parameter uncertainty for

the use of reserve targets. Craine, for example, shows the conditions under which a Friedmanian rule is superior to activist policy. Stated loosely, if uncertainty about the effects of policy is sufficiently great, incoming data on the state of the financial system, and the economy in general, provide no information and policy should not depart from a predetermined path.[19] Thus, if uncertainty is sufficiently great, then predetermined growth targets for nonborrowed reserves or other instruments of monetary policy are appropriate.

The analytic results for policy-making in a world with uncertain parameters appear to give some justification for the way the Fed established and modifies operating targets for reserve measures. Long-term objectives for the monetary aggregates are changed very infrequently and reserve paths are established with the objective of achieving these goals for the monetary aggregates. The theory of policy-making under uncertainty, however, does not justify the use of reserve targets to control the monetary aggregates. *All* the analytic results indicate that there is no economic rationale for setting reserve targets with the objective of controlling the monetary aggregates. Both theory and common sense indicate that reserve targets should be designed to influence the ultimate objectives of policy not the monetary aggregates.[20]

Counting Instruments and Targets

The most fundamental problem with making reserve targets work lies with the multiplicity of policy targets. It is well known that if there are more targets than instruments the best that policy can do is to achieve some "least bad" combination of the targets. In a stochastic, nonlinear, and dynamic environment, this can be a complex process. There are real limits to what one can expect of reserve targets.

In recent years, monetary policy has been used to "put out fires." That is to say, the instruments of monetary policy have been used to bring under control whatever the currently most troublesome problem seems to be. Thus, on October 6, 1979 it was decided that the flames of inflation were burning out of control so the Fed's fire fighting machinery was directed against inflation. The abrupt slowing of money and credit growth, coupled with soaring interest rates and a "credit control program," produced the desired result. The economy finally moved into recession. "Something" had been done. With the recession came falling interest rates. They fell very rapidly but soon posed a

[19] This is the limiting case. In general, it does pay to respond to incóming information. The degree of response is affected by the extent of uncertainty about the true parameters.

[20] This discussion has studiously avoided the literature on rational expectations applied to macroeconomic models. According to some of that literature, it is only unanticipated policy changes that affect real economic activity. This is not the place to provide a diatribe concerning this conclusion. However, even a rational expectations model would probably show less variance in real output and inflation if the Fed's policy reacted to actual and prospective inflation and output rather than to other endogenously determined, but stochastic, variables such as the monetary aggregates.

new problem. The dollar declined on exchange margets and fears of a capital flight began to build. The Fed turned its attention to this fire by putting a floor under the federal funds rate and accepting whatever shortfalls in reserve and money growth might result.

This is not an isolated episode for monetary policy. In 1974 the Fed had moved to fight inflation. With a deep recession and a temporary cessation of oil price increases, inflation was reduced. The Fed, and government policy in general, turned to the next fire which involved unemployment of labor and resources. A high rate of economic expansion resulted. By 1979, the fires of inflation were burning brightly, so the Fed turned to that problem. One has the impression that unless the policy-makers exhaust themselves running from one fire to the next, the process will continue without end. Unfortunately, the desire to "do something, and do it quickly" has probably increased the incidence and intensity of the fires.

This fire fighting approach is understandable politically, but it gets in the way of pursuing policies that are sustainable over the longer run. It is probably inevitable, however, that so long as the objectives of policies vastly outnumber the instruments available to achieve them, economic policy will leap from one fire to another. Along with the major issues of inflation, unemployment and fluctuations in real output, monetary policy is also concerned about the housing sector, small business, farmers, international factors, productivity growth, and other factors. That is a tall order for reserve targets.

The politically acceptable strategy for monetary policy has been to jump from one problem to the next. Reserve targets help to control fires, but in the process probably contribute little to economic stability and growth. To the extent that the limited number of instruments can make a contribution to stability and growth, it seems a pity that they be wasted on attempting to control the monetary aggregates rather than the true objectives of policy.

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Discussion

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The dates of this Conference — October 5–7 — just happen to surround the first anniversary of that fateful Saturday in October 1979 when the Federal Reserve announced, along with certain other monetary policy measures, a shift in its approach to open market operations. The new technique, described and critiqued in James Pierce's thoughtful and stimulating paper, "Making Reserve Targets Work," has sought to achieve closer control over the Fed's monetary growth objectives by placing greater emphasis on controlling the volume of reserves to support such growth, and less emphasis on interest rate levels. Pierce identifies a number of issues involved in working with the new reserve target approach — some of which may present significant problems, in my view, while in other cases I believe he exaggerates the significance of the questions raised. In some cases, too, I think he may have misconceptions about the reserve targeting approach that has been applied in the past year.

At the outset of his paper, Pierce provides useful background on how the Fed turned to reserve targeting, in its effort to seek better control of monetary aggregates. He states, and I would agree, that the System theoretically could have used a Federal funds targeting approach in seeking to achieve its desired money growth aims more effectively, but in practice rates were not allowed to vary sharply under that approach, so the approach had significant limitations. It is not that rates were held steady under the Fed's early approach; there could in fact be rather substantial moves (witness 1974) but the changes typically were fairly gradual and market participants usually could count on tomorrow's and next week's rates not being too drastically different from yesterday's and today's rates.

Even if abrupt changes in rates were considered quite acceptable, I believe the Fed might have had considerable difficulty, under its previous approach, in deciding how big a change to aim for at a particular time. If money is growing too fast, should rates be pushed up ½ percent? 1 percent? 2 percent? I doubt if we would have had available a credible rationale for just how much to raise rates and how long to leave them high — credible either to ourselves in the Fed or to the rest of the interested world. A reserve objective related to money growth targets sidesteps that question to some considerable extent because within the broad bands the Federal Open Market Committee (FOMC) has set, interest rate levels tend to fall out as a consequence of pursuing the reserve target.[1]

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[1] To be sure, one might ask what is the rationale for a particular monetary growth objec-

Pierce says he is troubled by the multiplicity of monetary growth targets — M-1A, M-1B, and M-2 — as this makes it difficult to judge how well the program is succeeding. As he notes, the FOMC's objectives are not scalar multiples of one another. True, but they are not unrelated either. If all come out fairly strong or weak relative to the Fed's preferred ranges, a clear conclusion can be drawn. Part of the reason for having what some critics have regarded as fairly wide acceptable ranges of growth is to allow for some variability in the relationships among the different Ms. (Another reason is that even if the Fed specified only one monetary aggregate there would be reason for a fairly broad range to encompass some degree of variability in the relationship between that aggregate and the economy.) While as Pierce notes, the FOMC has not stated explicitly an order of preference in reaching the targets for the different Ms, a close reading of the policy record can at times suggest greater concern with one or another of the family members — for example, by indicating an *expected* short-term growth rate for a particular aggregate in conjunction with achieving objectives for certain other aggregates. As for the choice of M-1A or M-1B, the double designation can perhaps be thought of as a transitional sibling rivalry which makes sense in a period when NOW accounts and other checkable interest bearing accounts are just getting started on a nationwide basis.

Pierce provides a good description of the derivation of a total reserve path — building it up from required reserves against the reservable elements in the FOMC's chosen aggregates, plus other revervable items not in the specified aggregates, plus an allowance for excess reserves. I could not follow his reference, however, to deriving the path to support desired monetary growth as a residual, after meeting reserve needs for components *not* in the FOMC's chosen aggregates; it seems to me the path is built up to include the reserves needed for elements both within and outside the chosen aggregates — although to be sure, there is a sense in which one can say that given the total path and taking also as given the volume of reserves needed to support elements *not* in the chosen aggregates, the balance of reserves in the path is available to support the aggregates.

The next step, derivation of a path for nonborrowed reserves, is not quite as Pierce describes it — i.e., as a staff decision — since the FOMC gives a fairly clear indication of an initial assumed level of discount window borrowing which the staff then subtracts from the total reserve path to get nonborrowed reserves. Typically, the initial borrowing level will be set in close relation to recently prevalent borrowing levels, though allowances could be made for special identifiable factors that may have made recent borrowing unusual in some way. Also, the Committee can impart some initial thrust toward greater accommodation or restraint of monetary growth by setting that initial borrowing level lower or higher.

tive, or set of objectives, but I believe we can feel more secure about the relationships of various money measures to the final economic objectives than would be the case with interest rate relationships. Still, there is enough substance to the question that I think we need to be ever watchful that the chosen aggregate objectives remain appropriate.

The handling of the short-term variability of borrowing has proven to be one of the most difficult aspects of working with reserve targets, but before turning to that practical application, let me comment on how things normally proceed after a path for nonborrowed reserves is derived. As Pierce points out, the Trading Desk has to live in the real world of seasonally unadjusted values for weekly nonborrowed reserves. We also get projections of the *supply* of reserves of nonborrowed reserves, which can be affected by the volume of Federal Reserve float, currency in circulation, Treasury balances at the Fed and some other technical factors. Comparison of the weekly nonborrowed reserve objective with the projected *supply* of nonborrowed reserves is the primary determinant of our day-to-day open market operations. Since the projections are always uncertain, in greater or lesser degree, we also try to draw some confirmatory guidance as to the availability of reserves from the state of the money market — including the federal funds market. That rate is no longer closely managed, though, as Pierce's charts and discussion vividly indicate. Of course, if the funds rate is pressing to the top or bottom of the Committee's broad range — 8 to 14 percent in the most recently published policy record — the Desk would have to give explicit attention to the rate as such. Instances of the latter have been rather few and far between during the past year, though; while there have been some periods of relative stability in the funds rate, this has been primarily happenstance as the forces did not emerge to push the rate off a particular perch for a time.

Given a nonborrowed reserve target based on the Committee's specified growth rates for the aggregates, what happens as we proceed through an intermeeting period? If monetary growth stays on track, then aiming for the nonborrowed path should keep borrowing about steady. If money growth speeds up, the banking system will demand more reserves but by staying with our nonborrowed path the extra reserves would have to come from borrowings and in time that would put pressure on the banking system, through higher rates and administration of the discount window, so that money and credit growth would tend to return to path. Where there is a large and persisting excess of demand for reserves above the reserve path, we have sought to accelerate the adjustment process by deliberately lowering the nonborrowed reserve path, so that a greater rise in borrowing is imposed earlier.

The process works the same way in the other direction, too — slower than desired money growth reduces the need for borrowing and this tends to encourage lower rates and renewed expansion. Again the process can be accelerated by raising the nonborrowed path, thus reducing borrowing even more at an earlier stage. The symmetry isn't perfect because there is a lower limit to borrowing, below which additional nonborrowed reserves would simply add to excess reserves; pushed far enough, additions to excess reserves would soon drive the funds rate down to whatever lower bound the Committee had specified. (Likewise, extended and intensifying pressure for increased borrowing could drive the funds rate up to its upper bound.)

Pierce clearly recognizes the Fed's ability to speed reactions of the banking system by raising or lowering the nonborrowed reserve path, but it was

not clear to me whether he took into account that some forces tending to return total reserves to path are set up by merely sticking with the initial path for nonborrowed reserves, as deviations in the demand for reserves cause variations in borrowing.

Pierce asserts that because of lagged reserve accounting (LRA), where this week's required reserves are determined by deposit levels two weeks earlier, the System is really on a free or net borrowed reserve target when the Desk aims for nonborrowed reserves. In the context of a single week's objective, this is right, since free reserves plus required (which is fixed, based on earlier deposits) equals nonborrowed. But this definitional identity should not be confused with the old free reserve targeting of some years ago, when the Desk tended to aim week after week for a particular level of free or net borrowed reserves and then shifted policy from time to time by changing that objective. That approach was quite different from the present reserve targeting. That earlier approach sought to keep the level of borrowing about unchanged from week to week, whereas now that level will change as described earlier, when money growth pushes above or sags below the desired path.

Pierce also makes a number of comments about the present system of lagged reserve accounting, to the effect that under contemporaneous reserve accounting (CRA) reserve targeting would work better and interest rate fluctuations would be reduced. I'm not at all sure of these conclusions. His best comment on the subject, I think is the remark that "It is possible, however, to make too much of lagged reserve accounting." For myself, I can see some theoretical advantages in the return to CRA, in terms of slightly speeding the response to deviations of monetary growth from path. At the same time, it could be more difficult under CRA to sort out the bulges in demand for reserves stemming from technical causes that one wished to accommodate from those that reflected underlying monetary growth and hence should be resisted. It is this inability to separate the transient and more persistent aberrations that makes me question whether the course of rates would indeed run smoother under CRA, or whether the Desk's life would really be easier.

Pierce refers a few times to the "tight" or "heavy" administration of the discount window, noting that this keeps the window from becoming an open-ended source of reserves that could frustrate efforts to approach desired total reserve paths. This is certainly so in a broad long-term sense, although in a shorter run the behavior of borrowing can be a complication for the Desk's day-to-day operations. For example, we might start a week aiming for $40 billion of nonborrowed reserves, in anticipation that borrowing would turn out to be $500 million in order for banks to cover their requirements of, say, $40.3 billion and desired excess of $ .2 billion. Now suppose we learn on Monday morning that in this reserve week, which began on Thursday, banks borrowed heavily over the weekend and already have daily average borrowing of $1.2 billion. Even if borrowing fell to zero for the rest of the week, the weekly average would be about $700 million; quite likely, some banks would stay in the window for the rest of the week so borrowing would most likely

turn out above that $700 million level for the week. If the Desk stuck by its nonborrowed reserve objective for the week, we would be over-providing total reserves and probably producing a sharp easing in market conditions that might convey misleading signals to the market. In such circumstances there has been a need for modification of the weekly nonborrowed reserve objectives. In part the extent of modifications might depend on what sort of overt actions might have been needed to achieve the path. Thus we might be more willing to undershoot the nonborrowed objective in the example if it would have taken overt action to attain the objective, while if a no action course left too many reserves out there, there might be a tendency to let that happen, at least up to some point. On the other side, if we run into a period when banks are significantly more reluctant to borrow than we had anticipated, there is a case for some upward modification of nonborrowed reserves — as the alternative could be an exceptional tightening in reserve availability at the end of a statement week that could also be misleading and could set a pattern for subsequent weeks that would be out of kilter with what was desired.

Pierce notes the variability of reserve multipliers as a potential source of difficulty in reaching desired aggregates, and this can indeed be a contributing factor, although as he also mentions, we can make short-term adjustments in the expected multipliers, even within an intermeeting period, to allow for variability of that kind. He goes on to suggest that if we really turned to the task with all available econometric techniques we'd surely be able to do a better job of anticipating the multipliers. While I'm not necessarily against "sophisticated techniques," I have real doubts as to whether it would help all that much. I suspect that the efforts to take closer account of shifting multipliers might just produce greater short-term rate fluctuation while achievement of the desired aggregates in the short run still eluded us.

One of the final points in Pierce's paper is to suggest that the Fed might do better to forget about monetary aggregates and just proceed directly from reserve objectives to "ultimate objectives" of policy — presumably such values as economic activity, or prices. The difficulty I find with this is that at any given time a reserve target implicitly embodies some monetary aggregate or set of aggregates and one might as well acknowledge this. At the same time, Pierce had a good point in that one should not blindly pursue a monetary aggregate objective that may be getting us off the track with respect to some more underlying objective. One must remain aware of the possibility of shifts in the demand function for money in its various forms which could change the significance of particular measured aggregates.

Pierce's closing comments about the multiplicity of targets and the tendency of the Fed to jump from one fire to the next — shuttling from the battle on inflation to the battle against unemployment — left me a little puzzled. I would regard the current effort to achieve reasonably steady, moderate monetary growth as the antithesis of that fire-fighting approach. The FOMC selected a money growth objective designed to be consistent with a gradual winding down of inflation, anticipating at the same time a sluggish economic performance. The Fed stayed with a policy of aiming for moderate monetary

growth when such growth bulged early in 1980, and rates rose sharply in consequence; the same annual growth objectives were retained through the spring when actual growth turned negative, in turn producing a sharp decline in rates. And the objectives have been maintained in recent months when monetary growth has rebounded, and this has produced a corresponding climb in rates.

The point is that deviations in growth have brought swift responses in the form of changed market conditions that should tend to work the growth rate back to the desired track. As to whether growth will come out reasonably within range for the year, the jury is still out. Just before mid-year, growth looked too low; continuation for the full year of the growth rate in the first several months would have left the growth rate well short of path on the M-1 measures. Since May, there's been a rebound, quite welcome at first, but more troublesome as it continued strong through the summer. Extension of the growth rate of the last few months through year-end would bring the aggregates out too high, but this has been engendering a response that could result in coming out not too badly against the FOMC's objectives for the year.