Short-Run Domestic Monetary Control in an International Money Market

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For several years prior to October 1979, the federal funds rate—the interest rate U.S. banks charge for overnight interbank lending—served as a daily guide for Federal Reserve System open market operations. Between meetings of the Federal Open Market Committee (FOMC), the manager of the "trading desk" at the New York Federal Reserve Bank would purchase or sell government securities to maintain a federal funds rate believed to be consistent with the desired growth rates of money and credit specified by the Committee. In October 1979 the Federal Reserve began placing greater emphasis on controlling the supply of reserves in the commercial banking system from week to week and less emphasis on limiting fluctuations in the federal funds rate. Under reserves targeting, the manager of the trading desk began purchasing or selling government securities to maintain the projected level of reserves close to a path intended to achieve the desired growth rates of money and credit specified by the FOMC.

While greater interest rate variation has been allowed since October 1979, the adoption of reserves targeting does not mean that the Federal Reserve has ignored domestic interest rate fluctuations. In fact, the post-October 1979 approach toward achieving the monetary growth objectives of the FOMC has been characterized by the Federal Reserve as "a bit of a hybrid that includes some interest rate concern along with the basic reserve-oriented approach."[1] Yet short-run U.S. monetary control decisions have usually been made paying little *consistent* attention to information from foreign exchange markets or from international money markets.[2] While exchange rate movements have influenced U.S. policy decisions during times of apparent crisis,[3] the absence of a systematic role for exchange rates or expected exchange rate changes in the conduct of short-run U.S. monetary policy contrasts sharply with monetary policy approaches of other industrialized countries. For example, in March 1982 the Bank of England announced that monetary policy would no longer focus on a single monetary aggregate but would focus explicitly

on several variables, with the exchange rate "specifically listed as a variable that provided information about monetary conditions and that would be taken into account in policy decisions."[4] Reports from the Bank for International Settlements—the central bankers' central bank—note that this view is shared by several non-U.S. monetary authorities: "Exchange rates have come to be regarded as intermediate targets or *indicators of monetary policy* in many countries . . . ." [Italics added.][5]

This article explores conceptually how international factors can influence the Federal Reserve's ability to attain—either with interest rate targeting or reserves targeting—the domestic monetary policy objectives specified at FOMC meetings, and how the exchange rate might offer information to the central bank to improve domestic monetary control. In brief, this article addresses the issue of short-run domestic monetary control in an international money market.

To lay the groundwork, the article first reviews the conditions under which reserves targeting is preferred to interest rate targeting, and vice versa, in a "closed" money market—that is, a money market insulated from foreign economic shocks.[6] Neither reserves targeting nor interest rate targeting is best under all conditions. However, under reserves targeting, interest rate fluctuations contain information that might improve short-run monetary control. Similarly, under interest rate targeting, fluctuations in the level of reserves offer information to the central bank that might improve short-run monetary control.

The analysis is then extended to describe an "open," or international, money market. The central bank's ability to control the money stock deteriorates under either reserves targeting or interest rate targeting as international financial disturbances become prominent, although reserves targeting may become relatively more attractive as the country's money market is increasingly subject to international shocks. However, additional information is available to the monetary authorities in an international money market to help offset this loss of control. Exchange rate fluctuations are just one such potential source of information. In conjunction with fluctuations in domestic financial indicators, exchange rate variation can help the monetary authorities under certain assumptions to distinguish between domestic and international financial disturbances that diminish short-run domestic monetary control.[7]

I. Short-Run Monetary Control in a Closed Money Market

A common misconception is that the Federal Reserve has direct control over the money stock, implying that the money stock is some policy instrument that the Federal Reserve can adjust daily.[8] In fact, the money stock is largely determined by the interactive behavior of banks and the (nonbank) public—households, nonbank firms, and government agencies. The public generates the demand for money. As income increases, the public desires to hold more balances for transactions—and perhaps for savings—purposes,

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[1] Peter D. Sternlight, Executive Vice President for Open Market Operations, Federal Reserve Bank of New York, "Implementation of Federal Reserve Open Market Operations," *Central Bank Views on Monetary Targeting*, Federal Reserve Bank of New York, May 1982, p. 43.

[2] For descriptions of the current (closed economy) stance of the Federal Reserve toward implementing monetary policy, see Stephen H. Axilrod and David E. Lindsey, "Federal Reserve Implementation of Monetary Policy: Analytical Foundations of the New Approach," *American Economic Review*, vol. 71, no.2, May 1981, pp. 246-252, or Stephen H. Axilrod, "Monetary Policy, Money Supply, and the Federal Reserve's Operating Procedures," *Central Bank Views on Monetary Targeting*, Federal Reserve Bank of New York, May 1982.

[3] For example, on November 1, 1978, the U.S. Government announced a new strategy of coordinated foreign exchange market intervention with Japanese and Western European governments, a higher U.S. discount rate, and higher minimum reserve requirements for banks—all in an attempt to raise the foreign currency value of the dollar.

[4] Karen H. Johnson, "Foreign Experience with Targets for Monetary Growth," *Federal Reserve Bulletin*, October 1983, p. 748.

[5] Bank for International Settlements, *Annual Report*, June 1981, p. 60.

[6] See also James L. Pierce and Thomas D. Thompson, "Some Issues in Controlling the Stock of Money," in *Controlling Monetary Aggregates II: The Implementation*, Federal Reserve Bank of Boston Conference Series, no. 9, 1972, pp. 115-136, and Stephen F. Leroy, "Efficient Use of Current Information in Short-Run Monetary Control," Division of Research and Statistics Special Studies Paper, no. 66, Board of Governors of the Federal Reserve System, Washington, D.C., September 1975. The models in both papers are closed money-market analogues to the IS-LM model in William Poole, "Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model," *Quarterly Journal of Economics*, vol. 84, no. 2, May 1970, pp. 197-216.

[7] Exchange rates also convey information useful toward achieving ultimate economic objectives such as a high rate of economic growth and a low rate of inflation. However, a discussion of achieving ultimate goals is beyond the scope of this paper. Furthermore, neither the relationship between monetary-credit aggregates and ultimate economic objectives nor the feasibility of an intermediate target strategy will be discussed in this article. On the former issue, see Richard W. Kopcke, "Must the Ideal 'Money Stock' Be Controllable?" *New England Economic Review*, March-April, 1983, pp. 10-23. On the latter issue, see Ralph C. Bryant, *Money and Monetary Policy in Interdependent Nations*, (Washington, D.C.: Brookings Institution, 1980), Part 4.

[8] The Federal Reserve can control the money stock but only over a considerable period of time; the Fed lacks *contemporaneous* control of the money stock. For the remainder of the article, distinctions among the various monetary and credit aggregates will be ignored. Issues pertaining to these distinctions are beyond the scope of this article.

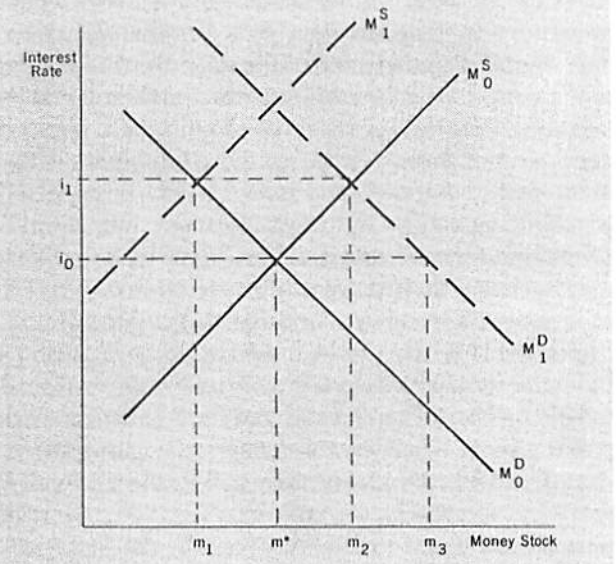
raising money demand. The quantity of money demanded by the public also rises as the interest rate on bonds falls, which lowers the implicit cost of holding money.

The commercial banking system partly determines the supply of money to the public. For example, 75 percent of the measure of money known as M1 is comprised of demand and other checkable deposits at banks. While banks must hold required reserves along with earning assets against these deposits, at any given time some banks also hold excess reserves (i.e., in excess of the required level) that earn no interest. For a given level of total reserves in the banking system, an increase in money demand induces banks without excess reserves to bid up the federal funds rate as they seek additional reserves against which to issue demand deposits. As the funds rate rises, banks holding excess reserves sell them in the federal funds market. Consequently, loans and deposits expand, increasing the quantity of money supplied for a given level of total reserves.[9]

In the very short run, the Federal Reserve can do no more than *influence* the money stock by altering the supply of reserves to the commercial banking system.[10] An increased supply of reserves by the Federal Reserve augments the supply of money by encouraging banks to expand loans and deposits at the prevailing interest rate, rather than holding idle excess reserves. If the stock of money adjusted instantaneously and predictably to changes in the supply of bank reserves, the Federal Reserve could in fact control the money stock—momentarily and continuously with incremental adjustments in reserves.

In reality, the money stock does *not* adjust instantaneously and predictably to unforeseen changes in the public's demand for money or the banking system's supply of money. Accordingly, the Federal Reserve has alternately used interest rate targeting or reserves targeting to try to achieve its inter-FOMC-meeting monetary growth objectives. If unanticipated changes in the public's demand for money are large and frequent, the Federal Reserve can better achieve its monetary objectives under reserves targeting. By contrast, in the presence of large and frequent unforeseen changes in the banking system's supply of money, the Federal Reserve can better achieve its monetary objectives under interest rate targeting.

Figure 1



To illustrate, let the money stock initially equal the desired value (m^*) at a given interest rate (i_0), as shown in Figure 1. Suppose the public's demand for money unexpectedly increases—say, caused by an increase in income—as represented by the upward shift of the money demand curve from M^D_0 to M^D_1. The money demand increase tends to raise the federal funds rate as commercial banks compete for reserves to support the higher level of deposits. Under interest rate targeting, the increased demand for money induces the Federal Reserve to expand reserves (virtually) automatically to prevent the interest rate from rising. As a result, the money stock expands considerably beyond the Federal Reserve's objective (to m_3). Under reserves targeting, the interest rate is allowed to rise in response to the increased demand for money, curbing the rise in the quantity of money demanded as the implicit cost of holding money increases. Although the money stock rises above its desired lev-

[9] In reality, total reserves are variable because the Federal Reserve has been controlling the level of nonborrowed reserves. For a given increase in money demand, a rising federal funds rate augments borrowing by banks at the Federal Reserve discount window. For a given level of nonborrowed reserves and a fixed discount rate, banks increase borrowings from the Federal Reserve and decrease holdings of excess reserves to increase the level of required reserves supporting the higher level of deposits.

[10] Discount rate changes and reserve requirement ratio changes are ignored here due to the infrequency of their adjustments and the dramatic impacts such changes incur.

el under reserves targeting (to m_2), the deviation from the desired level is considerably less than under interest rate targeting.

On the other hand, the Federal Reserve's ability to achieve its monetary objectives in the face of large and frequent unexpected changes in the banking system's supply of money is greater under interest rate targeting than under reserves targeting. To illustrate, suppose the money stock initially equals its desired level (m^*) and some commercial banks unexpectedly try to increase their holdings of excess reserves at the prevailing interest rate (i_0). For example, some banks may increase their demand for excess reserves today as a precaution against a large anticipated drain of deposits. This change is represented in Figure 1 by the leftward shift of the money supply curve from M_0^s to M_1^s. As these banks enter the federal funds market seeking more reserves, the federal funds rate tends to rise. Under interest rate targeting, the Federal Reserve automatically expands reserves to prevent the interest rate from rising. As a result, the Federal Reserve will increase reserves by an amount equal to the *desired* increase in excess reserves and the money stock will remain near the Fed's objective (m^*). Under reserves targeting, the Federal Reserve would not expand the supply of reserves to the banking system, instead allowing the funds rate to rise and the money stock to fall well below the preferred level (to m_1) as banks contract loans and deposits to enlarge their holdings of excess reserves. Consequently, given the same shock to the supply of money, the money stock deviates more from its desired level under reserves targeting than under interest rate targeting.

Yet the official adoption of reserves targeting did not necessarily imply that the Federal Reserve subsequently ignored interest rate fluctuations; the Federal Reserve maintained "some interest rate concern."

The Federal Reserve decided officially to switch from an interest rate approach to a reserves approach in October 1979 upon observing that rapid price increases, changing inflationary expectations, and financial innovations had created large and frequent shifts in money demand. Despite a gradually rising federal funds rate during the late 1970s, the accommodation of rising money demand under the existing interest rate approach allowed M1 growth to exceed its target range in 1977, 1978 and 1979.[11] This signaled to the Federal Reserve the need for switching to reserves targeting, as stated by the Chairman of the Board of Governors to the U.S. Congress:

> Our purpose in this program [implementing reserves targeting] was to signal clearly and forcibly our unwillingness to finance an accelerating rate of inflation and our desire to "wind down" inflationary pressures.[12]

Yet the official adoption of reserves targeting did not necessarily imply that the Federal Reserve subsequently ignored interest rate fluctuations; the Federal Reserve maintained "some interest rate concern." The potential "information content" of interest rates under a reserves approach can be illustrated in an example. Suppose that during a given week preliminary estimates of the Federal Reserve predict that the money stock has risen above its desired level. Without additional information, the Federal Reserve cannot infer whether an increase in the public's demand for money or an increase in the banking system's supply of money explains the money stock rise. But an accompanying fall in the interest rate would suggest that the money *supply* has unexpectedly expanded. Accordingly, the Federal Reserve could return the expected money stock toward the desired level and restore the initial interest rate by a withdrawal of reserves from the banking system—that is, a "discretionary adjustment" of the original reserves path.

If the predicted rise in the money stock above its target was instead accompanied by a rise in the interest rate, the Federal Reserve could infer that an unforeseen increase in money demand had occurred. The Federal Reserve could return the expected money stock toward its desired level by a discretionary withdrawal of reserves, but only by accepting a much higher interest rate than before (a restrictive stance). Alternatively, the Federal Reserve could maintain the established reserves path, accepting some increase in the money stock and a smaller rise in the interest rate (an accommodative stance). For instance, following a

[11] The target ranges for M1 (fourth quarter to fourth quarter) were 4.5-6.5 percent in 1977, 4.0-6.5 percent in 1978, and 1.5-4.5 percent in 1979 (revised to 3.0-6.0 in October 1979). Actual M1 growth rates (fourth quarter to fourth quarter) were 7.4 percent in 1977, 7.3 percent in 1978, and 5.5 percent in 1979. Data were collected from various issues of the *Federal Reserve Bulletin*.

[12] Statement by Paul A. Volcker, Chairman, Board of Governors of the Federal Reserve System, before the Joint Economic Committee of the U.S. Congress, February 1, 1980.

gradual decline in the federal funds rate from 19 percent to nearly 12 percent over the last half of 1981, the Federal Reserve observed the rate climbing again in early 1982. In conjunction with estimates of a rising money stock (M1) in the first quarter of 1982, the Federal Reserve may have been intentionally accommodative, attributing the expected money stock rise to an increase in the public's demand for money. This interpretation is suggested by the minutes of the March 1982 meeting of the FOMC:

> The great bulk of the first quarter growth of M1 had occurred in NOW accounts, suggesting that *individuals wished to hold increased liquid balances* in an environment of considerable uncertainty about the prospects for economic activity and interest rates. [Italics added.][13]

In retrospect, this "hybrid" approach followed by the Federal Reserve—incorporating interest rate concern into a reserve-oriented strategy—may have contributed significantly toward improving domestic monetary control.

II. Short-Run Monetary Control in an International Money Market

In reality, the U.S. money market is not isolated from foreign economic influences. Financial capital readily crosses national borders. The strong correspondence between changes in U.S. and other national interest rates supports the notion that capital is highly mobile internationally.[14] According to one view, the interest rate on a short-term U.S. dollar-denominated financial asset should equal the "exchange-adjusted" interest rate on a comparable asset denominated in foreign currency, where "exchange adjusted" means adjusted for the expected exchange rate change between the two currencies over the term of the asset (except for transactions' costs and execution lags). Thus, the domestic interest rate is likely to be influenced by—and to influence—the foreign interest rate and the expected rate of exchange rate change.

Much recent empirical evidence is consistent with the view that comparable short-term U.S. and foreign financial assets are *imperfect* substitutes, suggesting that their corresponding domestic and foreign interest rates need not match even when adjusted for the expected exchange rate change. According to this view, a time-varying differential may exist between a domestic interest rate and an exchange-adjusted foreign interest rate reflecting an additional return that investors require to hold the relatively riskier asset. To illustrate, let the interest rate on a three-month U.S. Treasury bill initially equal that on a comparable foreign asset plus the expected rate of the dollar's depreciation over the assets' term. If investors worldwide came to believe at some point that U.S. economic and political stability had increased compared to that abroad, this changed perception of risk might cause foreign financial capital to flow into the United States, lowering the U.S. interest rate and raising exchange-adjusted foreign interest rates. The resulting differential between an exchange-adjusted foreign interest rate and the domestic interest rate would represent the additional return that investors required to hold the now riskier foreign asset—a return commonly termed the "exchange risk premium."[15] Thus, the domestic interest rate is likely to be influenced by the foreign interest rate, the expected rate of exchange rate change, and the exchange risk premium. Evidence has indicated that this risk premium may be quite volatile over time. The 1984 *Economic Report of the President* argues that such a change in the perception of risk—the so-called "safe-haven" motive—is one important reason for recent large capital flows into the United States, contributing to the dollar's rise in foreign exchange markets:

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[13] "Record of Policy Actions of the Federal Open Market Committee," *Federal Reserve Bulletin*, June 1982, p. 366-367.

[14] Some partial correlation coefficients between weekly U.S. short-term interest rates and various other industrialized countries' short-term interest rates are 0.60 (United Kingdom), 0.71 (France), 0.72 (Germany), 0.73 (Switzerland), and 0.89 (Canada). Data are generally for the period May 1973 through September 1983.

[15] The exchange risk premium (rp) is defined as:

$$rp = i - (i^f + x)$$

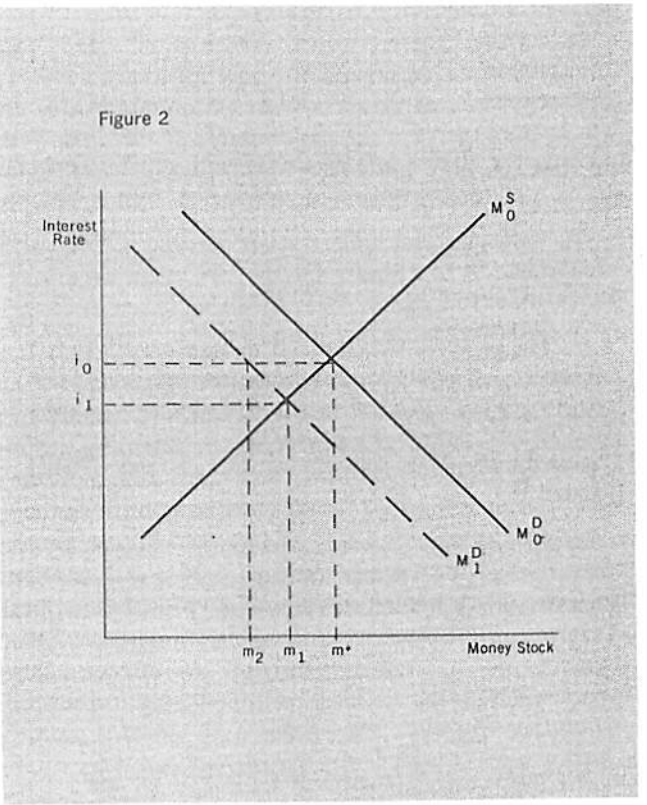
where i is the domestic interest rate, i^f is the foreign interest rate, and x is the expected rate of depreciation of the domestic currency (or appreciation, if negative) vis-a-vis the foreign currency. Empirical tests by necessity have had to test the joint hypothesis of market efficiency and perfect asset substitutability (the latter implying the absence of a risk premium). Many studies have rejected this joint hypothesis, including John Geweke and Edgar Feige, "Some Joint Tests of the Efficiency of Markets for Foreign Exchange," *Review of Economics and Statistics*, vol. 61, no. 3, August 1979, pp.334-341; Lars P. Hansen and Robert J. Hodrick, "Forward Exchange Rates as Optimal Predictors of Future Spot Rates: An Econometric Analysis," *Journal of Political Economy*, vol. 88, no. 5, 1980, pp. 829-853; David Longworth, "Testing the Efficiency of the Canadian-U.S. Exchange Market under the Assumption of no Risk Premium," *Journal of Finance*, vol. 36, no. 1, March 1981, pp. 43-49; Bonnie E. Loopesko, "Relationships among Exchange Rates, Intervention, and Interest Rates: An Empirical Investigation," Board of Governors of the Federal Reserve System Staff Studies No. 133, November 1983; and Robert E. Cumby and Maurice Obstfeld, "International Interest-Rate and Price-Level Linkages under Flexible Exchange Rates: A Review of Recent Evidence," in John F.O. Bilson and Richard C. Marson (eds.), *Exchange Rates: Theory and Practice* (Chicago: University of Chicago Press, forthcoming).

. . .investors have shifted their portfolios into dollar assets in response to the increased riskiness of investments in other parts of the world, Latin America in particular.[16]

Because international factors can influence U.S. money market conditions in such ways, this part of the article reexamines the issue of short-run domestic monetary control within the context of an international money market. Several interesting conclusions emerge. First, as in the case of a closed money market, neither reserves targeting nor interest rate targeting is always best in an open money market. Yet when the public's demand for money experiences large and frequent unforeseen shocks, reserves targeting may become even more attractive than interest rate targeting in an open (compared to a closed) money market. Second, domestic monetary control deteriorates under either reserves targeting or interest rate targeting as international disturbances become prominent because these shocks generally aggravate money demand instability. Third, while domestic monetary control is less precise in an international money market, additional information—such as that from exchange rate fluctuations—can be utilized to reduce this loss of control. If domestic and foreign assets are imperfect substitutes, information from exchange rate variation can be used by the monetary authorities to distinguish among the various domestic and international shocks reducing monetary control.

Reserves Targeting versus Interest Rate Targeting

It should not be surprising to learn that domestic monetary control can be weakened by unexpected international developments.[17] For example, an unanticipated rise in foreign income raises demand for domestic money on the part of foreigners who now plan greater imports from the United States—the bulk of U.S. exports being paid for in dollars.



However, the deterioration of domestic monetary control that results when international shocks become prominent cannot be explained solely by such direct effects. Many international factors induce domestic money demand instability indirectly. For instance, if investors decide that foreign bonds have become riskier investments compared to U.S. bonds, capital flows into the United States as risk-averse investors reduce their demand for foreign bonds and raise their demand for U.S. bonds. If U.S. bonds are substituted for foreign bonds dollar for dollar, there is no direct effect on domestic money demand. However, there is an indirect effect. As the exchange-adjusted foreign interest rate rises owing to the foreign capital outflow, the implicit cost of holding domestic money (foregone interest on foreign bonds) rises, which reduces domestic money demand. This induced decline in domestic money demand is represented in Figure 2 by the leftward shift of the money demand curve from M_0^D to M_1^D. At the same time, the capital flow into the United States lowers the U.S. interest rate. While the falling U.S. interest rate en-

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[16] *Economic Report of the President* (Washington, D.C.: U.S. Government Printing Office, 1984), p. 54. The shift into dollar-denominated assets may also have resulted from a belief that the expected rate of return on foreign assets declined.

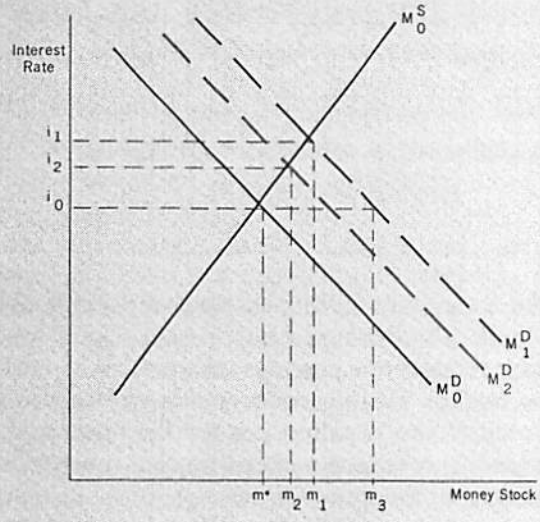
[17] The domestic money stock is defined as dollar-denominated liabilities of the central bank (currency) and of the banking system (deposits) issued domestically. For example, the domestic money stock of the United States—M1, M2, or M3—does not include dollar-denominated liabilities of foreign banks; overnight Eurodollars held by U.S. residents other than banks at Caribbean branches of member banks constitute a small portion of M2 or M3. The domestic money stock includes domestically issued dollar-denominated liabilities of U.S. banks to foreign residents. The analysis that follows assumes that the total investable wealth of the domestic commercial banking system is unaffected by exchange rate changes. The bulk of U.S. banks' assets are in dollar-denominated loans; foreign currency-denominated securities and loans are a minor portion of U.S. banks' assets.

courages an increase in the quantity of money demanded (from m_2 to m_1), the new level of the money stock (m_1) remains below the desired level (m^*). Consequently, even without directly disturbing domestic money demand or supply, international factors—in this case, a portfolio shift between foreign and domestic bonds—can erode domestic monetary control under either reserves targeting or interest rate targeting.[18]

While it may seen obvious that there should be a loss of domestic control as a country's money market becomes more open, it is not so obvious that reserves targeting may become relatively more attractive than interest rate targeting as international disturbances become more prominent. Reserves targeting may become relatively more attractive when unexpected changes in the public's demand for money are large and frequent. For instance, in an open money market, let the money stock initially equal its desired value (m^*) at a given interest rate (i_0). Suppose a rise in domestic income unexpectedly increases domestic money demand, shown in Figure 3 by the upward shift in the money demand curve from M_0^D to M_1^D. Under reserves targeting, the money stock will rise above its target, but probably *less* than in a closed money market. In a closed money market, the money demand increase would raise the domestic interest rate (to i_1) and expand the money stock (to m_1). But in an open money market a rising interest rate at home attracts financial capital from abroad, causing the exchange-adjusted foreign interest rate to rise. The rising exchange-adjusted foreign interest rate induces an offsetting reduction in domestic money demand, shown in Figure 3 by the downward shift in the money demand curve from M_1^D to M_2^D. Consequently, for the same initial money demand disturbance, the money stock rises less in the open money market (m^* to m_2) than in the closed money market (m^* to m_1) under reserves targeting.

Under interest rate targeting, the same disturbance to money demand leads to a larger rise in the money stock above its target but *no less* a rise than in a closed money market. Rising money demand—shown in Figure 3 by the shift from M_0^D to M_1^D—tends to raise the

Figure 3



domestic interest rate, inducing an automatic expansion of reserves by the monetary authorities to prevent the interest rate rise. With the domestic interest rate effectively fixed, reserves must expand enough to satisfy the increased demand for money.[19] This raises the money stock considerably above its target (to m_3). An unchanged domestic interest rate prevents an inflow of financial capital from abroad, so the initial money demand disturbance is not offset. Consequently, when money demand is unstable, reserves targeting becomes even more attractive than interest rate targeting as a country's money market becomes more open.

The Information Content of Exchange Rates and Foreign Interest Rates

With domestic monetary control expected to erode as international factors become prominent, does information exist that might reduce this loss of control? If domestic and foreign financial assets (money and bonds) are not perfect substitutes, then

[18] Analysis in this area usually precludes any role for wealth. Wealth effects introduce several alternative, and mutually offsetting, channels for adjustment. At home, a simultaneous appreciation of the dollar lowers the domestic currency value of domestic residents' holdings of foreign assets, reducing domestic financial wealth and reducing domestic money demand further. The dollar's appreciation lowers prices of imported goods, reducing domestic money demand. Yet the falling domestic interest rate—by improving capital gains—raises domestic financial wealth, increasing domestic money demand. Abroad, the corresponding depreciation of the foreign currency has offsetting wealth effects on the foreign demand for domestic money.

[19] The Federal Reserve is assumed to respond with sufficient speed so as to prevent any significant or prolonged deviation of the interest rate from its target, thus precluding any portfolio adjustment altering the demand for domestic money.

current exchange rates and foreign interest rates contain information that may help the authorities to achieve their inter-FOMC-meeting monetary objectives in an international money market, just as the domestic interest rate conveys information in a closed money market. Furthermore, exchange rate and foreign interest rate variation can aid the monetary authorities in trying to identify the source of a disturbance to the domestic money stock in an international money market. For the remainder of this part, the central bank is assumed to basically follow a "reserve-oriented" approach.

Current exchange rates and foreign interest rates contain information that may help the authorities to achieve their inter-FOMC-meeting monetary objectives.

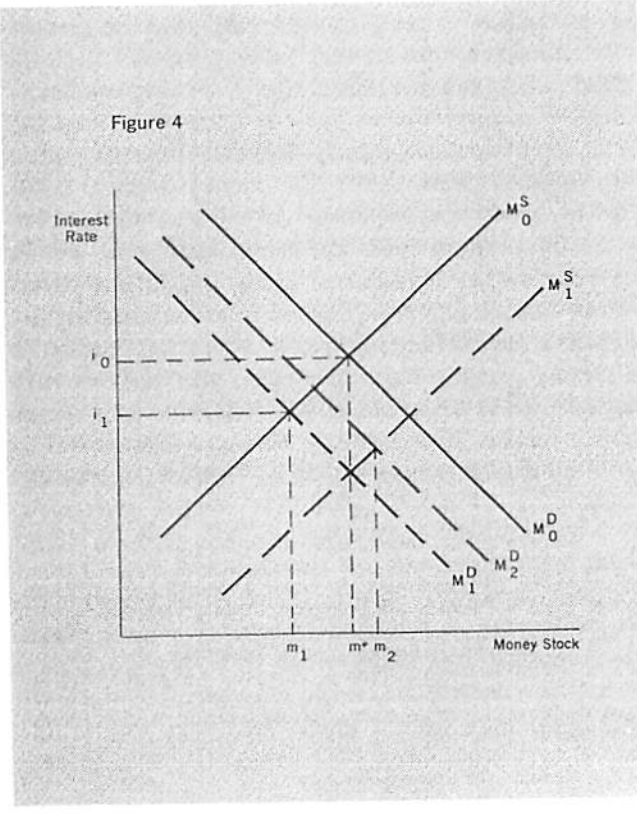
First, an example will illustrate how information on exchange rate and foreign interest rate variation might be helpful in achieving a monetary goal. Suppose that during a given week the U.S. interest rate falls (from i_0 to i_1) and preliminary estimates of the money stock show a decline below the desired level (from m^* to m_1), as in Figure 4. The monetary authorities would likely infer a decline in domestic money demand from M_0^D to M_1^D; they could return the expected money stock toward its preferred level with a discretionary expansion of reserves that would increase the money supply and, incidentally, lower the interest rate still further.

If the central bank were to ignore international financial repercussions of its actions, it would expand reserves enough to shift the money supply curve from M_0^S to M_1^S, in an effort to restore the money stock to the preferred level. Yet in an international money market, the U.S. interest rate decline resulting from this action would induce a domestic capital outflow and a depreciation of the dollar. As capital flowed abroad from this country, the (exchange-adjusted) foreign interest rate would fall as well. The foreign interest rate decline—by reducing the attractiveness of foreign bonds—would induce an increase in domestic money demand from, say, M_1^D to M_2^D, thereby raising the money stock beyond its desired level (to m_2). Consequently, the discretionary expansion of reserves would be *too large* if international linkages were ignored.

However, information from exchange rate and foreign interest rate changes is available to the authorities that would suggest a smaller expansion of reserves. Suppose the monetary authorities can estimate the sensitivity of domestic money demand to foreign interest rate changes, as they currently do for domestic interest rate changes. To determine the amount of the reserves expansion, the central bank would predict the expected rise in the quantity of money demanded in response to both the domestic interest rate fall *and* the exchange-adjusted foreign interest rate fall. The expansion of reserves to meet the monetary objective is consequently smaller in the international money market, because (predictable) induced increases in domestic money demand facilitate the return of the expected money stock toward its desired level.

Second, exchange rate and foreign interest rate variation can also help the monetary authorities in distinguishing between domestic and international disturbances to the domestic money stock, as illustrated in the following example. Suppose a declining expected money stock and a falling U.S. interest rate result from an unforeseen shift in investors' portfolio

Figure 4



preferences in favor of U.S. assets. That is, investors have decided, upon reassessing the risks, to reduce their demand for foreign bonds and to increase their demand for domestic bonds. As illustrated earlier, such a portfolio change has no direct impact on domestic money demand. Yet, the foreign capital outflow—by raising the exchange-adjusted foreign interest rate—can induce a decline in domestic money demand (see Figure 2). At the same time, the capital flow into the United States causes the dollar to appreciate and the U.S. interest rate to fall (because of the increased supply of capital). While the falling U.S. interest rate raises the quantity of money demanded, the money stock remains below the desired level.

In conjunction with the declining U.S. interest rate, the dollar's appreciation "signals" to the monetary authorities that the predicted money stock decline is attributable to a U.S. capital inflow—that is, to a rise in demand for domestic bonds—rather than to a reduction in domestic money demand arising from, say, a decline in domestic income. Moreover, if domestic money demand had unexpectedly declined because of declining income, the ensuing domestic interest rate fall would have induced a U.S. capital outflow instead and a corresponding dollar *depreciation*. Thus, exchange rate movements can also help monetary authorities to distinguish between the domestic and international disturbances impinging upon short-run domestic monetary control.

III. Conclusions

Traditional analyses of the choice of policy instruments for short-run monetary control tend to ignore international economic factors. In this article, the typical money market model used to discuss the conditions under which controlling reserves is preferred to controlling the interest rate, and vice versa, was extended to incorporate international financial linkages, as recent empirical evidence suggests that "the potential for external effects on U.S. short-term interest rates should not be ignored."[20] International capital mobility enables investors to choose among domestic and foreign money and bonds, rather than just among domestic assets. If all assets are imperfect substitutes, domestic money demand is sensitive to the domestic interest rate and the foreign interest rate adjusted for expected exchange rate changes.

In general, under either reserves targeting or interest rate targeting, domestic monetary control deteriorates as a country's money market becomes increasingly subject to international disturbances, although a reserves approach probably becomes even more attractive in an open money market when money demand is quite unstable. Just as the monetary authorities benefit in a closed money market by using information from interest rate fluctuations while following a reserve-oriented approach, the authorities benefit in an international money market by tapping information from interest rate *and* exchange rate fluctuations.

Modern approaches to exchange rate determination, on the other hand, tend to ignore the problem of short-run domestic monetary control facing central banks by assuming that the supply of money—and consequently the money stock—is exogenous. The spot exchange rate is perceived as adjusting instantaneously to maintain equality between the demand for and supply of the home (and foreign) currency. An appreciation of the home currency reflects a momentary excess demand for it in the foreign exchange market, while a depreciation reflects a momentary excess supply. This article shows how exchange rate movements can convey additional information. In conjunction with other financial indicators, exchange rates help the monetary authorities to identify the sources of disturbances that impede the attainment of short-run monetary objectives in a highly integrated, complex, international economy. Accordingly, central banks can use this information to help achieve monetary goals.

In order to make the analytical framework tractable, however, many assumptions and simplifications were necessary. Foremost, commodity markets were ignored to focus on short-run monetary control. A fuller model would integrate goods and financial markets and examine how exchange rate movements might provide information helpful to achieving ultimate economic objectives, such as a high rate of economic growth and a low rate of inflation. Trade in goods and services was ignored to focus on short-term capital flows. A broader analysis would require the exchange rate to adjust to current (or capital) account imbalances in the balance of payments. Much

[20] David G. Hartman, "The International Financial Market and U.S. Interest Rates," *Journal of International Money and Finance*, vol. 3, no. 1, April 1984, pp. 92-93. Hartman, applying a variant of the Sims-Granger method of testing causality, finds that the "tests suggest not only that changes in domestic interest rates have significant effects on the Eurodollar rate, but also that changes in the Eurodollar rate *which originate outside the U.S.* have a significant impact on domestic interest rates . . . . It is also shown that the international effects on the domestic market have become more significant in recent years than they were previously." [P. 92, italics added.]

of the analysis also assumed knowledge of parameters that, in reality, are difficult to estimate given current limitations in data collection and processing. Future research should address all these issues.

Despite these reservations, two broad conclusions emerge. First, given the present degree of capital mobility between the United States and other nations, short-run monetary control decisions should not be made without regard to that mobility. Second, while monetary policy decisions are more difficult when international factors are acknowledged, the potential "information set" available to the domestic monetary authorities is correspondingly larger.

A formalization of the conclusions of this paper is presented in "Short-Run Domestic Monetary Control in an International Money Market: A Technical Note," available upon request from the author or the editor of the *New England Economic Review,* Research Department, Federal Reserve Bank of Boston, Boston, MA 02106.