Alternatives to Intervention: Domestic Instruments and External Objectives

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I. Introduction

Every monetary policy has both domestic and international effects. In a world without fixed exchange rates, actions that are intended to stabilize the domestice price level will alter the exchange rate as well, which will not only affect other countries but will also feed back and modify the domestic response. During the past decade of generalized floating, there have been several episodes in which major industrial countries have implemented programs of monetary restraint, only to find their exchange rates appreciating by a greater magnitude than would have been warranted by the effect of the policy change on underlying economic conditions. These real appreciations have weakened the countries' international competitiveness and have thereby aggravated the deterioration in domestic output and employment associated with the monetary programs. Prominent among these episodes have been the experience of the Federal Republic of Germany during the mid-1970s and those of the United Kingdom and the United States during the past few years.

This tendency for monetary restraint to produce excessive and unsustainable appreciation of exchange rates is probably an inevitable byproduct of the relatively rapid response of financial markets to a policy shift.[1] But this does not imply that the magnitude of the responses that have characterized the past decade need be accepted as the norm. The monetary authorities in the large industrial countries have a number of policy instruments available for the implementation of their policies, some combinations of which may enable them to improve their control over exchange rates in order to limit the extent of overshooting and hasten the adjustment process. In some circumstances, sterilized intervention in the foreign exchange market may serve this function. Other methods that have been attempted at

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[1]This aspect of exchange market dynamics has been emphasized by Dornbusch in a number of papers. For a recent example, see Rudiger Dornbusch, "Exchange Rate Economics: Where Do We Stand?" in Jagdeep S. Bhandari and Bluford H. Putnam, *Economic Interdependence and Flexible Exchange Rates,* Cambridge: The MIT Press, 1983.

various times by one or more major central banks include the imposition of capital controls, reserve requirements on bank deposits of nonresidents, and controls on interest rates. This paper examines some of the alternatives to sterilized exchange market intervention that have been or could be implemented in four major industrial countries with diverse financial systems: The United States, the United Kingdom, France, and the Federal Republic of Germany.

Although the importance of the exchange rate as a policy objective differs substantively among these four countries, it plays a significant role in each. This role is most explicit in France and Germany, both of which have specific obligations as members of the European Monetary System. The U.S. dollar and the pound sterling float independently, but the authorities of both countries occasionally intervene or alter monetary policy in order to influence the exchange rate: frequently in the United Kingdom, and comparatively rarely in the United States. One may therefore treat control over exchange rate movements as at least an indirect policy objective in each case, even though the weights assigned to it obviously differ quite markedly. A more problematic dissimilarity is that the financial systems of these four countries are quite different from one another, so that the means of influencing the exchange rate differ among them. It is not possible to develop a single model explaining the relationship between policy instruments and the exchange rate that would apply uniformly to all of these countries. A secondary objective of this paper, therefore, is to describe the aspects of these financial systems that are relevant in this context in order to clarify the choices that may meaningfully be made in each country.

The theme of what follows is that the monetary authorities can influence the exchange rate independently of the general policy stance to the extent that they can alter the structure of yields available on financial assets or otherwise shift relative asset demands. The general policy stance may be described by its effect on the inflation rate, nominal aggregate demand, monetary growth, or the level of real returns on financial assets. The exchange rate, however, depends additionally on relative returns. Sterilized exchange market intervention is an attempt to alter relative returns between domestic and foreign assets by shifting their relative supplies.[2] The limitations of sterilized intervention, however, have been frequently averred [3] and have led many observers to conclude that domestic and international monetary policy cannot be differentiated. The major conclusion of the present study is that—under specified assumptions—there are alternatives to intervention that give the authorities at least the potential ability to

[2]For a review of the role of intervention policy in portfolio balance models, see Hans Genberg, "Effects of Central Bank Intervention in the Foreign Exchange Market," IMF *Staff Papers,* 28 (September 1981), pp. 451–476.

[3]For example, the working group on exchange market intervention that was established at the 1982 summit conference at Versailles concluded that sterilized intervention generally has had short-term but not lasting effects. See Phillipe Jurgenson (Chairman), "Report of the Working Group on Exchange Market Intervention," March 1983.

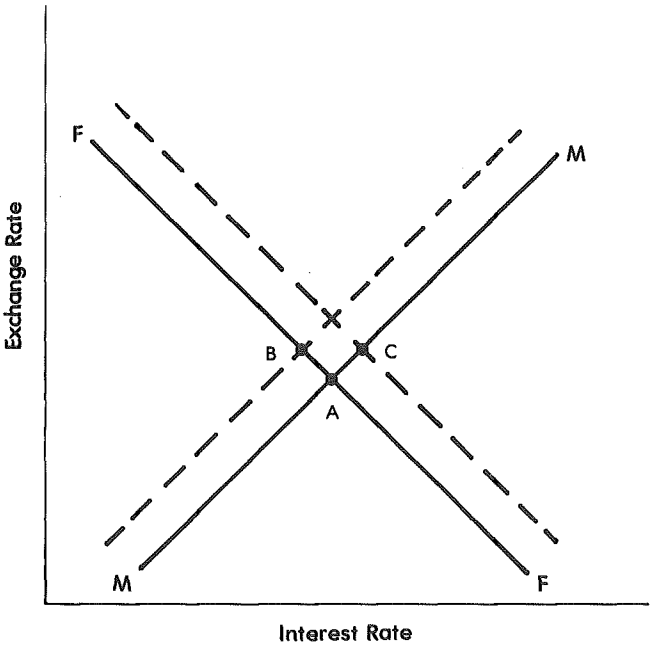
exert an independent influence on the exchange rate.

II. Monetary Policy and Sterilized Intervention

Monetary policy affects the exchange rate via a number of channels, including principally its effects on competitiveness, expectations, asset valuation, and current account balances. The competitiveness effect—in which the exchange rate adjusts to offset inflation differentials between countries—is the point of departure for any study of the monetary effects on the exchange rate, because it defines monetary neutrality. All of the relevant questions about monetary policy can be framed in terms of deviations from that position. In the modern therory of exchange rate determination, the remaining effects are envisaged as operating through the portfolio choices made by private market participants. For example, monetary expansion directly decreases the real yield on domestic securities. If foreign interest rates are unchanged or change by less than domestic rates, and if exchange rate expectations are regressive, then a depreciation of the home currency will be required in order to equalize the expected returns on domestic and foreign securities. In addition to (or instead of) this process, there may be

Figure 1

Domestic and International Financial Policies



wealth effects related to induced changes in current account balances.[4]

The exact specification of the transmission process from monetary policies to exchange rates is less important than the direction of the net effects and the stability of the process. Portfolio balance models can be predicated on any of several processes and then reduced to a common form. This reduced form can concentrate on two markets: domestic money balances and foreign exchange.[5] The latter represents the aggregate demand for and supply of assets denominated in foreign currencies. The specification of the reduced-form functions varies from one country to another, depending on how monetary policy is implemented; this point is examined in detail below. But a fairly general illustration may be derived by assuming the stock of money to be exogenously controlled by the monetary authorities. In that case, equilibrium in the two markets can be described by the two curves shown in Figure 1.

The MM curve in the diagram represents equilibrium in the market for domestic money balances, holding the stock of money constant. The demand for money is assumed to depend negatively on domestic interest rates and positively on the exchange rate (defined as the domestic price of foreign currencies).[6] If the underlying structural model operates through a regressive expectations effect, then a depreciation (i.e., an increase) of the exchange rate generates the expectation of an offsetting appreciation, reducing the relative return on holding foreign exchange and increasing the demand for money. If the underlying model operates principally through normal wealth effects, then depreciation raises domestic wealth via the current account and thus again increases the demand for money. Either way, the MM curve may be assumed to be positively sloped.

The eqilibrium curve for the foreign exchange market (the FF curve in Figure 1) is drawn as having a negative slope, although the opposite case is not as unlikely as for the MM curve. The excess demand for foreign exchange is assumed to depend negatively on both domestic interest rates and the exchange rate: a reduction in the relative return on holding foreign

[4]These include valuation effects (depreciation raises the home-currency value of foreign-currency assets if domestic residents hold positive net balances) as well as discrete-time flow effects (depreciation raises the home-currency value of the current account balance if the Marshall-Lerner condition holds over the relevant time period).

[5]The semi-reduced-form model developed in this paper is derived from the structural model in James M. Boughton, "Conditions for an Active Exchange Rate Policy With a Predetermined Monetary Target," IMF *Staff Papers,* 30 (September 1983). That model includes demand functions of domestic residents and of the rest of the world for several financial assets: money, other bank liabilities, government securities, bank loans, and foreign exchange. Relative interest rates are determined primarily by the profit-maximizing decisions of commercial banks, thus reducing the model to two markets with two relative prices: domestic interest rates and the exchange rate. The semi-reduced form of the model is described algebraically in the Appendix to this paper.

[6]Since the analysis in this paper is in terms of deviations from monetary neutrality, changes in interest rates and exchange rates are in real terms throughout.

exchange reduces the demand for it and increases the supply.[7] In addition, the supply of foreign exchange is affected by exchange market intervention. An increase in official foreign exchange reserves simultaneously increases the net assets denominated in the home currency that are held by the rest of the world. This fact reflects the balance of payments constraint: given the current account balance, any change in official capital must be mirrored in the private capital accounts. The increased net stock of assets held by the rest of the world will then normally result partly in increased holdings of home-currency assets and partly in decreased liabilities; i.e., in a reduced supply of foreign exchange to the home country.

In this simple model, an expansionary domestic open market operation shifts the MM curve to the left by increasing the supply of money, while sterilized intervention shifts the FF curve to the right by reducing the supply of foreign exchange. Monetary expansion thus results in a decline in interest rates and a depreciation of the home currency (a shift from A to B in Figure 1); expansion of external reserves results in an increase in interest rates, along with depreciation of the currency (from A to C). It is quite possible in practice that sterilized intervention will not work; i.e., that the foreign exchange market will not operate in the postulated manner, perhaps because of close substitutability between domestic and foreign assets or because the stock of outstanding private-sector assets is so large.[8] The point is simply that if sterilized intervention does work, it may be differentiated from domestic monetary policy through this difference in the implications for domestic interest rates corresponding to a given effect on the exchange rate. This difference is the source of the additional dimension for monetary policy afforded by the implementation of sterilized intervention.

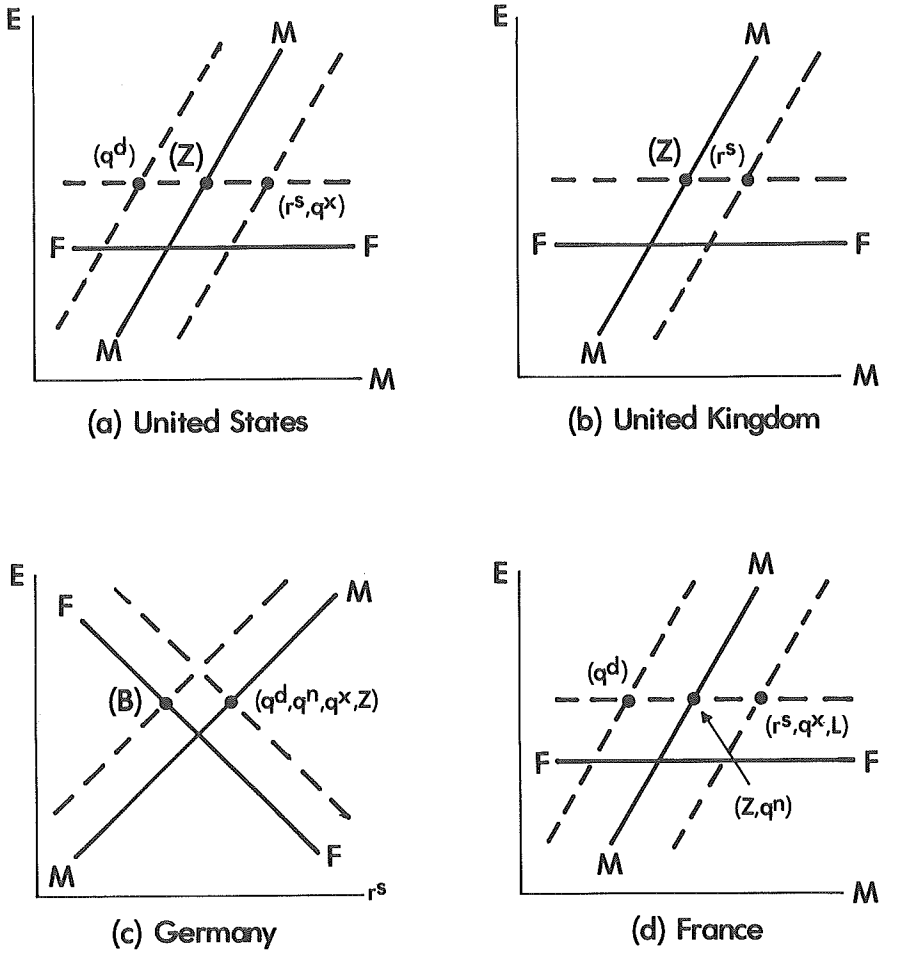
It is not obvious in this model whether monetary growth or sterilized intervention has the smaller effect on the level of domestic interest rates, relative to the effect on the exchange rate. The balance depends on the relative slopes of the two market curves. However, even if sterilized intervention has effects on interest rates that are just as large as those of monetary expansion, it has the great advantage of pushing the exchange rate and the interest rate in the same direction. If the authorities aim to influence the exchange rate with minimal disruption to their underlying policy course,

[7]The effect of the exchange rate is unambiguously negative if a regressive expectations effect dominates. On the other hand, the wealth-redistribution effect works in the opposite direction and so could impart a positive slope to the FF curve. As long as the slope remained less than that of the MM curve, the system would be stable but would have some perverse properties. These possibilities are examined in Boughton, "Conditions," and will be ignored for the remainder of this discussion.

[8]The necessary conditions for sterilized intervention or any of the alternatives examined below to have normal and stable effects in this model are that domestic securities and foreign exchange must not be perfect substitutes, and the demand for money must have a negative total elasticity with respect to domestic interest rates. The related sufficiency conditions are somewhat stricter than those that apply to most earlier models, as summarized in Genberg, "Effects of Intervention."

Figure 2

Policy Instruments in Four Countries[1]



[1]Open market operations are represented by changes in B or r^s; sterilized intervention by Z; reserve requirements by q^d, q^n, or q^x; and credit ceilings by L. In each case, the new equilibrium is indicated by the mnemonic for the instrument; the initial equilibrium is the intersection of the solid lines.

the effectiveness of such a policy will be weakened much more when depreciation is associated with monetary expansion and declining interest rates than when it is associated with rising interest rates that result from a shift in relative asset demands.[9] In this limited sense, sterilized intervention is clearly the more "efficient" means of altering the exchange rate.

Efficiency may be defined in a number of ways. What is meant here is the following: an instrument is a relatively efficient means of influencing a target if it has relatively small or benign side effects. Specifically, sterilized intervention is relatively efficient if it can be used to generate a given change in the exchange rate with a relatively small change in the level of domestic interest rates or if interest rates change in the same direction as the exchange rate. This concept certainly is not the only important aspect of the problem of determining whether an instrument is useful, but it is central to the development of meaningful policy alternatives. If the authorities had no concern with the interest rate consequences of their policies, they could readily achieve whatever exchange rate they chose.

III. Alternatives to Intervention

The difficulty with the model as expressed in Figure 1 is that it does not fully represent the policy options actually available to national authorities: the stock of money is not an instrument of policy, but an intermediate target. In practice, the authorities generally have recourse to several instruments for influencing monetary growth, and there is no prior reason to treat them as exact substitutes. Extending the model to incorporate those instruments opens the possibility of multiple dimensions, rather than the two suggested so far.

The most generally applied instrument of monetary policy is open market operations, which play a significant role in each of the four countries surveyed in this section. Strictly construed, the instrument is the central bank's portfolio of securities. As a practical matter, however, central banks vary that portfolio more or less automatically in order to stabilize a proximate target. That proximate target could be the monetary base, a subset of assets included in the base such as nonborrowed bank reserves, or a short-term interest rate. The choice among these depends on actual practices and is unlikely to be invariant over time or between countries.

In the United States, for example, open market operations are directed partly at short-term interest rates and partly at the growth of bank reserves. Over the medium term, monetary growth constrains and directs

[9]This relationship may be exacerbated by the effect of policy actions on expectations. When depreciation is accompanied by a decrease in real interest rates resulting from monetary expansion, the likelihood of a shift in the expected long-run exchange rate—invalidating the assumption of a stable regressive or static expectations process—is relatively large.

these short-term operational objectives. There is thus no single variable that can be designated unambiguously as the instrument, i.e., as the principal indicator for determining the scale of open market operations in the short run.[10] It is clear, however, that the path of short-term interest rates (specifically, the federal funds rate) has played an important role in this regard over much of the past decade. The key role of the federal funds rate was most explicit prior to the October 1979 reform of the Federal Reserve's operating procedures, but it has also been apparent more recently, especially since the derailing of monetary growth in the latter part of 1982. As an approximation, therefore, the level of domestic interest rates may reasonably be treated as the open market instrumental variable in the United States;[11] practices in other countries are described briefly below.

Another policy instrument that has been used with some frequency in these countries is the discount rate. It is by no means clear, however, that the discount rate is in any substantive way independent of open market policy. Two potential channels for an independent effect may be specified. First, the announcement of a discount rate change can affect expectations about the intent of monetary policy and so can hasten the response of financial markets to a policy change. This channel does not fundamentally alter the eventual outcome, but it can affect the speed of adjustment. Whatever the dynamic effect, it results largely from the announcement of the change, rather than from the change itself. Second, a change in the discount rate alters the commercial banks' borrowing costs and expected opportunity cost of holding excess cash reserves. These costs affect the levels of desired borrowing and excess reserves and thereby the amount of open market operations that is required in order to achieve a given level of interest rates or a given rate of monetary growth. That effect is of technical importance to the central bank, but it is of slight consequence to the rest of the economy.[12]

The discount rate has little independent influence because it does not

[10]The ambiguity inherent in the current control procedures is discussed by Peter Sternlight in Paul Meek (ed.), *Central Bank Views on Monetary Targeting*, Federal Reserve Bank of New York, April 1983. Mr. Sternlight, who directs open market operations at the Federal Reserve Bank of New York, notes (p. 43) that "it is probably fair to say that the present method is a bit of a hybrid that includes some interest rate concern along with the basic reserve-oriented approach." A number of outside observers have argued more strongly that the current procedures incorporate an interest-rate constraint as a dominant element. See, for example, the discussion by W. Lee Hoskins of David E. Lindsay, "Nonborrowed Reserve Targeting and Monetary Control," in Laurence H. Meyer (ed.), *Improving Money Stock Control: Problems, Solutions, and Consequences*, Boston: Kluwer-Nijhoff Publishing, 1983.

[11]The properties of the U.S. system under the alternative assumption—that growth of nonborrowed reserves is the relevant instrument—are similar to those of the German system as described below.

[12]If commercial banks have a demand for excess reserves that is proportional to required reserves, and if that demand is a function of the discount rate, then it may be shown that an increase in the discount rate will reduce deposit rates relative to yields on securities by an amount equal to the product of the required reserve ratio and the *ex post* change in the excess reserve ratio. This second-order effect is ignored in this discussion.

affect the demand for money. Regardless of the nature of the model, variables that enter only through the money supply function matter only to the extent that they shift that function and thus serve to implement general monetary policy. Under either an interest rate regime or an effective monetary targeting regime, the money supply process is redundant. The demand for money depends on the yields on assets that the nonbank public holds; the structure of these yields does not depend on the discount rate.

Reserve requirements provide a clearer example of an independent policy instrument. An increase in the required cash reserve ratio for a given type of deposit reduces the profit-maximizing interest rate for that deposit, relative to other interest rates, because it reduces the portion of the funds that the bank can invest in earning assets. Reserve requirements thus drive a wedge between yields on securities and yields on deposits, shifting the demands for money and other financial assets. Therefore, although reserve requirements obviously do not enter the public's structural demand functions, they do enter the reduced form functions via their influence on the yield structure. Requirements on deposits that are defined as money reduce the demand for money; requirements on excluded deposits increase it. Similar effects may be expected from controls on interest rates payable on deposits. Assuming that the controls are effective, they again drive a wedge between deposit rates and security yields.

Panel (a) of Figure 2 illustrates the effects of four policy instruments in the *United States*:[13] expansionary open market operations (represented by a decrease in the yield on government securities, r^s), an increase in reserve requirements on "included" deposits (q^d)—those that are defined as money—and on those that are excluded from the definition of money (q^x),[14] and intervention in the foreign exchange market (represented by an increase in the net stock of international reserves, Z). The effects of the last three instruments on the level of interest rates (r^s) are assumed to be sterilized through open market operations. The endogenous target variables are the stock of money (M) and the exchange rate (E), the latter being defined as the domestic price of foreign currency.

As in Figure 1, the MM curve represents equilibrium in the market for money balances; here, however, the money stock replaces the interest rate

[13]For a number of reasons, changes in required reserve ratios have been largely abandoned as a policy instrument in the United States, but the potential for their use remains in place. The Monetary Control Act of 1980, which established uniform requirements for all depository institutions, retained the option for the Board of Governors of the Federal Reserve System to vary requirements within prescribed ranges for purposes of monetary control. In addition, the Act gave the Board the authority to require interest-bearing supplementary reserves on a temporary basis, subject to certain conditions. However, since the implementation of the Act (from September 1980 to mid-1983) there have been no reserve requirement changes.

[14]The definitions of q^d and q^x employed here are theoretical constructs that do not correspond exactly to the categories in use in the United States. In practice, depending on the preferred definition of money, q^d and q^x might both be affected, though not necessarily uniformly, by changes in a given required ratio.

on the horizontal axis. With all policy instruments unchanged, depreciation (increase) of the exchange rate raises the demand for money (as explained above), so the MM curve has a positive slope. Partial equilibrium in the foreign exchange market depends only on interest rates, the exchange rate, and intervention policy; it does not depend directly on the stock of money.[15] The FF curve in this case is therefore a horizontal line.

Not surprisingly, sterilized intervention is a more efficient instrument than a pure open market operation for depreciating the exchange rate with minimal effects on the stock of money. As Figure 2 indicates, both policies lead to an increase in the money stock and a depreciation of the exchange rate, but the ratio of the two is unambiguously smaller for sterilized intervention because its direct effects are concentrated in the foreign exchange market. Of the two alternative policies, one is also relatively efficient, but the other is not. A sterilized increase in the reserve requirement against included (monetary) bank deposits either produces an increase in the money stock that is smaller than those produced by the other two policies, or it causes the money stock to decline. The advantage of this type of reserve requirement change is similar to the advantage of sterilized intervention: by combining the increase with expansionary open market operations so as to hold the level of domestic interest rates unchanged, the authorities affect only the structure of interest rates and hence the relative demands for money and other financial assets. In this case the demand for money declines, the demand for foreign exchange increases, and the exchange rate depreciates with little net effect on the money stock.

This advantage does not extend to the remaining instrument, the level of reserve requirements on excluded (nonmonetary) bank deposits. An increase in this requirement reduces the yield on excluded deposits and thus increases, rather than decreases, the demand for money. As the demand for foreign exchange also increases (asset holders shift out of excluded deposits into all other forms of financial assets), the exchange rate again depreciates. But in this case it cannot be determined that the increase in the money stock associated with this depreciation will be any smaller than under a pure expansionary open market operation, because the expansionary operations required to offset the rise in interest rates resulting from the increase in money demand are so large.[16] This type of policy, along with discount rate changes, may be eliminated as a candidate for consideration as an alternative to intervention, at least for the U.S. system.

A number of other instruments have been implemented at various times in the United States in order to influence the exchange rate or the

[15]This relationship may be seen by inspection of equations (3) and (4) in the Appendix. Note, however, that the independence of the FF curve from M does not imply that E is independent from M, since the MM curve is positively sloped.

[16]For simplicity of exposition, r^s and q^x are represented in Figure 2 as having identical effects. All that is intended is that the two instruments have effects that are qualitatively similar.

balance of payments. These include capital controls such as the Voluntary Foreign Credit Restraint (VFCR) program (1965–74) and the interest equalization tax (1964–74), reserve requirements on nonresident bank liabilities in the form of Eurodollar borrowings (since 1969), and—on occasions such as the implementation of the dollar support program of November 1978—changes in the discount rate. The redundancy of this last type of policy was discussed above. The other policies can be shown in principle to have been comparable to the "efficient" policies just described, although their empirical effectiveness was not clearly established.[17] The VFCR program and the nonresident reserve requirements would have affected only the foreign exchange market and hence would have been similar to sterilized intervention, while the tax on foreign interest earnings would have shifted both curves and had exchange rate effects broadly similar to those of reserve requirements (q^d).

In addition to these explicitly external policies, controls on interest rates payable on bank deposits have been a feature of the U.S. financial system since 1933. As noted above, these controls also have effects that are quite similar to those of reserve requirements. Choices among these theoretically similar instruments would therefore depend on their palatibility and an estimate of their likely effectiveness in more general terms.

The available policy options at present are rather more limited in the *United Kingdom*. As in the United States, the principal instrument for conducting domestic monetary policy is open market operations. Under the reforms implemented in August 1981, no regular reserve requirements are in effect except that certain commercial banks agree to maintain minimum portions of their assets in specified liquid forms, including call loans to the discount houses.[18] This requirement is not intended to serve as a fulcrum for monetary policy, but it does function similarly to any other liquid asset requirement. In addition, the authorities may impose the "special deposits scheme," under which the banks would be required to hold interest-bearing deposits with the Bank of England as a percentage of their eligible liabilities. Because these deposits would bear interest, the special deposits scheme would be practically equivalent to a liquid assets, rather than a cash reserve, requirement. In any event, it is not in regular usage and has not been imposed since July 1980.

Furthermore, there is not presently any strict equivalent to the discount window in the United Kingdom. The Bank of England lends infre-

[17]For an empirical analysis and review, see John Hewson and Eisuke Sakakibara, "The Impact of U.S. Controls on Capital Outflows on the U.S. Balance of Payments: An Exploratory Study," IMF *Staff Papers*, 22 (March 1975), pp. 37–60.

[18]In addition, banks are required to hold noninterest-bearing deposits at the Bank of England equal to ½ per cent of their eligible liabilities in the preceding six-month period. This requirement is imposed only to provide operational funding for the Bank of England; because it is independent of current changes in deposits, it would be of very limited value as a policy instrument.

quently to the discount houses, at rates that are established only at the time of the loan. The effects of these loans are closer to open market operations than to discount window loans because no fixed interest rate and no regularly oustanding stock of liabilities are associated with them. Finally, international capital controls were eliminated in 1979. Thus only two policy instruments are in effect in this system: open market operations and exchange market intervention.

The main fulcrum for open market operations in the United Kingdom is the banks' voluntarily held noninterest-bearing clearing balances at the Bank of England.[19] The banks provide daily estimates of their target balances to the Bank, which then conducts its security operations so as to influence the cost of acquiring those balances. But there are two crucial differences between this system and one based on required cash reserves. First, because the banks are able to choose the desired value of their clearing balances, they are able in principle to equalize the implicit marginal returns on these balances with the returns available on earning assets. Altering the cost of holding cash balances also alters the equilibrium returns on earning assets by the same amount. Second, the Bank of England does not possess a policy instrument in the form of a variable reserve requirement.

The relationship between the two U.K. instruments is shown in panel (b) of Figure 2. Because the Bank of England explicitly employs an interest rate strategy for conducting open market operations, the form of the model is similar to that described for the United States. Either instrument can be used to depreciate the exchange rate, but the depreciation can be achieved with less effect on monetary growth through sterilized intervention.

The *Federal Republic of Germany* presents a contrasting picture, as the range of instruments is more varied and is employed rather differently. The Deutsche Bundesbank has eschewed an interest rate strategy in favor of a close targeting of the central bank money stock. This aggregate is equivalent to the monetary base, adjusted for changes in reserve requirements and net of excess reserves. The stock of money responds endogenously to shifts in demand among the various types of deposits, since reserve requirements are not uniform. More importantly, the level of domestic interest rates responds endogenously to shifts in the demand for money or for foreign exchange, as shown in panel (c) of Figure 2. This system therefore is more closely akin to the hypothetical model described in Figure 1 than to those of the other countries considered in this section.

Because the central bank money stock is calculated on the basis of fixed reserve requirements, the equilibrium curve for the money market (the MM curve) for Germany is not affected systematically by sterilized

[19]The current operating procedures are described in "Methods of Monetary Control," Bank of England *Quarterly Bulletin*, 20 (December 1980) and are analyzed in a paper by A. L. Coleby in Meek, "Central Bank Views." The latter volume also contains useful discussions of monetary control procedures for each of the other countries surveyed here.

changes in reserve requirements. Consequently, also in contrast to the other countries being surveyed, each policy instrument shifts only one of the two market equilibrium curves. An increase in the central bank money stock depreciates the exchange rate and reduces interest rates, while the other policy instruments shift the FF curve and hence raise domestic interest rates while depreciating the exchange rate. All of these other instruments are therefore relatively efficient in the sense in which that term is being used here.

In addition to exchange market intervention, the sterilized instruments actually available in Germany include reserve requirements on monetary bank deposits (q^d), on excluded bank liabilities held by residents (q^x) and on bank liabilities held by nonresidents (q^n). From 1957 to 1978, requirements on nonresident deposits were usually higher than those on resident deposits, reducing the profit-maximizing interest rate available to nonresidents and thereby serving as a form of capital control.[20] Changes in these requirements therefore had effects similar to those of exchange market intervention.[21] In the German system, again because the central bank money stock is adjusted for changes in reserve requirements, the other two types of reserve requirements also have effects similar to those of exchange market intervention. In this context, therefore, it would seem to make little difference whether policies are implemented through changes in one category of deposit or in all together, although there could be significant practical differences that are beyond the scope of this exercise.

Monetary policy in *France* is characterized by a greater use of controls than in the other three countries. Specifically, the "encadrement de credit" is a ceiling that may be treated analytically as preventing banks from expanding loans to a profit-maximizing level. As a corollary, the nonbank public is unable to satisfy its notional loan demand, so the constrained value of bank loans replaces the interest rate on loans as an argument in the demand functions for other financial assets. Changes in this constraint serve as the principal instrument for controlling monetary growth in France.

In other respects, the French financial system can be represented by a model that is similar to that of the United States, with elements that are related to the German and U.K. systems as well. Open market operations are aimed at controlling domestic interest rates, and there is a system of reserve requirements, with different requirements applying to nonresident

[20]At present, no capital controls are in place in Germany. Furthermore, there are no interest rate ceilings, either for residents or nonresidents. Rediscount quotas are an important feature of monetary control, but it may be shown that—like changes in the discount rate—these quotas do not generally have effects that are independent of their overall monetary effects.

[21]The effect of reserve requirements on nonresident deposits as an instrument for influencing the exchange rate depends on the assumption that home-currency deposits in Eurobanks are not a perfect substitute for deposits in the home country.

than to resident deposits.[22] As is shown in panel (d) of Figure 2, changes in reserve requirements on nonresident deposits—as in the German model—are practically equivalent to sterilized intervention. Because residents, by definition, cannot hold such deposits, they are unaffected by changes in the yields; hence this particular reserve requirement is not an argument in the reduced-form money demand function, and changes in it do not cause the MM curve to shift. Both sterilized intervention and increases in nonresident reserve requirements result in a smaller increase in the stock of money in relation to the associated depreciation of the exchange rate than does a pure open market operation. Other reserve requirements have characteristics similar to those described above for the United States: requirements on monetary bank deposits are relatively efficient, while requirements on nonmonetary deposits in general are not. Changes in the banks' credit ceilings have properties that are similar to those of open market operations and therefore are also relatively inefficient in this sense.

IV. Conclusions

Two basic assumptions underlie the analysis developed in this paper. First, exchange rates are assumed to be influenced by portfolio choices; specifically, by the effects of relative rates of return on the demands for domestic money balances and for foreign exchange. This assumption in turn implies that financial assets are imperfect substitutes in demand functions. Under fairly broad conditions, if the demand functions are stable, this general assumption implies that the relationship between domestic monetary conditions and exchange rates can be altered in predictable ways by shifts in these functions. Second, it is assumed that the interest rates that matter in these demand functions include the rates on bank deposits and that these rates can be influenced by instruments that alter the marginal profit-maximizing conditions facing the commercial banks. In addition, other policy instruments—including sterilized exchange market intervention and quantitative credit ceilings—directly constrain the public's demand functions and thereby influence the exchange rate.

These assumptions imply that sterilized intervention is potentially a relatively efficient instrument for influencing the exchange rate with minimal domestic disruption. It is recognized, however, that intervention might not be sufficient by itself and might even be abjured by the authorities. Sterilized changes in some, but not all, of the other instruments examined here have the potential to serve as supplements or alternatives to intervention for the purpose of influencing the exchange rate. Reserve requirements and interest rate controls may be singled out as the clearest examples, with regulations on nonresident deposits being perhaps the closest and most natural alternative to intervention. Other instruments, most notably

[22]In 1972–73 and in 1980–81, requirements on nonresident deposits were raised above those of residents. Otherwise, they have generally been set to zero.

changes in discount rates, do not alter the banks' profit-maximizing conditions and hence do not have effects that may be differentiated from their overall effects on domestic monetary conditions.

The common feature of all of the policies examined here is that they alter the structure of interest rates by imposing taxes or controls on selected assets. The essential requirements for their success are that the controls be effective and that they not shift the excess demand functions for money and foreign exchange in the same direction. Where both curves do shift in the same direction, the effects are qualitatively the same as those of a general monetary policy. The effectiveness problem may be formidable for reserve requirements, since large changes may result primarily in shifts in intermediation patterns rather than in relative prices. In addition, one must recognize the limitations inherent in any policy designed to tinker marginally with the financial system. It is nonetheless important to recognize the potential impact that these instruments have on exchange rates, if only to ensure that policies not have unintended effects. The relevant empirical question suggested by this analysis is whether judiciously selected changes in reserve requirements, especially on nonresident deposits, or in the other potentially effective instruments can generate quantitatively important and predictable exchange rate movements without seriously disrupting financial flows.

Appendix

A Model of Exchange Rates and Domestic Financial Conditions

(1) $$W = W^d + K(E)$$
$$+$$

(2) $$M/W = M(r^d, r^x, r^s, r^\ell, r^f)$$
$$+ \; - \; - \; - \; -$$

(3) $$E \cdot F/W = F(r^d, r^x, r^s, r^\ell, r^f)$$
$$- \; - \; - \; - \; +$$

(4) $$E \cdot F = \Phi(r^n, r^s, r^\ell, r^f, Z - K)$$
$$+ \; + \; + \; - \; \; -$$

Equation (1) states that the financial wealth of the domestic private nonbank sector (W) is equal to domestic wealth (W^d) plus the cumulative external balance on current account and direct investment (K). The first component—which, for a given physical wealth, is essentially equivalent to the stock of government debt outstanding—is assumed to be exogenous. The second is affected by changes in the domestic price of foreign currency (E), the effect being positive if there is a positive valuation effect or if the Marshall-Lerner condition holds.

Equation (2) is the demand function for money (M), and equation (3) is the demand function for assets denominated in foreign currencies (F). Each function is homogeneous in wealth, with the portion of wealth allocated to each asset being a function of relative interest rates. There are several interest rates, as explained below. Each demand depends positively on the own yield and negatively on substitute yields.

Equation (4) is the supply of foreign exchange from the rest of the world. This supply

depends negatively on the own yield and positively on substitute yields, as well as negatively on the net supply of rest-of-world claims on the home country. This last item is equal to the negative of K plus the home country's net official claims on the rest of the world. That is, the current account balance, the private capital balance, and the official capital balance sum to zero. The effect is negative if a rise in wealth is allocated partly to additional assets and partly to reduced borrowing.[23]

$$r^f = f(r^s, E) \quad (5)$$
$$+ \; -$$

This equation states that the uncovered yield on foreign assets (r^f) is a function of the yield on domestic securities (r^s) and the exchange rate. The first argument reflects the interaction of international arbitrage and the reaction function of foreign monetary authorities: a rise in r^s leads to increases in rates elsewhere, with the magnitude of the effect depending on the importance of the home country in world financial markets and the policy objectives of the authorities in other countries. The second argument represents the effect of a change in the level of the exchange rate on its anticipated rate of change. The derivative is negative if exchange rate expectations are regressive.

The remainder of the model is country-specific. It is assumed that banks maximize profits subject to a set of regulations; this assumption generates equations relating the interest rates on bank loans (r^ℓ) and deposits (r^d, r^x, and r^n) to security yields. These relationships permit the reduction of the portfolio balance model to two markets (money and foreign exchange), eliminating the markets for bank loans, government securities, and for the different types of bank deposits.[24]

(1) United States

$$r^\ell = r^s \quad (6)$$

$$r^x = (1 - q^x)r^s \quad (7)$$

$$r^d = \delta(r^s, q^d) \quad (8)$$
$$+ \; -$$

$$r^n = r^x \quad (9)$$

All of these equations omit the constant differences between rates that arise from differences in risk or maturity structure, which are assumed not to depend systematically on the variables included in the model. Equation (6) states that loan rates must otherwise equal security yields, while equation (7) describes the wedge that reserve requirements (q^x) on bank liabilities that are excluded from the money stock drive between security yields and the profit-maximizing rates paid on those liabilities (r^x). Equation (8) is similar to (7) for deposits that are included in the money stock, except that it is specified more generally in order to allow for rigidities arising from ceilings on certain types of deposits and from the administered nature of these rates. Nonresident deposits should earn the same yield as resident deposits, since the same reserve requirements are applied; hence, equation (9).[25]

This model may be solved for the excess demand functions for money and foreign exchange, corresponding to the MM and FF curves shown in panel (a) of Figure 2.

[23]This hypothesis is a generalization of the homogeneity postulate governing the specification of equations (2) and (3). Equation (4) is not homogeneous because the sign of Z-K is indeterminate.

[24]This reduction of the model is derived in Boughton, "Conditions."

[25]In practice, r^n will differ from r^x because of differences in the composition of deposits for the two groups.

(10) $$\text{MM: } E = \underset{+}{\mu}(M, \underset{+}{r^s}, \underset{+}{q^d}, \underset{-}{q^x})$$

(11) $$\text{FF: } E = \underset{-}{\phi}(\underset{-}{r^s}, \underset{+}{q^d}, \underset{+}{q^x}, \underset{+}{Z})$$

The signs of the partial derivatives of equations (10) and (11) follow directly from those of the structural equations as long as normal gross substitution effects dominate. If the total elasticity of money demand to interest rates is positive, then $\partial\mu/\partial r^s$ will be negative; if wealth effects dominate substitution effects in the foreign exchange markets, then all of the partials in equation (11) will change sign and the system in general will be unstable.

(2) United Kingdom

(6′) $$r^\ell = r^s$$

(7′) $$r^x = r^d$$

(8′) $$r^d = q^s r^s + (1 - q^s) r^\ell$$

(9′) $$r^n = r^s$$

As noted in the text, banks in the United Kingdom are able approximately to equate marginal returns on all assets and liabilities, because reserve requirements may be satisfied by holding interest-bearing assets. Therefore, except for risk premiums, all interest rates will tend to be equal. There are no effective policy levers of the type described for the other countries, and the market equilibrium curves reduce to the following:

(10′) $$E = \underset{+}{\mu}(M, \underset{+}{r^s})$$

(11′) $$E = \underset{-}{\phi}(r^s, \underset{+}{Z})$$

(3) Federal Republic of Germany

The equations for r^d, r^x, and r^ℓ are the same as those for the United States (equations [6–8]). However, because separate reserve requirements (q^n) are imposed on nonresident deposits, the yield on those deposits will differ from domestic yields.

(9″) $$r^n = (1-q^n) r^s$$

In addition, the model must be extended to incorporate the central bank money stock (B).

(12) $$B = q^d_o D + q^x_o X^p + C$$

The control variable (B) is equal to reserves required against domestic deposits, calculated at constant reserve requirements, plus currency in circulation (C). Currency demand as a portion of total money demand may be assumed to depend on the yield on deposits.

(13) $$C/M = \underset{-}{c}(r^d)$$

Together with the definition of M ($M = D + C$), equations (12) and (13) produce the following money supply equation.

(14) $$M = mB - mq_o^x X^p$$

where $m = 1/[q_o^d + (1-q_o^d)C] = m(r^d)$ (+)

To close the system requires a demand function for excluded deposits (X^p), which should have the same form as the money demand function.

(15) $$X^p/W = X(r^d, r^x, r^s, r^l, r^f)$$ (− + − − −)

In the excess demand function for money, reserve requirements now play a less important role. For example, a decrease in the requirement on monetary deposits (q^d) increases the demand for money by increasing the own yield, but it also increases the supply, both by increasing the multiplier (m) and by reducing the demand for excluded deposits. The net effect on excess demand is indeterminate. Similarly, a decrease in the requirement on nonmonetary bank liabilities (q^x) decreases the demand for money by increasing a substitute yield, but it also decreases the supply via equation (14) by increasing the demand for X^p. Both q^d and q^x have therefore been omitted from equation (10″).

(10″) $$E = \mu(B, r^s)$$ (+)

(11″) $$E = \phi(r^s, q^d, q^x, q^n, Z)$$ (− + + + +)

(4) France

The imposition of credit ceilings in France means that the interest rate on loans must be replaced by the constrained value of loans as an argument in the portfolio allocation equations. The other domestic interest rates are determined as in Germany (equation [6–8] and [9″]). The solution is as follows.

(10‴) $$E = \mu(M, r^s, q^d, q^x, L)$$ (+ + + − −)

(11‴) $$E = \phi(r^s, q^d, q^x, q^n, Z, L)$$ (− + + + + +)

Discussion

Robert W. Eisenmenger*

Dr. Boughton has prepared an ambitious and highly thought-provoking paper on the potential of sterilized intervention and some alternatives to intervention as tools for influencing the exchange rate—independent of traditional monetary and fiscal policies. Adapting a typical small-open-economy portfolio-balance model of exchange rate determination to four institutionally distinct *large* open economies, Dr. Boughton is able, given his assumptions, to show that sterilized intervention and some (heretofore ignored) alternative policies are relatively more "efficient" than monetary policy if the goal is to influence the exchange rate. Accordingly, he suggests that recent large and prolonged real appreciations of certain industrialized countries' currencies need not be accepted in the presence of these policy alternatives.

The paper is comprised basically of two parts. The first part describes a small-open-economy portfolio-balance model similar to earlier ones by William Branson, Michael Dooley and Peter Isard. Such a model is typically used to contrast the exchange rate and domestic interest rate effects of sterilized intervention policy with those of traditional monetary policy (i.e., open-market operations), where the effectiveness of policy is usually defined as its ability to influence the exchange rate without regard to the ultimate effects on other policy targets.[1] In contrast, Dr. Boughton elects to subdue the issue of the relative effectiveness of sterilized intervention and instead analyzes the relative efficiency of such intervention—where an efficient policy is one that minimizes side effects on other policy targets. He claims that sterilized intervention is more efficient than pure open market operations as an exchange rate policy because "it has the great advantage of pushing the exchange rate and the interest rate in the same direction" (p. 8).

In part I of my remarks, I comment on some technical attributes of Dr. Boughton's model. I conclude that given different, and equally plausible assumptions, his model would produce somewhat different conclusions. In part II, I relate his paper to the broader issues being discussed at this conference.

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[1]See Hans Genberg, "Effects of Central Bank Intervention in the Foreign Exchange Market," IMF *Staff Papers,* vol. 28 (3), September 1981.

I. Technical Issues

In developing his portfolio-balance model, Dr. Boughton assumes that exchange rate expectations are regressive. Such an assumption is clearly at odds with much current theorizing which instead assumes that expectations are formed rationally. Moreover some recently completed, widely referenced empirical studies suggest that regressive exchange rate expectations are unrealistic. Both in-sample[2] and out-of-sample[3] tests of structural and autoregressive models of exchange rate determination suggest that a "random walk" model of exchange rates performs as well as any of the other models, indicating that static expectations are "a reasonable rule of thumb."[4] Although Dr. Boughton recognizes that his portfolio-balance model is also consistent with an alternative framework emphasizing static expectations and wealth effects, he relies on the regressive expectations approach in his analysis of alternatives to intervention. This choice, however, is not trivial; under a more realistic framework emphasizing static expectations and wealth effects, the results are weaker.

In the second part of his analysis Dr. Boughton modifies his small open economy portfolio-balance model for the institutional idiosyncrasies of monetary policy in each of the United States, the United Kingdom, Germany, and France. Thus he attempts to narrow a bothersome gap in this literature in which the typical small-open-economy model has persistently been estimated for *large* open economies. Dr. Boughton exercises care in establishing how the financial distinctions across the four countries either create or eliminate certain potential instruments for exchange rate policy as alternatives to sterilized intervention and pure open market operations. A major conclusion of his analysis is that—in the case of the United States, United Kingdom, or France—sterilized intervention is unambiguously a more efficient exchange rate policy than a pure open market operation because—for a given exchange rate rise—the accompanying money stock increase is smaller for sterilized intervention than for the open market operation.

Yet, the strength of this conclusion relies heavily upon the assumption of regressive exchange rate expectations. To illustrate, suppose exchange rate expectations are static, as suggested by empirical evidence, and wealth effects are not ignored. In Figures 2(a), 2(b), and 2(d), the FF curve would now be positively sloped; that is, foreign exchange market equilibrium is no longer independent of the money stock. A rise in the money stock increases domestic wealth. As wealth rises, demand increases for net for-

[2]See Michael Mussa, "Empirical Regularities in the Behavior of Exchange Rates and Theories of the Foreign Exchange Market," in *Policies for Employment, Prices, and Exchange Rates*, Carnegie-Rochester Conference Series on Public Policy, vol. 11, 1979.

[3]See Richard Meese and Kenneth Rogoff, "Empirical Exchange Rate Models of the Seventies," *Journal of International Economics*, vol. 14, 1983.

[4]William H. Branson, "Economic Structure and Policy for External Balance," IMF *Staff Papers*, vol. 30 (1), March 1983.

eign assets. To restore foreign exchange market equilibrium, the exchange rate must rise to increase the domestic value of foreign assets held. Thus, by including wealth effects, sterilized intervention is now actually more effective—although no less efficient. For the same size sterilized intervention as before, the exchange rate rises even further because of added stimulus from incorporating the effect of increased wealth.

Furthermore, consider a pure expansionary open market operation. Under regressive expectations, a pure open market operation generating an exchange rate rise equivalent to that from a sterilized intervention induces a money stock increase larger than that accompanying the sterilized intervention, suggesting that intervention is equally effective but relatively more efficient. However, the same pure expansionary open market operation under static expectations and including wealth effects would cause the exchange rate to rise even further. The reason is that under static expectations the consequent increases in wealth from the money stock expansions cause increases in the demand for net foreign assets, generating a larger exchange rate change for a given decline in the domestic interest rate. Thus, under static expectations pure open market operations can be shown to be much more effective than sterilized intervention, though still less efficient. Furthermore, if the relative "usefulness" of the two policies is evaluated on grounds of effectiveness and efficiency jointly, it becomes ambiguous whether sterilized intervention is more or less useful than a pure open market operation as an exchange rate policy in this model.

Dr. Boughton, as indicated earlier, chooses to subdue the importance of effectiveness. However, if a policy is essentially ineffective, efficiency is of little consequence. To illustrate, suppose domestic and foreign financial assets are virtually perfect substitutes. If the exchange rate rose, the domestic interest rate need fall by only a negligible amount in order to restore foreign exchange market equilibrium. In this case, sterilized intervention is ineffective in altering relative yields on assets and in altering the exchange rate (i.e., FF is nearly vertical). Several recent studies[5] including the recently completed Versailles Working Group Study on Exchange Rate Intervention have suggested that domestic and foreign assets are almost perfect substitutes. In the absence of clear evidence in support of the portfolio

[5]For example:

John P. Martin and Paul R. Masson, "Exchange Rates and Portfolio Balance," NBER Working Paper No. 377, August 1979;

Peter Hooper and John Morton, "Fluctuations in the Dollar: A Model of Nominal and Real Exchange Rate Determination," Board of Governors International Finance Discussion Paper No. 168, October 1980;

Peter Isard, "Factors Determining Exchange Rates: The Roles of Relative Prices, Balances of Payments, Interest Rates and Risk," Board of Governors International Finance Discussion Paper No. 171, December 1980;

Jeffrey Frankel, "Monetary and Portfolio-Balance Models of Exchange Rate Determination," in J.S. Bhandari and B.H. Putnam, eds., *Economic Interdependence and Flexible Exchange Rates,* Cambridge: MIT Press, 1983.

balance model or the effectiveness of sterilized intervention, the relative *efficiency* of sterilized intervention becomes a moot issue.

II. Sterilization and Public Policy

Under certain assumptions, of course, Dr. Boughton's analysis is correct and sterilized intervention might be an efficient method for reducing the exchange rate impact of a given policy of monetary restraint. If that were the case, *should* currency appreciations—such as those generated by monetary restraint in the United States and England during the last few years—have been partially offset by sterilization? In his paper Dr. Boughton argues that the U.S. dollar and pound have appreciated unnecessarily and that this has aggravated "the deterioration in domestic output and employment." He suggests that sterilized intervention would have alleviated the problem.

I have two responses to Dr. Boughton. First, I believe the administrations in both the United States and England believed that a large dosage of tight monetary policy was necessary to curtail inflationary expectations. Certainly the 1983 Economic Report of the President to the Congress of the United States suggests this is the case. I doubt that much of the restraint was unintentional.

Second, I would ally myself with Jeffrey Frankel[6] who argues that monetary restraint should constrain both the export trading sections of an economy as well as the purely domestic sectors. He argues that appreciation of the home country's currency spreads the impact of restraint across more sectors, thereby making monetary policy more effective and equitable. Moreover, in a flexible exchange rate regime, monetary restraint in one country depreciates the foreign exchange values of other countries' currencies, thereby partially neutralizing the spread of restraint worldwide. Thus exchange rate flexibility, unfettered by sterilized intervention, permits each country to have its own growth policy.

I should also like to comment on the "political" consequences of monetary restraint. In his paper, Professor Duesenberry suggests that in the post World War II period monetary policy has had its primary effect in housing and that this industry has regularly opposed tight money. I would agree that this was true in the past. Now that we have a flexible exchange regime, however, many sectors of the economy besides housing and consumer durables are clearly restrained by monetary policy. High technology exports (e.g., aircraft, computers, specialized machinery), agricultural exports, and import vulnerable industries (autos, steel, textiles) are all affected. Thus the burden of restraint is spread across many industries and the combined political power of all these industries could easily curtail the indepen-

[6]Jeffrey A. Frankel, "The Desirability of a Dollar Appreciation, Given a Contractionary U.S. Monetary Policy," Dept. of Economics, University of California, Berkeley, California, Feb. 28, 1983.

dence of any central bank. In fact if the reaction function analysis outlined by Professor Woolley in this conference were applied in this situation, we might conclude that "politics" will completely frustrate monetary policy in the future.

I would argue, however, that with articulate and strong leadership the direction of "political" causation can run the other way. Top government leadership can help businessmen understand and favor more effective policies. For example, in the United States Paul Volcker, the Chairman of the Federal Reserve Board, Martin Feldstein, Chairman of the Council of Economic Advisers, Alan Greenspan, personal adviser to President Reagan, and Rudolph Penner, the new head of the Congressional Budget office, have been passionate and effective advocates of a new policy mix of less monetary/more fiscal restraint. The Volcker/Feldstein/Greenspan/Penner logic is that such a mix would reduce interest rates worldwide and would encourage greater industrial investment in the United States. I believe these four senior officials are being very effective in helping the Congressional and business leadership in the United States understand the continuing danger of inflation *and* the disadvantages of the present policy mix. Obviously a changed mix would bring slightly lower interest rates (helping the housing industry), stimulate exports (helping high technology industries, specialized service industries and agriculture) and moderate the competitive burden on import vulnerable industries (steel, autos, textiles). The new policy mix would also encourage investment in those industries in which the United States has a comparative advantage—research intensive manufacturing, agriculture, and specialized export services—and stop the erosion of the competitive position of these industries. Thus the overall efficiency of the world economy would be improved.

In my view, these economic truths can be explained and understood by businessmen in the United States. Therefore, a political coalition of all the benefiting industries should be able to influence economic policy in the United States in a very constructive way. They could lobby Congress for the improved policy mix. Thus leadership can create a political climate which can give scope for creative new policies. Central banks and governments do not have to be captives of their political environments.