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by

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In analyzing the extent to which alternative financial stabilization policies can be expected to dampen the effects of shocks to macro-economic equilibrium in a single open economy, it has often been assumed that the authorities must choose between fixing the exchange rate and allowing it to fluctuate freely. Which of these two pure intervention policies is better usually depends not only on the source of the shocks to the economy (see Robert Mundell, Jerome Stein, and Edward Tower and Thomas Willet), but also on the specification of monetary policy. The nature of the truly optimal financial policy is determined by the kind of information available to the authorities about the structure of the economy and about the shocks to which it is subjected. Under plausible assumptions it is not optimal for a single open economy to adopt either pure intervention policy. However, interactions in a two-country world economy must be considered when choosing financial policies, and an agreement to pursue a pure intervention policy may lead to better outcomes than those implied by noncooperative behavior.

I. Shocks and Financial Policies in a Single Open Economy

The outcomes of alternative financial policies in a single open economy can be illustrated by employing a discrete time model in which asset portfolios are balanced at the beginning of each period.[1/] In Figure 1, X_0X_0 is an equilibrium schedule for the single home good which is purchased by both home residents and foreigners; an increase in the home interest rate, which lowers

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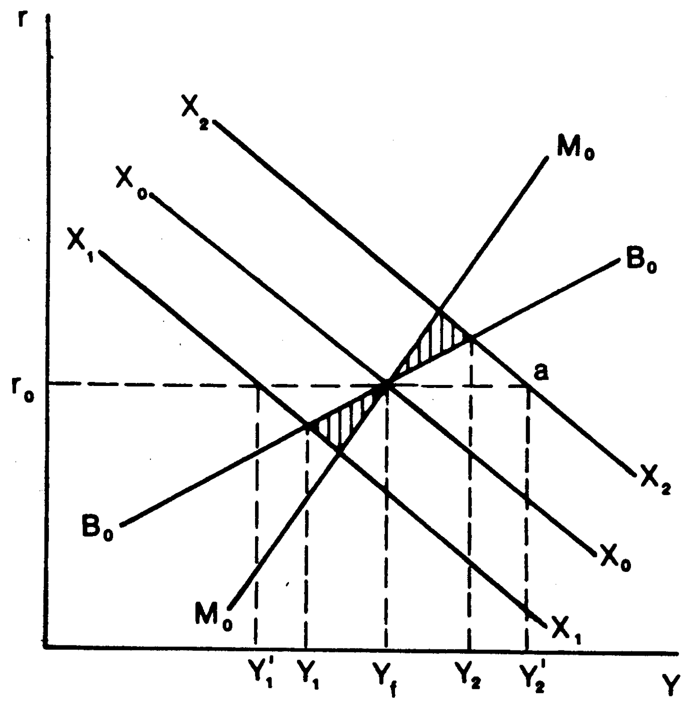

Figure 1

demand, must be accompanied by a decline in home output. The line M_0M_0 is an equilibrium schedule for home money which is held by home residents alone; an increase in the interest rate, which reduces money demand, must be offset by a rise in output. The line B_0B_0 is an equilibrium schedule for the single security denominated in home currency which is held by both home residents and foreigners; an increase in the interest rate, which raises demand for the home security, must be accompanied by an increase in output which lowers demand. It is assumed that home money, the home security, and a single security denominated in foreign currency are strict gross substitutes, so the M_0M_0 schedule must be steeper than the B_0B_0 schedule.[2/] Either the exchange rate, defined as the home currency price of foreign currency, or foreign exchange reserves, defined as the home authorities' holding of foreign securities, change in a manner described below until the three schedules have a common intersection point. In Figure 1, X_0X_0, M_0M_0, and B_0B_0 intersect at the "full-employment" level of home output (Y_f). It is supposed that the home currency price of the home good and the foreign currency price of a single foreign good, which is different from the home good, are fixed in the short run and that the foreign authorities act to keep the foreign interest rate and foreign output constant.

The home authorities have both home and foreign securities as assets and the money supply as a liability.[3/] They can choose as policy instruments and set values for any two of the following four financial variables: the money supply, foreign exchange reserves, the interest rate, and the exchange rate. The values of the other two financial variables are then determined by the model. The authorities conduct financial policy using two kinds of financial market operations: 1) monetary operations, exchanges of home securities for money with private agents; and 2) intervention operations, exchanges of home securities for foreign securities with private agents. Under an "aggregates constant policy" the money supply and foreign exchange reserves are kept unchanged at chosen values, while under a "rates constant policy" monetary and intervention operations are employed to keep the interest rate and the exchange rate constant at selected values.

Consider the effects of stochastic shifts in the XX schedule in the range between X_1X_1 and X_2X_2 shown in Figure 1. These shifts might result from changes in home or foreign saving behavior, or from changes in preferences between home and foreign goods either at home or abroad.[4/] If the authorities pursue an aggregates constant policy, levels of output between Y_1 and Y_2 result. For example, suppose an increase in demand for the home good shifts the XX schedule to X_2X_2. Output increases creating an excess demand for home money and an excess supply of home securities. Under plausible assumptions these disequilibria can be removed only by a rise in the interest rate and an appreciation of the home currency. It is assumed that an appreciation of the home currency raises excess supply in the markets for the home good, home money, and the home security.[5/] These assumptions imply that as the home currency appreciates, the X_2X_2, M_0M_0, and B_0B_0 schedules shift toward one another, until they intersect at a point in the shaded triangle above X_0X_0.

If instead, the authorities pursue a rates constant policy, levels of output between Y_1' and Y_2' result. If the XX schedule shifts to X_2X_2, then the new equilibrium is at point a. Since there is no change in the exchange rate, the XX schedule does not shift from X_2X_2. The MM and BB schedules are shifted to the right by monetary and intervention operations until they pass through point a. An expansionary monetary operation, a purchase of home securities with home money, shifts both MM and BB to the right. However, BB is shifted farther since increases in income raise the demand for money by more than they reduce the demand for home securities because the demand for foreign securities is also reduced. Thus, in order to keep both the exchange rate and the interest rate constant, the authorities must undertake an intervention operation, a sale of home securities in exchange for foreign securities, so that the BB schedule does not shift farther to the right than point a. When the only source of shocks to equilibrium is stochastic shifts in the XX schedule, an aggregates constant policy leads to less variation in output than a rates constant policy.

Exactly the opposite conclusion is reached when stochastic shifts in the BB schedule between B_1B_1 and B_2B_2 shown in Figure 2 are considered. These shifts result from changes in preferences between home and foreign securities either at home or abroad. If the authorities pursue an aggregates constant policy, levels of output between Y_1 and Y_2 result. Suppose a shift in asset preferences toward home securities and away from foreign securities causes the BB schedule to move to B_2B_2. The increase in demand for home securities leads to a decrease in the home interest rate, which in turn causes an excess demand for home money. In order for equilibrium in the financial markets to be reestablished, the home currency must appreciate. Appreciation causes the three schedules to shift together as before, so the new equilibrium must lie in the shaded triangle below B_0B_0. Output may fall, rise, or remain the same since the changes in financial variables have opposite effects on demand for the home good.

If instead, the authorities pursue a rates constant policy, output definitely remains unchanged. The BB schedule is shifted back to B_0B_0 by an intervention operation operation consisting of a sale of home securities and purchase of foreign securities. When the only source of shocks to equilibrium is stochastic shifts in the BB schedule, a rates constant policy leads to less variation in output than an aggregates constant policy.

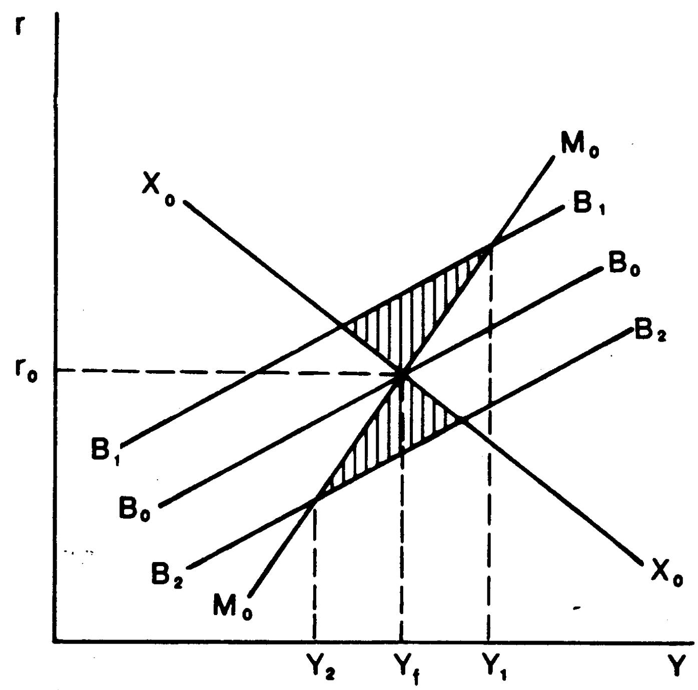

Figure 2

Two other possible sources of stochastic shocks to equilibrium are 1) shifts in home residents' preferences between home money and foreign securities which cause movements in the MM schedule and 2) shifts in home residents' preferences between home money and home securities which cause movements in both the MM and BB schedules. In both these cases, a rates constant policy leads to less variation in output than an aggregates constant policy.

A familiar conclusion can be confirmed with the diagram if the additional assumption is made that the excess demand for home money does not depend on the exchange rate:[6/] when either the money stock or the interest rate is kept constant, 1) with stochastic shocks in the home good market, output variation with a freely floating exchange rate is always less than or equal to that with a fixed exchange rate; and 2) with stochastic shifts in or between the markets for home securities and home money, output variation with a fixed exchange rate is always less than or equal to that with a freely floating exchange rate.

II. Information and Financial Policies in a Single Open Economy

Assume for simplicity that the authorities wish to minimize the expected squared deviations of output from Y_f. How should they proceed when the economy is buffeted by all of the types of shocks considered above? What financial policy is optimal depends on what information the authorities have about the structure of the economy and about the shocks to which it is subjected. Suppose the authorities operate in an environment in which they know, or have unchanging subjective beliefs about, the nonstochastic coefficients of the three linear market equilibrium relations and the joint distribution of the additive stochastic terms. Suppose also that they cannot observe output, and cannot observe or, at least, do not respond to movements in the two financial variables they do not fix when choosing their monetary and intervention policies. In this setting it makes sense to compare alternative pure financial policies. Alternative certainty equivalent policies should be compared, and when there are two policy instruments, as in the system under consideration, one can be set arbitrarily. Then once a policy is found to be superior it is followed period after period unless there are changes in the parameters of the system or the joint distribution of the stochastic disturbances (see William Poole and Benjamin Friedman).

The diagrammatic analysis above suggests one simple kind of conclusion; for example, given the coefficients of the system and all of the other parameters of the joint distribution of the disturbances, there exists a variance of the disturbance term in the market for the home good large enough to insure that an aggregates constant policy leads to lower expected loss than a rates constant policy. Additional conclusions must be based on calculations of expected losses. Suppose that the three equilibrium relations are normalized on income and that the variances of the normalized disturbances are equal. An aggregates constant policy may or may not be better than a rates constant policy whereas under similar assumptions in a closed economy a money supply constant policy dominates an interest rate constant policy (see Poole). An aggregates constant policy is superior (inferior) to a rates constant policy for large values of the degree of substitutability between home and foreign securities (the responsiveness of home good demand to changes in the exchange rate).

The authorities should proceed differently in a second environment in which the only difference is that the coefficients of the model are stochastic variables which have a joint distribution with the additive stochastic terms that is known to the authorities. As before, it is logical to consider alternative pure financial policies. However, in general, certainty equivalent policies are not optimal, and all policy instruments, potentially two in the system considered here, are set at well-defined optimal levels even though there is only one target variable. This is because different values of the same instrument imply different variances for output (see William Brainard). Again, once chosen, instrument levels are not varied. Two questions are of interest: which pure policies should be chosen and how far should the instruments be set from their certainty equivalent levels.

Optimal behavior for the authorities can be described in yet a third environment in which they know the nonstochastic coefficients of the market equilibrium relations and can observe and respond to changes in the two financial variables not chosen as policy instruments. In this setting one policy instrument can be set arbitrarily. The authorities should choose a linear rule which tells them how to set the other policy instrument given the levels of the remaining two financial variables which can be regarded as information variables. In general, the coefficients of the decision rule will be functions of both the coefficients of the model and the parameters of the joint distribution of the additive disturbance terms. While the decision rule is the same period after period, the value of the variable policy instrument is changed from period to period since the authorities can learn something about the shocks in the current period from observations on the two information variables (see Friedman; John Kareken, Thomas Muench, and Neil Wallace; Poole).

Consider the case in which the interest rate and the exchange rate are chosen as policy instruments and the exchange rate is kept fixed. Suppose the authorities make a trial choice of the interest rate which would lead to an output equal to Y_f, if there were no disturbances. However, there are disturbances, and as a result the authorities will observe a money supply and a value of foreign exchange reserves which are different from the ones which would be associated with Y_f if the disturbances were zero. Given the exchange rate, the trial choice of the interest rate, and the observed financial aggregates, the three market relations can be used to eliminate unobservable output and to solve for two linear combinations of the current disturbance terms. These two linear combinations can in turn be employed to form an optimal estimate of the current disturbance term in, for example, the market for the home good, using the parameters of the joint distribution of the disturbance terms. With this optimal estimate of the current disturbance in the market for the home good, the authorities can then choose a new value for the interest rate which assures that the expected value of output is equal to Y_f, given the current disturbances. This new choice of the interest rate will imply new values for the money supply and the authorities' foreign exchange reserves. The differences between the original choice of the interest rate and its final value and between the values of the money supply and foreign exchange reserves implied by the original choice of the interest rate with disturbance terms set equal to zero and their final implied values can all be expressed as linear functions of the two calculated linear combinations of the disturbance terms, so the required adjustment in the interest rate can be written as a linear function of the deviations in the aggregates. This linear function is the decision rule.[7/] When the interest rate is chosen as the variable policy instrument the coefficients on the deviations in the aggregates are both zero if there is no disturbance in the market for the home good.

The implication that one financial policy instrument, the exchange rate in the example above, can be set arbitrarily depends crucially on two assumptions: the assumption that the authorities are concerned only about squared deviations of output from Y_f, and the assumption that the coefficients of the system are known with certainty. If the authorities were also concerned, for example, about squared deviations in interest-sensitive consumption from some desired level, optimal financial policy would involve variations in both policy instruments, so the exchange rate would have to vary no matter whether it was chosen as a policy instrument or was used as an information variable. Likewise, if the coefficients of the model were stochastic variables, all financial variables, including the exchange rate, would have to vary in an optimal way. In this case inferences would also have to be drawn regarding the coefficients of the model.

III. Financial Policies in a Two-Country World Economy

The discussion above suggests that in general circumstances it will always be optimal for an individual country to opt for a managed floating exchange rate rather than a fixed or freely floating exchange rate if the authorities in the other country in a two-country world economy set their output at its full employment level while pegging their interest rate. This result continues to hold when some types of modification are made in the treatment of the foreign country. It could be assumed that foreign output and the foreign interest rate are random variables which may or may not be correlated with each other and with the shocks to the market relations considered so far (see Stephen Turnovsky). Alternatively the system could be expanded to comprehend two countries with the addition of appropriate market relations and additive disturbances, and it could be assumed that the home authorities know all the coefficients of the model, the joint distribution of all the additive disturbances, and the unchanging values of the policy instruments of the foreign authorities (see Robert Flood and C. Michael Jones).

Another approach to the analysis of financial policy in a two-country world is to determine whether or not two countries, each of which is committed to a particular monetary policy could agree on a pure exchange rate regime. Consider a two-country generalization of the system presented above with enough additive disturbance terms to permit analysis of shifts between every pair of the four financial markets, shifts between the markets for the two goods, and shifts in the market for each good alone.[8/] Suppose that the authorities in both countries fix their interest rates. Both countries will prefer a fixed exchange rate if there are disturbances only in financial markets. Under plausible assumptions both countries will prefer a freely floating rate if there are shifts only between the markets for the two goods, since the country which undergoes the increase (decrease) in demand experiences an appreciation (a depreciation) of its currency which mitigates the effect of the disturbance on output. However, when shocks affect only the market for one good, the country producing it will prefer a freely floating exchange rate, while the other country will prefer a fixed exchange rate since movements in a freely floating exchange rate mitigate the output effects in the producing country but exaggerate them in the other country. As before, if all types of shocks must be faced, then the expected losses for each country associated with each of the two exchange rate regimes could be calculated and compared.

Suppose the authorities in each of the two countries can observe and react to all of the financial variables not chosen as policy instruments. Taken together the two sets of authorities can choose as policy instruments any three of the following six financial variables: the two money supplies, the difference between their holdings of foreign exchange reserves measured in the same currency, the two interest rates, and the exchange rate. If the authorities are concerned only about output deviations and if the coefficients of the system are known to them, then they can set one policy instrument arbitrarily. They should choose two linear decisions rules which tell them how to set the other two policy instruments given the levels of the three financial information variables. There is no conflict of interest between the two sets of authorities, and financial policy making can be cooperative or decentralized as long as there is agreement about which policy instrument to keep fixed and how to do it.

The situation is quite different if each country has two objectives, say minimizing squared deviations in output and interest sensitive consumption from desired values, and if these values are inconsistent (as they will be in general when there are only three independent policy instruments). If the two sets of authorities behave like Cournot duopolists, no equilibrium exists. If one set of authorities or the other is allowed to behave like a Stackelberg leader an equilibrium is reached which in general is off the contract curve (see Koichi Hamada, Jones, and Jurg Niehans). In these circumstances both countries might be willing to agree either to refrain from changing their foreign exchange reserves or to use them in a well-defined way to fix the exchange rate since such an agreement might lead to better outcomes than those which would emerge under unrestrained noncooperative behavior. Though it is not obvious how to go about constructing them, it is possible that other simple guidelines for the management of foreign exchange reserves or the exchange rate would generate outcomes superior to both unrestrained noncooperative behavior and either pure intervention policy. Even if the two countries agree to a pure intervention policy, in general a policy conflict remains, and both countries can be made better off by cooperation.

IV. A Concluding Reminder

This discussion of financial policies has proceeded under simple assumptions about how private agents form their expectations; exploration of the implications of more sophisticated assumptions is important (see Flood and Michael Parkin). It has been assumed that there are no costs associated with changing the values of policy instruments. The short-run focus has precluded consideration of how the financial authorities should respond to the dynamic effects of saving, capital accumulation, the transfer of wealth between countries through current account imbalances, and monetary policies implying differing secular rates of inflation. Attention has been devoted to the financial policy problems which are evident when there are financial relations between only two countries; additional "optimum currency area" problems arise when there are relations among many countries (see Tower and Willet).

Footnotes

1/ A description of a continuous time version of this model is provided by the author. Ralph Bryant's analysis of the effects of shocks under alternative financial policy regimes is similar to the one of this paper.

2/ This footnote contains a terse description of one specification of the financial sector from which the conclusions in the text can be derived. Home residents hold home money, and home and foreign securities. Foreign residents do not hold home money. The fraction of home nominal wealth which home residents hold in the form of home money depends positively on home output measured in physical units, and the fractions they hold in home and foreign securities depend negatively on home output. The fraction of wealth held in each asset by home residents and foreigners' demand for home securities measured in foreign currency depend on the home interest rate and the foreign interest rate augmented by the expected rate of depreciation of the home currency. The expected rate of depreciation of the home currency is an increasing function of the gap between a constant "long-run equilibrium" value of the exchange rate and its current value. The supply of home securities available to private agents is equal to the exogenous supply of fixed-nominal-value, variable-interest-rate bonds issued by the government of the home country minus the holdings of the authorities.

3/ Values for only two of the three items on the authorities' balance sheet can be chosen independently. If the authorities have the monetary base as a liability, uncertainty in the relationship between the monetary base and money supply can affect the analysis of financial policy in open economies as explained by Bryant.

4/ In a beginning-of-period-balancing model a change in saving behavior does not affect asset demands. No attempt is made here to classify shocks as "real" or "monetary" for two reasons. First, these adjectives have been used in different ways by two sets of authors. In most of the literature on the analysis of financial policies in closed and open economies real shocks are shifts in the aggregate demand for goods, monetary shocks are shifts in money demand, and aggregate supply adjusts passively to fulfill aggregate demand, so there are no stochastic shifts in aggregate supply. In the contributions of Stanley Fischer and Jacob Frenkel, as in much of the literature on indexation, however, real shocks are shifts in aggregate supply, and monetary shocks are shifts in the quantity-theory money demand function. Second, there is more than one financial market in the system considered here, and of the three kinds of shifts in financial markets considered, only two involve shifts in money demand.

5/ The financial-market assumptions are implications of the specification of the financial sector in fn. 2 and many other plausible specifications.

6/ The excess demand for home money would be independent of the exchange rate if the demand for home nominal balances deflated by the price of the home good, instead of a price index which included the exchange rate, depended on only home output measured in physical units and the home interest rate.

7/ Russell Boyer calculates an optimal decision rule in a model which is similar to the one employed here except that he assumes that home and foreign securities are perfect substitutes. Frenkel's optimal rule is derived in a quite different model.

8/ In a beginning-of-period-balancing model, a shift which affects only the home good market could result from a reduction in home saving which is spent entirely on the home good; under plausible assumptions the qualitative effects would be the same in the case in which spending on both the home and foreign goods increases. Richard Sweeney uses an end-of-period-balancing model in which a change in saving behavior must be matched by a change in at least one asset demand function.

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