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Abstract
Current interest in the monetary theory of the balance of payments has spurred interest in both the static and dynamic and effects of central bank sterilization policies. In particular, the monetary approach to the balance of payments demonstrates that an improper rate of monetary expansion will lead to an official settlements deficit or surplus. As sterilization policies alter the rate of growth of the domestic money supply, it is important to determine how sterilization affects the balance of payments. The ongoing debate concerning the relative merits of fixed versus flexible exchange rates also serves to underline the importance of balance of payments sterilization. Proponents of flexible exchange rates argue that monetary independence cannot be attained under a pegged rate regime, whereas advocates of fixed rates claim that sterilization can lead to monetary independence even if the exchange rate is pegged.

Disciplines
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Portfolio Balance and Balance of Payments Sterilization

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Current interest in the monetary theory of the balance of payments has spurred interest in both the static and dynamic and effects of central bank sterilization policies. In particular, the monetary approach to the balance of payments demonstrates that an improper rate of monetary expansion will lead to an official settlements deficit or surplus. As sterilization policies alter the rate of growth of the domestic money supply, it is important to determine how sterilization affects the balance of payments. The ongoing debate concerning the relative merits of fixed versus flexible exchange rates also serves to underline the importance of balance of payments sterilization. Proponents of flexible exchange rates argue that monetary independence cannot be attained under a pegged rate regime, whereas advocates of fixed rates claim that sterilization can lead to monetary independence even if the exchange rate is pegged.

Academic economists seem to be of one mind in their findings that sterilizing the balance of payments prolongs the speed of adjustment, for example, Alibner argues:

"...the central bank in the country with a payments surplus would take measures to sterilize the impact of the payments imbalance on the monetary base, perhaps by offsetting open-market operations. Similarly, the country with the payments deficit would not permit the imbalance to affect its money supply. In the absence of sterilization, the impact of payments imbalances on the monetary base tends to be self-correcting. With sterilization, the self correcting tendencies are weakened, and so the imbalances are prolonged."

Sterilization is also deemed to have undesirable effects concerning the size of the necessary adjustments needed to restore equilibrium in the
face of an initial disturbance in the international economy. For example, some of the comparative statics results of a model by Argy and Kouri are summarized as follows:

"For all disturbances, the volatility of reserves is greater with sterilization than without... sterilization policies, however, tend to destabilize income when the disturbance originates in fluctuations in liquidity preference. Sterilization of external disturbances almost certainly destabilizes income."²

The purpose of this paper is to re-examine the effects of sterilization in the context of a two country model which is consistent with the monetary approach to the balance of payments. It will be shown that the properties of a two country world are such that sterilization policies—even during periods of monetary disequilibria—can act to reduce the volatility of income levels and interest rates and possibly increase the speed of adjustment. The model will also demonstrate that the institutional arrangements of the Bretton-Woods system and its aftermath are such that central banks outside of the U.S. actually pursue a type of sterilization policy which is incongruous with international stability.

The Model

The model postulates two countries—say the U.S. and the U.K.—in which only two assets are held, money and bonds. Residents of a country are assumed to hold only that country's money,⁶ whereas foreign denominated bonds can be held by domestics. It is assumed that capital markets are sufficiently integrated such that there is a single world interest rate, and no significant loss of generality is incurred if it is assumed that only one country—the U.S.—issues bonds. In accord with the McKinnon (1968) and Argy and Kouri (1974) monetary models of the balance of payments, the Keynesian assumption of fixed commodity prices and variable income levels is made.
For the U.S., the private sector's demands for cash balances and bond holdings are given by equations 1 and 2. These demands are functions of the current level of U.S. income, the real (equal to the nominal) rate of return on bonds, and are homogeneous of degree one in terms of U.S. private sector wealth.

1) \( M^D = L(Y, r, W) \)  
Where: \( M^D \) = private U.S. demand for cash balances

2) \( B^D = B^D(Y, r, W) \)  
and: \( Y \) = current U.S. income
\( r \) = rate of return on bonds

3) \( W = B^P + M \)  
\( W \) = U.S. private sector wealth
\( B^P \) = bond holdings of the U.S. private sector
\( M \) = money holdings of the U.S. private sector

At a moment in time, in which wealth is fixed, the balance sheet constraint imposes certain sign restrictions on the asset demand functions. In particular, as long as wealth is fixed, the sum of the asset demands must always be equal to the given stock of wealth since it is impossible to allocate more assets than the existing stock. The above condition will be met if the sum of the effects of changes in the interest rate and changes in the level of income both sum to zero across the portfolio, while the effect of a change in wealth sums to unity across the portfolio, i.e., \( \frac{\partial L}{\partial Y} + \frac{\partial B^D}{\partial Y} = \frac{\partial L}{\partial r} + \frac{\partial B^D}{\partial r} = 0 \); and 
\( \frac{\partial B}{\partial W} = 1 \). By assumption: \( 0 < \frac{\partial L}{\partial Y} < 1 \); \( \frac{\partial L}{\partial r} < 0 \); and \( 0 < \frac{\partial B}{\partial W} < 1 \).

Similarly the U.K. demands for money and bonds can be represented by:

4) \( M'^D = L'(Y', r, W') \)  
Where: Primed symbols represent the U.K. counterpart of the U.S. variable.

5) \( B'^D = B'^D(Y', r', W') \)

6) \( W' = B'^P + M' \)
It is assumed that money has no backing, but the rules of the game are such that there is a reserve asset in which international payments are made. When a resident of a country receives the reserve asset, the central bank immediately exchanges the reserve asset for the domestic currency. Thus, one component of each country's money supply is the cumulated sum—either positive or negative—of the central bank's accumulations of the reserve asset, each times the currency price of the reserve asset. If the currency price of the reserve asset in both the U.S. and the U.K. is set equal to unity (necessitating an exchange rate equal to one), a component of each country's money supply is equal to the central bank holdings of the reserve asset. The second component of a country's money supply is equal to the cumulated sum of bonds purchased by the central bank since central banks are assumed to purchase bonds only during open market operations.

Thus, the money supply in each country can be represented by:

7) \( M = B + R \)

8) \( M' = B' + R' \)

Where:

- \( B \) = cumulated sum of U.S. central bank bond purchases
- \( B' \) = cumulated sum of U.K. central bank bond purchases
- \( R \) = dollar value of U.S. central bank holdings of the reserve asset
- \( R' \) = dollar value of U.K. central bank holdings of the reserve asset

Since the world stock of the reserve asset is assumed fixed:

9) \( dR = -dR' \)

The central bank in each country may attempt to sterilize the balance of payments by increasing (decreasing) bond holdings in the face of a deficit (surplus). Alternatively, a central bank may decide to accommodate the balance of payments by increasing (decreasing) its bond holdings in the face of a surplus (deficit). Such behavior can be represented by:

10) \( \frac{dR}{dt} = s \frac{dR}{dt} \)

Where:

- \( s \) = sterilization coefficient
- \( \frac{dR}{dt} \) = change in U.S. reserves at time "t"
Note: \(-1 < s < 0\) for a sterilization policy
\(s > 0\) for an accommodating policy

Integrating 10) and 11):

\[ \frac{dB^C}{dt} = s \frac{dR^*}{dt} \]

\[ \frac{dB^C}{dt} = \text{change in U.S. central bank bond holdings at time } t \]

Note: \(-1 < s < 0\) for a sterilization policy
\(s > 0\) for an accommodating policy

\[ B^C = sR + c \]

Where: \(c = \text{constant of integration}\)

\[ B'^C = s'R^* + c' \]

Note: an increase in \(c\) represents an exogenous increase in the U.S. money supply

It will be convenient to assume that the U.S. government issues a fixed price bond denominated in terms of dollars. Since the total stock of bonds must be held:

\[ B = B^P + B'^P + B^C + B'^C \]

Where: \(B = \text{given world stock of bonds}\)

The asset demand equations (equations 1-6) describe the demands for assets at a point in time wherein portfolio size is fixed. Over time, however, the size of a portfolio need not be constant and following Jones, it is assumed that saving is proportional to the discrepancy between desired and actual wealth. Since the desired or target level of wealth is solely a function of income and the interest rate, saving behavior can be represented by:

\[ \frac{dW}{dt} = \alpha [W^*(Y, r) - W] \]

Where: \(W^* = \text{desired wealth}\)

\[ \alpha = \text{constant of proportionality} \]

\[ \frac{dW'}{dt} = \alpha' [W'^*(Y', r) - W] \]

and: \(\frac{\partial W^*}{\partial Y'} > 0; \frac{\partial W^*}{\partial r} > 0\)

Note that a change in the interest rate has two opposing effects on the long run demand for money. If the interest rate increases, the desired proportion of cash balances in a portfolio of a given size decreases. The increase in the interest rate, however, increases desired portfolio size so that it may be possible for an increase in the interest rate to increase the long run demand for money. In order to rule out this possibility, it
is assumed that $\frac{\partial U}{\partial r} + \frac{\partial U}{\partial W} \frac{\partial W}{\partial r}$ and $\frac{\partial U'}{\partial r} + \frac{\partial U'}{\partial W'} \frac{\partial W'}{\partial r}$ are both negative.

With saving behavior specified, the consumption or expenditure function becomes a redundant equation, i.e.-

17) $E = Y - \frac{dW}{dt}$

Where: $E =$ U.S. expenditures on the U.S. and U.K. good

18) $E' = Y' - \frac{dW'}{dt}$

Total consumption expenditures, by definition, sum to the demand for the domestic good plus the demand for the foreign good. Given fixed commodity prices and a fixed exchange rate, the demand for imports is solely a function of expenditures. The balance of payments condition states that the change in the U.S. money supply due to the balance of payments is equal to the difference between U.S. exports and imports plus net U.S. bond sales to the U.K., i.e.-

19) $\frac{dR}{dt} = X(E') - X'(E) + \frac{dB^c}{dt} + \frac{dB^p}{dt}$

Where: $X =$ U.S. exports

= U.K. imports

and: $0 < \frac{\partial X}{\partial E} < 1$; $0 < \frac{\partial X'}{\partial E} < 1$

**Comparative Statics**

Full stock equilibrium requires that desired asset stocks equal actual asset stocks and that all asset flows equal zero. The mathematical results are presented in the Appendix, wherein the model is represented by six equations and six unknowns ($Y, Y', r, R, B^F, B^P$).

The discussion below focuses on the effects of sterilizing an initial increase in the U.S. money supply. Since the countries have similar supply and demand functions, symmetry suggests that analogous effects will result if the disturbance originates in the U.K. The analysis is concerned with money supply changes since the interrelations of sterilization and monetary independence are crucial. The effects of increasing the stock of bonds are given in the Appendix.
An increase in the U.S. money supply via open market operations changes the composition of wealth in the U.S. while leaving the sum intact. Portfolio equilibrium can be restored by a fall in the interest rate resulting in a corresponding increase in expenditures. The increased U.S. expenditures act to increase income levels in both the U.S. and the U.K. With a higher U.K. income level and a lower interest rate, the U.K. must experience a temporary balance of payments surplus such that the increased U.K. demand for money is met by an increase in the U.K. money supply. With higher income levels and a lower interest rate, however, the net direction of bond flows cannot be determined.

If the U.S. monetary authorities partially sterilize the U.S. balance of payments deficit, U.S. residents will experience additional increases in their money holdings. These additional increases in the U.S. money supply require still larger changes in income levels, reserve holdings and the interest rate. As sterilization of the U.S. deficit increases the volatility of economic activity, the U.S. monetary authorities should attempt to accommodate their deficit. However, sterilization of the U.K. surplus acts to reduce the volatility of economic activity and an accommodating monetary policy by the U.K. increases the magnitude of disturbances. If the U.K. monetary authorities increase the money supply due to the U.K. surplus, the initial increase in the U.S. money supply results in additional increases in the world money supply. Since the world demand for money must equal the world supply of money, an accommodating monetary policy by the U.K. will require relatively large changes in income levels and the interest rate. Thus, fluctuations in economic activity will be minimized if the country with an initial monetary disturbance pursues an accommodating monetary policy while the second country follows a sterilization policy. Note that
this result is in direct contradiction to the statement by Argy and Kouri who argue... "Sterilizing external disturbances almost certainly destabilizes income".

It is also interesting to note that the reduction in U.S. reserves is increased if either the U.S. or the U.K. sterilize. If the U.S. sterilizes its deficit, the additional increases in the U.S. money supply act to further worsen the U.S. balance of payments. If the U.K. sterilizes its surplus, sterilization retards the necessary increase in the U.K. money supply creating forces which further stimulate the U.K. surplus. Another interesting aspect of the model is that income levels and the interest rate are invariant with respect to the magnitude of sterilization as long as the U.S. and U.K. sterilization coefficients equal. This result follows from the fact that if \( s = s' \), a U.S. deficit of \( dR/dt \) induces the U.S. to change the world money supply by \( s(dR/dt) \) while inducing a change in the world money supply of \(-s(dR/dt)\) by the U.K. Thus, as long as sterilization coefficients are equal, the world money supply is unaltered via sterilization policies, and clearly it is the world money supply to which income levels and the interest rate must adjust.

These findings serve to point out one of the fundamental problems of the Bretton-Woods system and its aftermath. The institutional arrangements of the international monetary system are such that central banks tend to hold their reserves in the form of interest bearing claims on the U.S. The foreign central bank purchases of U.S. assets have no direct effects on foreign money supplies but do serve to increase the U.S. money supply and decrease the U.S. supply of bonds. Thus, the fact that foreign central banks hold interest bearing claims on the U.S. means that foreign central banks are sterilizing the U.S. balance of payments deficits.\(^{10}\) To the extent that U.S. deficits have been caused by increases in the U.S. money
supply, the institutional arrangements of the international monetary system have served to increase the volatility of income levels in both the U.S. and abroad. Also note that sterilizing the U.S. deficit means larger reserve losses for the U.S., implying that U.S. deficits were magnified by the desire of foreign central banks to hold interest bearing claims on the U.S.

**Stability**

The comparative statics results have no direct bearing on the stabilizing or destabilizing effects of sterilization nor upon the speed of adjustment. As shown in the Appendix, the system has a single characteristic root which is unambiguously negative if the sum of the marginal propensities to import is less than unity and governments do not fully sterilize the balance of payments. Given the standard assumption that the sum of the marginal propensities to import is less than unity, neither partial sterilization nor accommodating monetary policies are unstable. Also note that if the two sterilization coefficients are equal, the invariance of the world money supply assures that the speed of adjustment is independent of the actual magnitude of the coefficients themselves. When the sterilization coefficients are not equal it is not possible to determine whether sterilization increases or decreases the speed of adjustment, i.e.- if \( P \) is the characteristic root of the system, \( \partial P/\partial s \) and \( \partial P/\partial s' \) have ambiguous signs. Yet when the sterilization coefficients are unequal, it is misleading to discuss the effects of sterilization on the speed of adjustment since the final equilibrium position also depends upon the magnitude of the sterilization coefficients.

**Conclusion**

The view taken in this paper has been that international asset flows will only take place in response to a stock disequilibrium. An excess money
supply in a country will result in a temporary balance of payments deficit, partially serving to eliminate the excess money supply. As opposed to "one country models" the deficit does not fully eliminate the excess supply of money for the corresponding surplus for the rest of the world disturbs foreign portfolios. The increased world money supply can only be absorbed by higher income levels and a lower interest rate. The magnitudes of adjustment then, depend upon the size of the change in the world money supply. As sterilization of a deficit and accommodating a surplus act to increase the world money supply, these policies act to magnify the effects of money issuance. Yet accommodating deficits and sterilizing surpluses cannot be used as a policy rule which minimizes volatility. A country may experience a deficit due to a decrease in the domestic demand for money or an increase in the foreign demand for money. To the extent that a country has a deficit due to an increase in the demand for money in the rest of the world, accommodating the deficit changes the world money supply in the wrong direction. The only policy rule which minimizes the volatility of economic activity is to sterilize disturbances which originate abroad and accommodate disturbances originating domestically. Thus, it is possible to explain why the "one country models" show that monetary authorities should never sterilize the balance of payments. In a "one country models" all disturbances (except a shift in the export function) originate domestically and the money market in the rest of the world is never out of equilibrium.
Comparative Statics

In the steady state, desired wealth is equal to actual wealth and net asset flows between countries are zero. Substituting these conditions into equations 1-19 and setting asset demands equal to asset supplies, the steady state version in differential form can be represented by:

\[
\begin{bmatrix}
\frac{\partial L}{\partial Y} & 0 & \frac{\partial L}{\partial r} & \frac{\partial L}{\partial W} & 0 & -(1+s)(1-\frac{\partial L}{\partial W}) \\
0 & \frac{\partial L}{\partial Y} & \frac{\partial L}{\partial r} & 0 & \frac{\partial L}{\partial W} & (1+s')(1-\frac{\partial L}{\partial W'}) \\
\frac{\partial W^*}{\partial Y} & 0 & \frac{\partial W^*}{\partial r} & -1 & 0 & -(1+s) \\
0 & \frac{\partial W^*}{\partial Y} & \frac{\partial W^*}{\partial r} & 0 & -1 & (1+s') \\
-\frac{\partial X}{\partial E} & \frac{\partial X}{\partial E} & 0 & 0 & 0 & 0 \\
\end{bmatrix}
\begin{bmatrix}
dY \\
dY' \\
dr \\
dB^P \\
dR \\
\end{bmatrix}
= 
\begin{bmatrix}
(1 - \frac{\partial L}{\partial W})dc \\
(1 - \frac{\partial L}{\partial W'})dc' \\
dc \\
dc' \\
dB - dc - dc' \\
0 \\
\end{bmatrix}
\]

The determinant of the coefficient matrix (\(A\)) is unambiguously negative, i.e.-

\[
\Delta = -(1+s')\left\{\frac{\partial X}{\partial E}\left[\frac{\partial L}{\partial Y}\left(\frac{\partial W^*}{\partial r} + \frac{\partial W^*}{\partial r}\right) - \frac{\partial W^*}{\partial Y}\left(\frac{\partial L}{\partial r} - \frac{\partial L}{\partial W}\frac{\partial W^*}{\partial r}\right)\right] - \frac{\partial X}{\partial E}\frac{\partial W^*}{\partial Y}\left(\frac{\partial L}{\partial r} - \frac{\partial L}{\partial W}\frac{\partial W^*}{\partial r}\right)\right\} - (1+s)\left\{\frac{\partial X}{\partial E}\left[\frac{\partial L}{\partial Y'}\left(\frac{\partial W^*}{\partial r} + \frac{\partial W^*}{\partial r}\right) - \frac{\partial W^*}{\partial Y'}\left(\frac{\partial L}{\partial r} - \frac{\partial L}{\partial W}\frac{\partial W^*}{\partial r}\right)\right] - \frac{\partial X}{\partial E}\frac{\partial W^*}{\partial Y'}\left(\frac{\partial L}{\partial r} - \frac{\partial L}{\partial W}\frac{\partial W^*}{\partial r}\right)\right\}
\]

Note: It is assumed that the long run demand for money is negatively related to the interest rate.
Comparative Static Effects of Asset Supply Changes

\[ \frac{dY}{ds}, \frac{dY'}{ds}, \frac{dR}{dc} \]

Note: if \( s = s', (1 + s) \) is a factor of both the numerator and denominator in the expressions for \( \frac{dY}{dc}, \frac{dy}{db}, \frac{dy'}{dc}, \frac{dy'}{db}, \frac{dr}{dc}, \frac{dr}{db}, \frac{dR}{dc}, \frac{dR}{db} \). Thus, when the sterilization coefficients are equal, the magnitudes of these multipliers are independent of the magnitudes of the sterilization coefficients.

1) The effects of changes in asset stocks on U.S. and U.K. bond holdings are quite complex and are not presented in the table. The interested reader is referred to Enders (1975) for a thorough examination of the various effects involved.

2) An increase in \( c \) represents an increase in U.S. central bank holdings of bonds acquired via open market operations. The comparative static effects of U.K. open market operations are not presented for the symmetrical nature of the model guarantees that the effects of U.S. open market operations have the same sign as U.K. open market operations.

3) Each element \( a_{12} \) and \( a_{13} \) shows the sign of the partial derivative of the money multiplier presented in column 1 with respect to the sterilization coefficient. Thus, an increase in \( s \) decreases the effects of a change in the money supply on income levels, reserves and the interest rate. An increase in \( s' \) increases the impact of a change in the U.S. money supply on income levels and the interest rate while reducing the magnitude of reserve changes.
Stability

Approximating all non-linear functions by means of a Taylor Expansion and allowing $D$ to be the differential operator, the system's coefficient matrix post multiplied by the column vector of unknowns can be represented by:

$$
\begin{bmatrix}
\frac{\partial L}{\partial Y} & 0 & \frac{\partial L}{\partial r} & \frac{\partial L}{\partial w} & 0 & -(1 + s)(1 - \frac{\partial L}{\partial w}) \\
0 & \frac{\partial L'}{\partial Y} & \frac{\partial L'}{\partial r} & 0 & \frac{\partial L'}{\partial w'} & (1 + s')(1 - \frac{\partial L'}{\partial w'}) \\
\frac{\partial W^*}{\partial Y} & 0 & \frac{\partial W^*}{\partial r} & -(1 + \frac{d}{\alpha}) & 0 & -(1 + s)(1 + \frac{D}{\alpha}) \\
0 & \frac{\partial W'^*}{\partial Y} & \frac{\partial W'^*}{\partial r} & 0 & -(1 + \frac{D}{\alpha'}) & (1 + s')(1 + \frac{D}{\alpha'}) \\
0 & 0 & 0 & 1 & 1 & (s - s') \\
\frac{\partial X'}{\partial E} & \frac{\partial X}{\partial E'} & 0 & -(1 - \frac{\partial X'}{\partial E})D & \frac{\partial X}{\partial E'}D & -(1 + s)(1 - \frac{\partial X'}{\partial E}) \\
\frac{\partial X'}{\partial E'} & \frac{\partial X}{\partial E} & 0 & -(1 + \frac{D}{\alpha'}) & \frac{\partial X}{\partial E'}D & -(1 + s)(1 + \frac{D}{\alpha'}) \\
\end{bmatrix}
$$

The determinant of the coefficient matrix takes the form $\lambda D + \lambda_0$. Setting this equation equal to zero, the solution for $D$ yields the characteristic root of the system. The necessary and sufficient condition for stability is that $\lambda_0$ have the same sign as $\lambda$. Clearly, $\lambda_0$ must be identical to $\Delta$ as presented in the section concerned with comparative statics. Since $\Delta < 0$, stability requires $\lambda$ to be negative. Solving for $\lambda$:

$$
\lambda = -\left(1 - \frac{\partial X'}{\partial E} - \frac{\partial X}{\partial E'}\right) \left[(1 + s)\frac{\partial W^*}{\partial Y} \frac{\partial L'}{\partial r} \frac{\partial W'^*}{\partial Y'} - \frac{\partial L'}{\partial r} \frac{\partial W'^*}{\partial Y'} \right) \\
+ (1 + s')\left[\frac{\partial W'^*}{\partial Y} \left(\frac{\partial L}{\partial r} - \frac{\partial L'}{\partial r} \frac{\partial W^*}{\partial Y} \right) - \frac{\partial W'^*}{\partial Y} \left(\frac{\partial L}{\partial r} - \frac{\partial L'}{\partial r} \frac{\partial W^*}{\partial Y} \right) \right] \\
\frac{1}{\alpha'} \left[(1 + s)\frac{\partial X'}{\partial E} \frac{\partial L'}{\partial r} \frac{\partial W'^*}{\partial Y} - \frac{\partial L'}{\partial r} \frac{\partial W'^*}{\partial Y} \right) + (1 + s')\left[\frac{\partial X'}{\partial E} \frac{\partial L}{\partial r} \frac{\partial W^*}{\partial Y} - \frac{\partial L'}{\partial r} \frac{\partial W^*}{\partial Y} \right] \\
\frac{1}{\alpha'} \left[(1 + s)\frac{\partial X'}{\partial E} \left(\frac{\partial W^*}{\partial Y} - \frac{\partial W'^*}{\partial Y} \right) - \frac{\partial L'}{\partial r} \frac{\partial W'^*}{\partial Y} \right) + (1 + s')\left[\frac{\partial X'}{\partial E} \frac{\partial L}{\partial r} \frac{\partial W^*}{\partial Y} - \frac{\partial L'}{\partial r} \frac{\partial W^*}{\partial Y} \right]
$$

$\lambda$ is unambiguously negative if the sum of the marginal propensities to import is less than unity, i.e., $1 - \frac{\partial X'}{\partial E} - \frac{\partial X}{\partial E'} > 0$. Note that if full sterilization occurs, the system never approaches equilibrium. Further, if $s = s'$, $(1 + s)$
is a factor of both $\lambda$ and $\lambda_0$. Thus, if the sterilization coefficients are equal, the speed of adjustment—as well as the magnitude of adjustment—is independent of the magnitude of the coefficients.
Footnotes

*This paper is based on portions of my dissertation, "A Two Country Portfolio Balance Model," (Columbia University, 1974) which was greatly aided by my advisors Ronald Findlay and Donald Mathieson. I am particularly grateful to Harvey Lapan of Iowa State University who could rightfully be a co-author of this paper.

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1/ For an excellent discussion of the monetary theory of the balance of payments see Johnson (1972). Many of the important implications of the monetary approach are presented in Mundell (1971) and Komiya (1969).

2/ For example, of the sixteen papers presented at a 1972 conference sponsored by the University of Chicago, five specifically dealt with the effects of sterilization policies. See Alibner (1974) for the complete collection of these papers.

3/ For a notable exception see Tsiang (1975).


6/ The model is easily adaptable to allow residents of each country to hold two monies. The basic results of the model are not altered by this assumption.

7/ It is assumed that sterilization is less than complete, i.e. $s < -1$ and $s' < -1$. If both countries fully sterilize, the system does not possess a solution. The results presented in the Appendix can allow for full sterilization by one country although this case is not discussed in the text.

8/ See Jones (1968).

9/ The problems associated with incorporating interest payments on bond holdings are quite difficult and the interested reader should see Levin (1968) or Tsiang (1975). In order to eliminate interest payments from the analysis it is assumed that each government imposes a lump sum tax, equal in magnitude to the interest paid to the private sector of that economy. Thus, interest payments do not affect income or appear in the balance of payments equation. Clearly, it must be assumed that the amount of tax an individual pays in no way depends upon that individual's bond holdings.

10/ McKinnon (1974) makes this point without discussing the how this form of sterilization increases U.S. reserve losses and volatility of income.

11/ For example, see Argy and Kouri (1974), Mathieson (1974), or McKinnon (1968).
References


