The Assignment Problem and the Speed of Adjustment

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The Assignment Problem and the Speed of Adjustment

Abstract
Mundell [20] demonstrated that in order to achieve balance of payments equilibrium and full employment, monetary policy should be paired with external balance and fiscal policy with Internal balance. The fundamental problem posed by Mundell concerned the methods governmental authorities should utilize to insure that both internal and external balance would be achieved when the underlying structural parameters of the economy were unknown. Mundell argued that the assignment of monetary policy to external balance and fiscal policy to Internal balance followed from the Principle of Effective Market Classification [20, p.76]: "Policies should be paired with objectives on which they have the most direct effect."

Disciplines
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The Assignment Problem
and the
Speed of Adjustment

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by
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Mundell [20] demonstrated that in order to achieve balance of payments equilibrium and full employment, monetary policy should be paired with external balance and fiscal policy with internal balance. The fundamental problem posed by Mundell concerned the methods governmental authorities should utilize to insure that both internal and external balance would be achieved when the underlying structural parameters of the economy were unknown. Mundell argued that the assignment of monetary policy to external balance and fiscal policy to internal balance followed from the Principle of Effective Market Classification [20, p.76]: "Policies should be paired with objectives on which they have the most direct effect."

The number of papers that have emerged from this original contribution is an indication of the interest and importance of the problem posed by Mundell. The papers which attempt to modify or extend Mundell's work do not dispute the Principle of Effective Market Classification in the two target-two instrument case, but seek to determine whether fiscal policy has the most direct influence on internal balance and monetary policy on external balance. The first section of this paper discusses the problems associated with Mundell's formulation of the capital flow equation and recent attempts to rectify Mundell's formulation. In this section we also discuss the rationale for considering the assignment problem in a two-country setting. The second section of the paper considers a two-country portfolio balance model in which all asset demands are demands for stocks. The nature of the model is such that the balances of trade and payments are self correcting but actual income levels may not converge to the levels desired by policy makers. The assignment problem, then, is partially a speed of adjustment problem: the best assignment will be that which guarantees the convergence of desired
and actual income levels, as well as maintaining convergence to balance of trade and payments equilibrium. The third section of the paper, which contains our principal results, discusses the stability and speeds of adjustment of the various assignments. It is shown that the best assignment consists of using monetary policy for internal balance: whether or not fiscal policy should be assigned to the external accounts depends upon the parameters of the system. A concluding section summarizes our results and contrasts them with previous work.

I. Capital Stocks and Flows

Central to the determination of the proper assignment of monetary and fiscal policy is the precise nature of the role of international capital movements. Mundell's choice of assignments was based on his assumption that capital movements represent sustainable flows, whereas recent work in portfolio theory has shown that the demand for assets is a stock demand. Numerous papers have criticized Mundell for his specification of the capital flow equation and, instead, argued that a change in the rate of return on an asset will lead to a permanent change in desired asset stocks which can be accommodated by temporary asset flows.

As the portfolio approach has led to the recognition that capital flows are transitory in nature, the monetary approach has led to the recognition that an Official Settlements deficit or surplus is also a temporary phenomenon if the underlying system is stable. When money is viewed as an asset in individual portfolios, it follows that a continual change in the money stock - via a balance of payments deficit or surplus not fully sterilized by the monetary authorities - is inconsistent with equilibrium in a static economy. The direct implication, then, of the portfolio approach to the
balance of payments is that an Official Settlements surplus will be positively related to an increase in the demand for money, and negatively related to an increase in the supply. Further, as a balance of trade deficit (surplus) represents net dissaving (saving) vis-à-vis the rest of the world, a balance of trade deficit (surplus) represents an excess supply (demand) for wealth.\(^5\)

A distinction has been made between continuing flow effects versus stock shift effects,\(^6\) or what alternatively has been called the scale effects versus the composition effects.\(^7\) The essential distinction is that asset holders have two decisions to make concerning their portfolios: the scale effect is concerned with the determinants of desired portfolio size, while the composition effect is concerned with the determinants of the asset mix within a portfolio of a given size. As the determinants of the scale and composition decisions are not mutually exclusive, a change in the determinants of asset demands can normally be expected to produce asset flows to accommodate both the realignment of the mix of assets in a portfolio and the change in desired portfolio size. In light of the discussion in the preceding paragraph, the balance of trade is a mechanism by which portfolio size can be altered while the balance of payments is a mechanism by which portfolio composition can be altered. Tsiang [26] considered the assignment problem using a model in which international capital movements represented a stock adjustment process in order to examine the importance of capital flows in determining the proper assignment. However, he assumes that savings, which represents a flow component of wealth, is a constant fraction of income. In an economy without population or income growth, it is quite paradoxical to state that the demands for the individual components of wealth are demands for stocks but that individuals will accumulate these stocks continually.\(^8\) By allowing asset holders to continually accumulate assets, Tsiang finds - as did Mundell -
that interest rate changes will produce sustainable capital flows.

In a recent paper, Enders [5] developed a two-country portfolio balance model in which asset demands, as well as the demand for wealth, represented stock decisions. As such, when the underlying structure of the economic system was stable, both the balance of trade and balance of payments were self-correcting. Given the "fixed commodity price" assumption, however, actual income levels were not necessarily equal to full employment levels. Since Enders did not investigate how government policy actions could best achieve full employment income levels, the question of simultaneous achievement of internal and external balance is still at issue.

It is the purpose of this paper to expand Enders' [5] to consider the speed of convergence to balance of trade, balance of payments, and full employment equilibria; and the role played by fiscal and monetary policy. Within this framework, Mundell's original question must be reformulated as the government(s) need not assign any policy tools to the balances of trade or payments if the economic system is stable. Instead, the question we seek to answer is: What assignments, if any, will assure the convergence of desired and actual income levels without destabilizing or reducing the speeds of adjustment of the balances of trade and payments? Further, the distinction between portfolio size and composition effects suggests that it is important to examine both the wealth creation effects of policy instuments and the particular form in which they create wealth. For any assignment of fiscal policy, we then determine whether the change in government expenditures should be financed by changes in taxes, increases in the stock of bonds or increases in the money stock. 

We propose to study the Assignment Problem in a two country model. The usual small country assumption greatly simplifies economic analysis at the expense of relevance for large economic regions such as the U.S. or E.E.C.
Further, small countries generally have fewer effective policy tools than do large countries. For example, McKinnon [19] shows that in a small country portfolio model, fiscal policy has no permanent effects on the level of income unless capital is immobile and the exchange rate is flexible (i.e., unless the small country is effectively closed). Open market operations, on the other hand, can only alter the level of income if the exchange rate is flexible. In order to be able to capture the widest possible range of policy options, we focus on a two country model.

II. The Basic Model

The model presented in this section is almost identical to the fixed exchange rate version of the model presented in Enders [5]. It is assumed that there are two countries (say the United States and the United Kingdom) in which only two assets are held (money and bonds). Residents of a country are assumed to hold only that country's money, whereas foreign bonds can be held by domestics. It is assumed that the exchange rate is kept permanently fixed and that capital markets are sufficiently integrated such that asset holders are indifferent to holding domestic or foreign bonds. Thus, there is a single world interest rate. In accord with the McKinnon [19] and Argy and Kouri [3] monetary models of the balance of payments, the Keynesian assumption of fixed commodity prices and variable income levels is made.

The U.S. 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. disposable income, the real (equal to the nominal) rate of return on bonds, and U.S. private sector wealth, i.e.,

1) \[ M^D = L(Y_d, r, W) \]

Where: \( M^D \) = private U.S. demand for cash balances
2) \( B^D = B^D(Y_d, r, W) \)

and:

3) \( W = B^P + M \)

\( Y_d \) = U.S. disposable income
\( r \) = rate of return on bonds
\( W \) = U.S. private sector wealth
\( B^D \) = private U.S. demand for bonds
\( B^P \) = 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 implies that 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., \( \frac{\partial L}{\partial Y_d} + \frac{\partial B^D}{\partial Y_d} = \frac{\partial L}{\partial r} + \frac{\partial B^D}{\partial r} = 0; \) and \( \frac{\partial L}{\partial W} + \frac{\partial B^D}{\partial W} = 1. \) By assumption: \( \frac{\partial L}{\partial Y_d} > 0; \frac{\partial L}{\partial r} < 0; \) and \( 0 < \frac{\partial L}{\partial W} < 1. \) For simplicity, we denote partial differentiation by subscripts, e.g., \( \frac{\partial L}{\partial Y_d} = L_{Y_d} \) and \( \frac{\partial L}{\partial r} = L_r. \)

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

4) \( M^{D'} = L'(Y'_d, r, W') \)

Where: Primed symbols represent the U.K. counterpart of the U.S. variable.

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

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's 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) \( M = B^c + R \)  
   Where: \( B^c \) = cumulated sum of U.S. central bank bond purchases

8) \( M' = B'^c + R' \)  
   \( R \) = dollar value of U.S. central bank holdings of the reserve asset

Since the world stock of the reserve asset (\( R \)) is assumed fixed:

9) \( R + R' = \bar{R} \)  
   Where: \( \bar{R} \) = fixed world stock of the reserve asset.

Each government is assumed to issue a fixed price bond, and since the two bonds are viewed as perfect substitutes, bond market equilibrium requires:

10) \( B + B' = B^p + B'^p + B^c + B'^c \)  
    Where: \( B \) = stock of bonds issued by the U.S. government

\( B' \) = stock of bonds issued by the U.K. government

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 [13], it is assumed that saving is proportional to the discrepancy between desired and actual wealth. Since the desired or target level of wealth is positively related to both the level of disposable income and the interest rate, saving behavior can be represented by:

11) \( \dot{W} = \alpha [W^*(Y_d, r) - W] \)  
    Where: \( W^* \) = desired wealth
\[ s = \alpha \frac{\partial W_k}{\partial y_d} = \text{marginal propensity to save} \]
\[ \alpha = \text{constant of proportionality} \]

A dot appearing over a variable represents the time derivative of that variable.

12) \[ \dot{W}' = \alpha' \{ W' \ast (Y'_d, r) - W \} \]
and: \[ \frac{\partial W_k}{\partial y_d} > 0; \frac{\partial W_k}{\partial r} > 0; s < 1. \]

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

13) \[ E = Y'_d - W \]
Where: \( E \) = U.S. expenditures on the U.S. and U.K. good

14) \[ E' = Y'_d - \dot{W}' \]

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 private demand for imports is solely a function of private expenditures. The total demand for imports is the sum of the private and government demands. If the private and government marginal propensities to import are equal,\(^{14}\) total imports are solely a function of private plus government expenditures. The balance of payments equation 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.,\(^{15}\) i.e.,

15) \[ \dot{R} = X(E' + G') - X'(E + G) + B^c - B^p \]
Where: \( G \) = U.S. government expenditures
\[ X = \text{U.S. exports} = \text{U.K. imports} \]
\[ \frac{\partial X}{\partial (E' + G')} = m' = \text{U.K. marginal propensity to import} \]
\[ \frac{\partial X'}{\partial (E + G)} = m = \text{U.S. marginal propensity to import} \]
and: \( 0 < m < 1; 0 < m' < 1 \)
Assuming that governments finance their deficits by bond issuance, the government budget constraints become:

16) \( G - T = B \)  
   Where: \( T = \text{U.S. tax revenues} \)

17) \( G' - T' = B' \)

Disposable income equals income minus taxes, so that:

18) \( Y_d = Y - T \)  
   Where: \( Y = \text{U.S. income} \)

19) \( Y'_d = Y' - T' \)

Before considering the possible assignments for monetary and fiscal policy, we temporarily assume that governments are not policy active. Specifically, we treat central bank bond holdings (\( B^c \) and \( B'^c \)) as being exogenous and we assume that each government's expenditures, temporarily assumed to be exogenous, equals its tax revenues (implying that the stocks of outstanding bonds are exogenous and unchanging). The system can be greatly simplified by first setting money demands (equations 1 and 4) equal to money supplies (equations 7 and 8) and substituting \( R - R' \) for \( R' \):

20a) \( B^c + R = L(Y_d, r, w) \)

20b) \( B'^c + R - R = L'(Y'_d, r, w') \)

Adding the resulting two equations yields:

20c) \( B^c + B'^c + R = L(Y_d, r, w) + L'(Y'_d, r, w') \)

Secondly, substitute equation (7) into equation (3) and equation (8) into equation (6). Add the resulting two equations to obtain: \( W + W' = B^c + B'^c + R + R' \). From equations (9) and (10) it follows that:

21) \( W + W' = B + B' + R \)

Thirdly, substitute equations (13) and (14) into equation (15). Since (from equation (3)) \( W = B^p + B^c + R \), equation (15) can be rewritten as:

22) \( W - B = X(Y'_d - W + G') - X'(Y'_d - W + G) \)

or 22a) \( W = X(Y'_d - W + G') - X'(Y'_d - W + G) \) when \( B = 0 \)
Equations (11), (12), (20c), (21) and (22a) constitute a set of five independent equations in five unknowns \( Y_{d}, Y'_{d}, r, W, \) and \( W' \). The nature of this system is that desired saving (asset accumulation) equals actual saving and that desired portfolio composition equals actual portfolio composition. The dynamic nature of the model arises from a possible discrepancy between desired and actual portfolio size. If such a discrepancy exists, individuals will alter their expenditures in order to save or dissave. As saving represents an increase in total portfolio size, desired and actual portfolio size will converge if the system is stable. In considering stability, note that the system contains only two variables with time derivatives \( W \) and \( W' \), so that the system contains no more than two non-zero characteristic roots. However, equation (21) constrains \( \dot{W} + \dot{W}' \) to equal zero so that the system has a single non-zero root. For ease of exposition, we only consider the case in which U.S. and U.K. asset demand functions, expenditure functions, and import demand functions are identical (e.g., \( W^* = W'^* = W; L^r = L'^r; \) \( W^*_Y = W'^*_Y = W_Y; m = m'; s = s' \)). As will be shown in Section III, the single root of the system (when governments are not policy active) is:

\[
- \frac{2cm}{s + 2m(1 - s)} < 0 \quad \text{if } 1 - s > 0.
\]

As long as \( s \) (the marginal propensity to save) is less than unity, the system will be stable. As all asset flows will converge towards zero, the balances of trade and payments will also converge towards zero. While the balances of trade and payments are self-correcting, income levels may not equal those desired by policy makers. In the next section we consider the method(s) which policy makers can use to achieve desired income levels without destabilizing the system.
III. Policy Assignments and Stability

The policy parameters available to a government are the variables in its government budget constraint (equation (16) or (17)) and central bank bond holdings. As governments cannot separately determine the sizes of their expenditures, tax revenues, and deficits, only two of the three variables in each budget constraint are independent. We assume that government deficits and the proportion of taxes to government expenditures are independent variables.

Expressing taxes as a proportion of government expenditures:

24) \( T = tG \) 

Where: \( t = \text{constant of proportionality} \) 
\( t \geq 0 \)

25) \( T' = t'G' \)

Fiscal policy involves selecting the size of the deficit and the constant of proportionality between taxes and expenditures. In this manner, either \( G \) (\( G' \)) or \( T(T') \) can be viewed as the dependent variable in the government budget constraint. As in the Mundell model, a government can assign its deficit to either internal balance or to the balance of payments. An alternative assignment, however, is to increase the government deficit when the country experiences a balance of trade surplus. As pointed out in Section I, a balance of trade surplus represents desired net saving. Since the government deficit involves wealth creation, the government may decide to assign fiscal policy to the balance of trade. The potential assignments of fiscal policy can be represented by:

26) \( (1 - t)G = g_1BP + g_2BT + g_3(Y* - Y) \) 

Where: \( BP = \text{U.S. balance of payments} = R \) 
\( BT = \text{U.S. balance of trade} = X - X' \)

27) \( (1 - t')G' = g_1'BP' + g_2'BT' + g_3'(Y'* - Y') \) 

\( Y* = \text{desired income level} \)

\( g_1 = \text{positive constant} \) (i.e., 1, ..., 3)

Note: \( BT = -BT' \) and \( BP = -BP' \)
The policy instrument available to the monetary authorities is their bond holdings, which can be assigned to internal balance, the balance of payments or the balance of trade. The central bank may also attempt to monetize the government deficit by purchasing a portion of the new bond issuances.

Thus, the potential assignments of monetary policy can be represented by:

\[ B^c = m_1 B^P + m_2 B^T + m_3 [Y^* - Y] + m_4 B \]

Where: \( m_1 = \) positive or negative constant as the monetary authorities may sterilize or accommodate the balance of payments. If they sterilize \(-1 < m_1 < 0\). If they accommodate \( m_1 > 0 \)

\[ B'^c = m_1' B'^P + m_2' B'^T + m_3' [Y'^* - Y'] + m_4' B' \]

\( m_2 \) & \( m_3 \) = positive constants

\( m_4 = \) positive constant where \( 0 \leq m_4 \leq 1. \)

Note: increases in \( m_4 \) represent increases in the amount of the government deficit financed by money issuance.

Equations (11), (12), (16-19), (20a), (20b), (21), (22), and (24-29) constitute a set of sixteen independent equations in sixteen unknowns \((Y, Y', Y_d, Y'_d, W, W', R, r, B^c, B'^c, B, B', G, G', T, T')\). The system can be shown to contain, at most, three non-zero characteristic roots (all derivations are available from the authors). However, if \( g_1 = g_1' = 0 \), one of these roots is identically equal to zero. In order to facilitate our discussion, we first consider the case in which fiscal policy is not assigned to the balance of payments (i.e., \( g_1 = g_1' = 0 \)). Furthermore, in the text we only consider the case in which corresponding policy parameters are equal, e.g., \( g_1 = g_1', m_1 = m_1' \). The Appendix considers the case in which policy parameters differ.

Fiscal Authorities do not Respond to the Balance of Payments

Linearizing the system by means of a Taylor Expansion around the point of long run equilibrium, the solution of the system is given by:

\[ -12- \]
30) \[ Y(t) - Y'(t) = [(Y(0) - Y*) - (Y'(0) - Y'*)]e^{-\sigma_1 t} + Y* - Y'\]

31) \[ Y(t) + Y'(t) = [(Y(0) - Y*) + (Y'(0) - Y'*)]e^{-\sigma_2 t} + Y* + Y'\]

32) \[ R(t) = [R(0) - R(s)]e^{-\sigma_1 t} + R(s) \quad \text{where: } R(s) = \text{steady rate value of } R\]

and:

\[ \sigma_1 = \frac{[-2\alpha m + 2\alpha m(1 - t)g_2 + \alpha(1 - 2m)(1 - t)g_3]}{[s + 2m(1 - s) + 2mg_2(1 - t + st) + g_3(1 - 2m)(1 - t + st)]}\]

\[ \sigma_2 = \frac{-\alpha[m_3 W_r + (1 - t)g_3 \left(W_r (m_4 - L_w) - L_r \right)]}{[\alpha W_r L_y (1 + t g_3) - L_r (s + (1 - t + st) g_3)]}\]

Notice that the characteristic roots depend upon only \( g_2, g_3, m_3 \) and \( m_4 \), and when \( g_2 = g_3 = m_3 = 0 \), the system has a single negative characteristic root \( \sigma_1 \) which equals \(-2\alpha m[s + 2m(1 - s)]^{-1}\). Thus, when governments are not policy active, the balances of trade and payments converge towards zero. Income levels, however, may not converge to desired levels. We now consider the effects (or lack of effects) of \( g_2, g_3, m_1, m_2, m_3, \) and \( m_4 \) on the characteristic roots.

1) Of particular interest is the fact that neither \( m_1 \) nor \( m_2 \) affects either of the characteristic roots of the system. This result is partially due to our assumption of equality between \( m_1 \) and \( m'_1 \), and \( m_2 \) and \( m'_2 \) (the non-symmetric case is considered in the Appendix). In the face of a change in U.S. reserves, the U.S. monetary authorities change their bond holdings by \( m_1 R \), while the U.K. monetary authorities change their bond holdings by \( m'_1 R' \). Since \( R = -R' \), the total accumulation of bonds by the two central banks is equal to \((m_1 - m'_1)R\). In the case in which \( m_1 = m'_1 \), the world money supply, total private sector bond holdings \((B^P + B'^P)\), and total private sector wealth are invariant to sterilization policies. As such, there will be no effects on income levels, the interest rate, or saving. Since saving is invariant to sterilization policies, and it is saving which "drives" the system, the speed of adjustment
of income levels and reserves will be invariant to sterilization policies.
In regard to $m^2$, note that one nation's trade surplus is identical to the
second nation's trade deficit. As such, it is also the case that monetary
policy directed towards the balance of trade (i.e., $m^2 \neq 0$) will not affect
speeds of adjustment. This result is quite different from that in the literature;
e.g., \cite{20, 21}

"...the central banks in the country with a payments surplus
would take measures to sterilize the impact of the payments
imbalance or the monetary base, perhaps by offsetting open
market operations ... In the absence of sterilization, the
impact on the monetary base tends to be self-correcting. With
sterilization, the self-correcting tendencies are weakened, and
so the imbalances are prolonged..."

2) If monetary policy is assigned to income levels, both $\sigma_1$ and $\sigma_2$
will be negative if $m^3 > 0$ and $g_2 = g_2' = 0$. Thus, if monetary policy alone is
used to equate desired and actual income levels, the system will be unambiguously
stable if $m^3 > 0$. That $m^3$ must be positive follows from the fact that open
market purchases have an expansionary effect on income levels. Further, the
root corresponding to the balance of payments ($\sigma_1$) is identical to that
given in equation (23). Thus, monetary policy assigned to income levels does
not at all affect the speed of adjustment of the balance of payments: the
self-correcting nature of the balance of payments is not hampered by the
assignment of monetary policy to internal balance.

3) Before considering the effects of assigning fiscal policy to the balance
of trade ($g_2 > 0$) or to internal balance ($g_3 > 0$), it should be pointed out
that if $t = 1$, the two roots of the system are invariant to fiscal policy
since equation (23) and (24) refer to possible assignments for the government
deficit.\footnote{22} We now consider the effects of assigning fiscal policy to the
trade balance. Notice that when $(1-t)g_2 \neq 0$, only $\sigma_1$ is affected by this
assignment. The invariance of \( \sigma_2 \) to \( g_2 \) stems from the fact that \( \sigma_2 \) represents the speed of adjustment of actual summed incomes \( (Y + Y') \) to the sum of desired incomes \( (Y^* + Y'^*) \). When fiscal policy is assigned to the trade balance, \( G(1-t) = g_2BT \) while \( G'(1-t) = -g_2BT \), so that \( G(1-t) + G'(1-t') = 0 \). With no net wealth creation present it should be clear that the sum of U.S. and U.K. income levels are invariant to this assignment.

The speed of adjustment of reserves and the difference between income levels \( (\sigma_1) \) is negative if \( (1-t)g_2 > 0 \) and \( g_3 = 0 \). Thus, fiscal policy assigned to the balance of trade cannot destabilize the system as long as \( g_3 = 0 \). This result follows since a trade deficit (surplus) reflects a negative (positive) discrepancy between desired and actual wealth. As long as \( (1-t)g_2 > 0 \), the fiscal authorities in the nation with the deficit will be decreasing wealth, while the fiscal authorities in the surplus nation will be increasing wealth. However, \( \sigma_1 \) is negative even if \( (1-t)g_2 = 0 \), so that the relevant question for this assignment is whether increasing \( g_2 \) acts to increase or decrease \( \sigma_1 \). The sign of \( \partial|\sigma_1|/\partial g_2 \) is equal to the sign of \( (1-2m-t) \).

If the tax parameter \( (t) \) is set equal to zero, assigning fiscal policy to the balance of trade will increase the speed of adjustment of reserves and the difference between incomes if the sum of the marginal propensities to import \( (\bar{m} + m' = 2m) \) is less than unity.\(^{23} \) In order to interpret this result, recall that in the event of a balance of trade disequilibrium, governments will alter their expenditures. Some of these expenditures will be for foreign goods. As such, the fall in government expenditures in the deficit country will act to reduce its imports while the increase in government expenditures in the surplus country will act to increase its imports. What happens to the balance of trade as a result of these government purchases will depend upon the sum of the marginal propensities to import. If the sum
of the marginal propensities to import is greater than unity, the effect of these changes in government expenditures is to prolong a deficit or surplus. If fiscal policy is assigned to internal balance in such a manner that 

$$(1-t)g_3 > 0$$

while $g_2 = 0$, both $\sigma_1$ and $\sigma_2$ may be positive. Thus, fiscal policy assigned to internal balance may be destabilizing. If the expression $W_r(m_4 - L_w) - L_r$ is positive, $\sigma_2$ will be negative. Since $W_r > 0$ and $0 < L_w < 1$, the fiscal authorities can guarantee that $\sigma_2$ will be negative by setting $m_4$ (the proportion of the government deficit financed by money issuance) equal to unity. Thus, if fiscal policy is assigned to internal balance, the government deficit should be financed by money issuance: monetizing the government debt is more expansionary than the government financing its deficit by borrowing from the public. As such, the desired sum of the two income levels ($Y^* + Y'^*$) can best be attained by the more expansionary policy of monetizing the government deficit.

A sufficient condition for $\sigma_1$ to be negative is for the sum of the marginal propensities to import to be less than unity ($1 - 2m > 0$). Thus, fiscal policy assigned to internal balance may destabilize the balance of payments and the difference between income levels ($Y - Y'$). Consider the case in which the sum of the two income levels equals the desired sum ($Y^* + Y'^*$), but U.S. income is below desired U.S. income while U.K. income is above desired U.K. income. The impact effect of an increase in U.S. government expenditures on U.S. income is equal to $1-m$ multiplied by the change in U.S. government expenditures. With the U.K. government decreasing its expenditures, the impact effect of this policy on U.S. income is $-m'$ multiplied by the absolute value of the change in U.K. government expenditures. As $g_3 = g_3'$, the absolute values of the changes in U.S. and U.K. government expenditures will be equal. In the case where $m = m'$, U.S. income will rise if $1 - 2m > 0$. 

---

---
Fiscal Policy Assigned to the Balance of Payments, Monetary Policy to Internal Balance

We now consider the case in which the fiscal authorities assign their deficit to the balance of payments. Setting $g_2 = g_2' = g_3 = g_3' = m_1 = m_1' = m_2 = m_2' = 0$, this assignment can be represented by:

\[ 26a) \quad (1-t)G = g_1 BP \quad \quad (27a) \quad (1-t')G' = g_1' BP' \]
\[ 28a) \quad b^c = m_3 [Y^* - Y] + m_4 B \quad \quad (29a) \quad b'^c = m_3' [Y'^* - Y'] + m_4' B' \]

For this assignment there are three characteristic roots. The one corresponding to the sum of the two income levels $(Y + Y')$ is:

\[ 33) \quad \sigma_3 = -a \nu_m_3 [a \nu L_y - s L_r]^{-1} < 0. \]

As long as $m_3 > 0$, $\sigma_3 < 0$ so that the sum of desired income levels converges to the sum of desired income levels. The other two roots are given by the solution of the following quadratic equation:

\[ 34) \quad d^2 L_y g_1 [1 - t - 2m] + \sigma [(1 - t - 2m) (a L_y g_1 + s L_w g_1) + (1 - t + st) g_1 m_3 (1 - 2m) - \{ (1 + g_1 (1 - t) m_4) (2m + s (1 - 2m)) \} + \alpha [(1 - 2m) (1 - t) g_1 m_3 - 2m (1 + (1-t) g_1 m_4)] = 0 \]

When $g_1 = 0$, the quadratic is degenerate; the remaining root being equal to $-2c m [s + 2m (1-s)]^{-1} < 0$. Recall that this is equal to the root for the balance of payments when all policy parameters equal zero. However, when $g_1 \neq 0$, the stability of the system depends upon the underlying structural parameters as well as the sizes of $g_1$, $m_3$ and $m_4$. While it is possible for this assignment to be stable, it is possible to partially vindicate Mundell by saying that unless the underlying structure of the system is known, the assignment of fiscal policy to external balance (the balance of payments) can be destabilizing. Our reasoning, however, differs from that of Mundell.
A balance of payments surplus is due to transitory capital flows that will be eliminated when desired portfolio composition equals actual portfolio composition. Fiscal policy, however, acts to alter portfolio size. Thus, a country in which there was an excess demand for money and an equal excess supply of bonds would experience a balance of payments deficit. This payments deficit would induce a fiscal surplus \( (G-T < 0) \) as long as \( g_2 > 0 \). The resulting reduction in actual portfolio size would act to decrease both the demand for money and bonds. At the same time, the second country would experience a balance of trade surplus, inducing its fiscal authorities to increase actual portfolio size. As there is no guarantee that the induced changes in portfolio sizes will act to reduce the discrepancies between actual and desired portfolio composition, this assignment may be unstable. Notice that our result is directly opposed to Levin [15], who argues that monetary policy should be assigned to internal balance and fiscal policy to external balance.

IV. Conclusion

In this paper we have explored the assignment problem in a two country model in which the demand for wealth, and its composition, represent stock, rather than flow decisions. In small country versions of this model (as well as in Keynesian models, if it is not possible to sustain Balance of Trade disequilibria over the long run) both monetary and fiscal policy are impotent in affecting the equilibrium income level because stock equilibrium requires Balance of Trade equilibrium. Thus, in such small country models expenditure switching policies (exchange rate change, tariffs, differential government propensities to import) are required to alter domestic income.

However, we feel that it is more appropriate, particularly for the developed countries of the Western world, to investigate such issues in an
interdependent setting. In this context we have found that either monetary or fiscal policy can alter income levels and that, because of the inherent adjustments caused by balance of trade or payments disequilibrium, only one target (aggregate demand) does not necessarily converge to the target level. In investigating various assignments we have shown that, provided some instrument is assigned to income, the system tends to be stable, if fiscal policy is not assigned to balance of payments equilibrium. Unless the sum of the marginal propensities to import are known to be less than unity, monetary policy should be assigned to internal balance. Fiscal policy assigned to the balance of trade will not be destabilizing. However, if fiscal policy is assigned to the balance of trade, the speed of adjustment of the balance of payments may be reduced.

Our conclusions differ from Mundell's for the obvious reason that we view capital movements as stock adjustments, rather than sustainable flows. On the other hand, our results tend to be consistent with those of Tsiang [26]. In his paper, Tsiang argues that fiscal policy should be assigned to Balance of Payments equilibrium once it is purged of transitory capital flows. However, since he does not view wealth holdings as a stock decision, his model allows wealth stocks to permanently grow, even though real income does not. If no sustainable capital flows are possible (as is the case if wealth stocks do not grow), then his assignment reduces to ours. Of course, it should be noted that, even in the context of his own model, Tsiang provides no suggestions as to how policy makers can distinguish "volatile" transitory capital flows from what he perceives as sustainable flows.

Perhaps our most interesting results concern the use of monetary policy. Mundell argues that monetary policy should be assigned to the balance of payments; this follows from his flow specification of the model. Other
authors[e.g., 2, 3] have argued that sterilization retards adjustment, and that policy makers should accommodate balance of payments disequilibria. Tsiang, [26, p. 211] on the other hand, argues that "it would seem advisable to sever ... the link between domestic money supply and the balance of payments." However, these results have all been developed in the context of one country models. In our paper we find that sterilization policy, provided both countries do not fully sterilize, has no impact on the speed of adjustment towards equilibrium.
Appendix

The complete model is given below:

1A) \[ W = \alpha[W^*(Y_d', r) - W] \]  
2A) \[ W' = \alpha'[W^*(Y'_d, r) - W'] \]  
3A) \[ B^C + R = L(Y_d', r, W) \]  
4A) \[ B'^C + \overline{R} - R = L'(Y'_d, r, W') \]  
5A) \[ W + W' = B + B' + \overline{R} \]  
6A) \[ Y - B = X(Y'_d - W' + G') - X'(Y - W + G) \]  
7A) \[ G - T = B \]  
8A) \[ G' - T' = B' \]  
9A) \[ Y_d = Y - t \]  
10A) \[ Y'_d = Y' - T' \]  
11A) \[ T = tG \]  
12A) \[ T' = t'G' \]  
13A) \[ (1-t)G = g_1R + g_2(W - B) + g_3(Y^* - Y) \]  
14A) \[ (1-t')G' = -g_1R - g_2'(W - B) + g_3'(Y'^* - Y') \]  
15A) \[ B^C = m_1R + m_2(W - B) + m_3(Y^* - Y) + m_4B \]  
16A) \[ B'^C = -m_1'R - m_2'(W' - B') + m_3'(Y'^* - Y') + m_4'B' \]

(Note: In obtaining equations 13A - 16A, we have used the relationships: 
\[ BT = X - X' = W - B \] (see equation 6A); \[ BT' = -BT'; \] \[ BP = -BP' = R \]

These sixteen independent equations contain sixteen unknowns \( Y, Y', Y_d, Y_d', W, W', R, r, B^C, B'^C, B, B', G, G', T, \) and \( T' \). In order to save space we do not directly solve the system. Instead, the simplification of the system and the derivation of the solution are available from the authors upon request.)
When the system is linearized around the point of long run equilibrium it is possible to simplify the system into a set of three differential equations. Any possible assignment, then, will contain no more than three characteristic roots in the general form of the solution. The characteristic matrix for the system is given by:

\[
\begin{bmatrix}
  a_{11} & a_{12} & a_{13} \\
  a_{21} & a_{22} & a_{23} \\
  a_{31} & a_{32} & a_{33}
\end{bmatrix}
\begin{bmatrix}
  y - y' \\
  y + y' \\
  R
\end{bmatrix}
\]

\[
\begin{align*}
\text{Where: } y & = -(Y* - Y) \\
y' & = -(Y'\, Y')
\end{align*}
\]

Note that \( y \) and \( y' \) represent deviations of desired incomes from actual incomes. It is assumed that exchange rates are compatible with full employment (see footnote 17) so that \( mY* = m'Y'\, Y' \). The nine elements of the matrix in 17A are given below. Note that \( \sigma \) represents the differential operator.

(i) \[ a_{11} = \sigma L_y \left[ 1 + \frac{tm}{1 - 2m} \left( g_2 + g_2' \right) + \frac{t}{2} \left( g_3 + g_3' \right) \right] + \left( \frac{m}{1 - 2m} \right)^2 \left( m_2 + m_2' - 2L_w \right) + \left( 1 - t \right) \left( g_2 (m_4 - L_w) + g_2' \left( m_4' - L_w \right) \right) + \left( \frac{1 - t}{2} \right) \left[ g_3 (m_4 - L_w) + g_3' \left( m_4' - L_w \right) \right] \]

(ii) \[ a_{12} = \frac{\sigma L_y t}{2} \left[ g_3 - g_3' \right] + \left( \frac{m - m_3'}{2} \right)^2 + \left( \frac{1 - t}{2} \right) \left[ g_3 (m_4 - L_w) + g_3' \left( m_4' - L_w \right) \right] \]

(iii) \[ a_{13} = -\sigma L_y t(g_1 + g_1') - 2 - \left( m_1 + m_1' \right) - \left( 1 - t \right) \left[ g_1 (m_4 - L_w) + g_1' \left( m_4' - L_w \right) \right] \]

(iv) \[ a_{21} = \sigma \left[ s + \frac{2m}{1 - 2m} + \frac{1 - t + st}{1 - 2m} (g_2 + g_2') + \frac{1 - t + st}{1 - 2m} (g_3 + g_3') \right] \]

\[ + \alpha \left[ \frac{2m}{1 - 2m} + \frac{m(1 - t)(g_2 + g_2')}{1 - 2m} + \frac{(1 - t)(g_3 + g_3')}{2} \right] \]
The characteristic roots presented in the text are obtained from the characteristic equation of 17A. Note that this specification allows us to consider mixed assignments. The symmetric case \((g_1 = g_1', m_1 = m_1')\) in which \(g_1 = g_1' = 0\) (fiscal policy is not assigned to the Balance of Payments) is particularly simple since \(a_{12} = a_{22} = a_{23} = a_{31} = a_{33} = 0\). In this case the characteristic equation is a quadratic (if \(m_1 = m_1' \neq -1\) and the roots are obtained from \(a_{21} = 0; a_{32} = 0\). Moreover, the root from \(a_{21}\) corresponds to \(y' - y\) (BT) and \(R(BP)\), whereas the root for \(a_{32}\) corresponds to \((y' + y)\) i.e., aggregate demand. All of our results in Section III come from solving the characteristic equation (and the associated characteristic roots and vectors) from 17A in the case in which \(g_1 = g_1'\) and \(m_1 = m_1'\). Below, we consider some of the more interesting results when corresponding policy parameters are not equal. \(25/\)
Case I - Fiscal Policy to Income, Monetary Policy to the Balance of Payments

The first assignment we consider in this Appendix is the one recommended by Mundell [20]. We set \( g_1 = g_1' = g_2 = g_2' = m = m_2 = m_3 = m_3' = 0 \). If only the sterilization rates are the same (\( m_1 = m_1' \)), the system will converge if:

a) \( 1 - 2m > 0 \); b) \( L_r + L_w r < \min[m_4 W_r, m_4' W_r] \); and c) \( g_3 > 0 \) or \( g_3' > 0 \).

Condition a) is explained in the text of the paper. Notice that condition c) is weaker than that in the text. Only one of the governments need assign fiscal policy to internal balance. Condition b) will hold as long as \( m_4 = m_4' = 1 \). However, fully monetizing the debt is not a necessary condition for stability.

Furthermore, even if sterilization rates differ, the system will be stable (if a, b, and c hold), provided \( g_3 = g_3' \). In this case the characteristic roots become:

\[
\sigma_1 = -\alpha [g_3 (1-t)(1-2m) + 2m] \cdot \frac{[g_3 (1-t)(1-2m) + 2m + s(1-2m)(1+tg_3)]^{-1}}{
\phantom{[g_3 (1-t)(1-2m) + 2m + s(1-2m)(1+tg_3)]^{-1}}}
\]

\[
\sigma_2 = \frac{-\alpha (1-t) g_3 [(m_4 (1+m_1') + m_4' (1+m_1') - L_r (2+m_1+m_1')) W_r - L_r (2+m_1+m_1')]}{(2+m_1+m_1') [\alpha W_r L_y (1+tg_3) - L_r (g_3 (1-t) + s(1+tg_3))]}\]

From 19A) it is apparent that even if one country fully sterilizes \( m_1' = -1 \), the system will still be stable provided \((m_4' - L_r W_r - L_r) > 0, m_1 > -1 \).

Although sterilization rates do alter stability in this case, they can either lower or increase the speeds of convergence. In particular:

\[
\frac{\partial \sigma_2}{\partial m_1} = \text{sign} \left[ (1 + m_1') (m_4' - m_4) \right] \]
If both countries monetize debt at the same rate, sterilization again is irrelevant. If $m_4 \neq m^4$, then the country with the lower monetization rate should accommodate its Balance of Payments surplus (or deficit), whereas the other should sterilize. The explanation for this result is that if there is deficient (excessive) aggregate demand, the country with the higher monetization rate will run a Balance of Payments deficit (surplus). If the country with the deficit (surplus) sterilizes and the surplus (deficit) country accommodates, the world money supply is increased (decreased), thus speeding convergence towards full employment equilibrium.

Thus, while sterilization may affect speeds of convergence if monetary policies differ, there is certainly no presumption that sterilization retards adjustment. Moreover, the preceding analysis implies that convergence is enhanced by financing government expenditures through money creation. When both governments finance their deficits via monetary issuance, monetary policy is impotent in altering the speed of adjustment of the balance of payments.

**Case II - Fiscal Policy to the Balance of Trade, Monetary Policy to Income.**

In this case we set $g_1 = g_1' = g_3 = g_3' = m_1 = m_1' = m_2 = m_2' = 0$. The case in which the magnitudes of policy responses differ presents no special problem in this assignment. Assuming only the same tax rates in each country, the characteristic roots are readily calculated:

$$\sigma_1 = \frac{-2\alpha m \left[1 + (1-t)\left(\frac{g_2 + g_2'}{2}\right)\right]}{2m \left[1 + (1-t)\left(\frac{g_2 + g_2'}{2}\right)\right] s \left[1 - 2m\left(1-t\left(\frac{g_2 + g_2'}{2}\right)\right)\right]} < 0$$

$$\sigma_2 = -\alpha W_r (m_3 + m_3') \left[2(\alpha W_r L_y - s L_r)\right]^{-1} < 0$$

Note that stability remains assured and that debt monetization does not matter.
This follows because, even though there may be wealth creation in the asymmetric case, there is no relation between aggregate demand equilibrium and Balance of Trade equilibrium.

To conclude, this assignment is, in some sense, the most stable since no assumptions are needed concerning money demand functions or marginal propensities to import. Further, both instruments affect convergence in this assignment. As in previous assignments, it is inappropriate to couple taxes with stabilizing government expenditures.

Case III - Fiscal Policy to Income, Monetary Policy to the Balance of Trade.

In this case we set \( g_1 = g_1' = g_2 = g_2' = m_1 = m_1' = m_3 = m_3' = 0 \). When \( g_3 \) differs from \( g_3' \), the characteristic roots are, in general, irrational.

If only the fiscal policy response parameters \( (g_3 \text{ and } g_3') \) are equal, the two characteristic roots are:

\[
\sigma_1 = -\alpha (g_3 (1-t)(1-2m) + 2m)[g_3 (1-t)(1-2m) + 2m + s(1-2m)(1+tg_3)]^{-1} \]

\[
\sigma_2 = \frac{-\alpha (1-t)g_3 \left[ \frac{m_4 + m_4'}{2} \right] - L_r}{\alpha \left[ \frac{1+tg_3}{2} - \left( g_3 (1-t) + s(1+tg_3) \right) \right]} L_r
\]

The speed of adjustment of the balance of payments \( (\sigma_1) \) is negative if \( 1-2m > 0 \). The speed of adjustment of the sum of income levels \( (\sigma_2) \) will be negative if \( m_4 + m_4' = 2 \). Thus, full monetization of the government debt promotes stability. Assigning monetary policy to the balance of trade is irrelevant even when \( m_2 \neq m_2' \).
The authors are Assistant and Associate Professors of Economics at Iowa State University respectively. Professor Lapan was visiting the Institute for International Economic Studies while working on this paper.

1/ Fortin [7] discusses the breakdown of this principle in the n target, n instrument case.

2/ See, for example Tobin [24], Tobin and Brainard [25], or Markowitz [16].

3/ See, for example, Levin [15], Patrick [22], Floyd [6] or Roper [23].

4/ This point is made by Aghevli and Borts [1], Boyer [4], and Enders [5] among others. Also see: Frenkel and Rodriguez [8], Johnson [11] and Komiya [14].

5/ One of the first authors to stress the importance of this point was Johnson [12]. It is important to distinguish between the wealth effects of a balance of trade disequilibrium and the asset substitution effect of a balance of payments disequilibrium.

6/ Jones [13].

7/ Girton and Henderson [10].

8/ Note that both the life cycle and permanent income hypotheses imply individuals desire to hold a terminal stock of wealth. See Modigliani and Brumberg [18] or Friedman [9].

9/ Many authors, such as Tsiang, seem to ignore considerations of how government purchases are financed, and thus miss the wealth creation effects of government deficits and the problem of how such deficits should be financed.

10/ Mathieson [17] demonstrated that by controlling the required reserve ratio, the monetary authorities, in a small country, could gain a degree of monetary control. Aside from the institutional constraints and the reluctance of central banks to alter reserve ratios, this finding is not relevant to the Assignment Problem. As fiscal policy cannot alter the level of income, the reserve ratio necessarily must be assigned to internal balance in a small country.

11/ For additional detail concerning this model, interested readers should read the development in Enders [5]. Enders' model, however, does not consider fiscal policy.

12/ The model is easily adaptable to allow residents of each country to hold two monies.
Johnson [11] stated that the monetary approach to the balance of payments necessarily assumes full employment and flexible prices. Mussa [21], Argy and Kouri [3] and McKinnon [19], however, used monetary models with fixed prices and variable income levels.

This assumption can be relaxed and each government's marginal propensity to import can be treated as a policy instrument. However, the assumption used in the text is consistent with much of the work concerning the effects of tariffs on the terms of trade and can be rationalized by assuming residents consider government purchases in making their own consumption decisions. We reconsider this point in footnote 24, below.

The difficulties involved with incorporating interest payments are well known to macro-theorists. It is not our intent to tackle these problems here. Rather we assume that each government sterilizes the international interest payments, via lump sum taxes. Interest payments, then, do not appear in equation 15 nor do they add to disposable income. Obviously, it must be assumed that the amount of tax any individual pays is not commensurate with that individual's holdings of bonds. Readers interested in this point are referred to Levin [15] and Tsiang [26].

Note that equations 1-3 (equations 4-6) constitute a set of only two independent equations. As such equations 2 and 5 were not used in the simplification used in the text. Also note that the system implies that commodity markets clear. Since \( G - T = \bar{B}, \bar{W} = \text{saving}, \) and \( X - X' = \) the U.S. trade balance, equation 22 shows that: \( \text{U.S. saving} - (G-T) = \text{U.S. trade balance}. \)

We assume that the exchange rate is fixed at a level such that desired income levels are consistent with steady state equilibrium, i.e., \( \bar{m}Y^* = m'Y'^* \). This assumption must be made in any model in which capital flows are temporary. Since the underlying structural parameters are not known it is an interesting - but separate - issue to determine the results arising from inconsistent policy targets. Also see footnote 21 concerning the use of the government deficit as the policy instrument.

It would also be possible to assign central bank bond holdings to the stock of reserves as opposed to the flow of reserves (i.e., the balance of payments). In this case it would be necessary for U.S. and U.K. desired reserve stock to equal total world reserves. It can be demonstrated that total income levels and \( \sigma_1 \) and \( \sigma_2 \) in equations 30-32 would not be affected by the assignment.

In obtaining equations 30-32, we have linearized the system around the point of long run equilibrium. Furthermore, the balance of trade (\( BT \)) is given by: \( BT = X(Y' - \bar{W}' + \bar{G}' - \bar{T}') - X'(Y - \bar{W} + \bar{G} - \bar{T}). \)

In linear form, \( BT = m'[Y' - \bar{W}' + \bar{B}'] - m[Y - \bar{W} + \bar{B}], \) since \( G - T = \bar{B} \) and \( G' - T' = \bar{B}' \). When \( m = m', BT = m[Y' - Y] \) since \( \bar{W} + \bar{W}' = \bar{B} + \bar{B}' \).
Thus, $\psi_1$ also represents the speed of adjustment of the trade balance, as well as the difference between $Y'$ and $Y$.

Aliber [2, pp. 5-6].

Sterilizing or accommodating the balance of payments will, however, affect the equilibrium distribution of reserves. Our result in the text follows from allowing $m_0 = m_0'$. Further, if one country fully sterilizes, the other country's monetary policy directed towards the balance of payments is irrelevant.

Our assignment of the government deficit is chosen as it is in accord with Mundell [20]. While the model contains a non-zero balanced budget multiplier, it can be shown that setting $t = 1$ and assigning either government expenditures or taxes to the policy targets will not be the best way to increase speeds of adjustment or achieve desired targets.

The condition that $1 - 2m > 0$ is a familiar one from the literature on the transfer problem, and the secondary burden of the transfer if exchange rates are flexible.

The authors have considered a governmental marginal propensity to import which differs from the private sector's. If the government's marginal propensity to import is zero, increasing $g_2$ always acts to increase the absolute value of $\psi_1$. However, in this case, increasing $g_2$ interferes with the convergence of $Y + Y'$ to $Y^* + Y^*$.}

In this Appendix, we consider only pure assignments: each policy tool is assigned to a single instrument. Further, we do not specifically consider the case in which $g_1$ and/or $g_1'$ differ from zero. When $g_1$ differs from $g_1'$, little can be said about the stability of the system. However, the inability to conclude that the assignment of fiscal policy to the balance of payments is stable is sufficient to allow us to conclude, as does Mundell, that this assignment is inappropriate. All other assignments can be obtained from setting the determinant of the coefficient matrix in (17A) equal to zero. The solution set for $\psi$ will yield the characteristic roots.
References


20. Mundell, Robert (1962) 'The appropriate use of monetary and fiscal policy under fixed exchange rates.' International Monetary Fund Staff Paper 10, 70-77.


