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FISCAL AND MONETARY POLICIES IN AN OPEN ECONOMY WITH A SUPPLY SIDE

by

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1. Introduction

Open economy macro models have traditionally been based on the assumption of fixed prices or fixed income. Some recent studies have included the supply side , endogenizing both. The other trend has been towards including endogenous expectations. Mathematical tractability has then imposed serious limitations on the rest of the model , and therefore these models have returned to the primitive goods market and particularly supply side specifications. The fixed price assumption has been characterized as the Keynesian , and the fixed income case as the Classical model. As will be shown, this characterization of the classical model , carried over from closed macro models , does not hold in an open economy. The fixed price assumption , in turn , is inconsistent when the exchange rate is allowed to vary , because foreign goods prices have a defitional , and often considerable effect on the price level and through it on the demand for goods and nominal cash balances.

On the other hand , models with a fully specified supply side and other generally accepted macro relationships have not been fully worked out. At the present state of the art , the two approaches seem alternatives , and it is not clear which works out better empirically. What they should have in common , however , is the stationary state effects , since there expectations do not matter. In the short-run , the comparative statics correspond to the rational expectations equilibrium with perfect information , provided the agents have the short-run as their planning horizon. This renders the effects directly comparable. The above specification errors should make it clear which results to choose when they differ.

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An extensive survey of the substantial literature on the subject is redundant. Reference to the synthesizing works of Helliwell (1969, 1974) and Takayama (1969) suffices to cover the sixties. An explicit supply side was first incorporated by Salop (1974) who analyzed the effects of devaluation in a real wage model. Kyle (1976) uses a general functional form of the labor supply function and a "correctly" specified supply side. Analyzing a fixed rate regime, the absence of capital flows, and ignoring the Pigou effect, he gets many new results. Quite a few are, however, a result of the above special assumptions.

The purpose of the present paper is to provide a reconsideration of the policy effects in an open economy, including the Mundell-Fleming theorem, and study the effects that the supply side specification has on these effects. Specifically, the following features are incorporated in the model, which have not, to this author's knowledge, appeared simultaneously in any of the papers dealing with the problem, including the most recent contributions, such as Branson and Buiter (1982), Argy and Salop (1979), Rodriguez (1979), Sachs (1980), and Takayama (1978), though they are generally accepted macro relationships or follow from consistency requirements:

1. The definitional relationship between the exchange rate and the domestic price level.
2. An explicit supply side in general enough a form to allow different labor market specifications.
3. The Pigou effect (which according to Ando and Modigliani (1963) is 6 per cent of the change in the value of net nominal assets and thus potent in face of exchange rate changes), as well as the Laursen-Metzler effect.
4. An endogenous money supply (under fixed rates), with its domestic component as the policy variable.
5. Endogenous terms of trade.

I.e. we are trying to construct an "honest" general model, which makes it possible to show how the present theorems come out as special cases and how they are related to each other. In this kind of a general model it can be found that particularly the policy effects under flexible exchange rates are changed: the current consensus, as summarized by Rodriguez (1979, p. 176) that "monetary policy is an effective stabilization tool under flexible exchange rates, while the ability of fiscal policy to affect the level of economic activity varies inversely with the degree of international capital mobility" breaks down. The same happens to the Mundell-Fleming theorem under flexible exchange rates. Indeed, it cannot be generated without inconsistent assumptions concerning the price level one way or another. The assignment problem has the Mundellian solution only under fixed exchange rates. Under flexible rates it sometimes results in the reverse of the Mundell rule. In portfolio balance equilibrium , policies do have effects under flexible rates.

The paper will proceed as follows. In part 2, the model is developed. In part 3, the effects of monetary and fiscal policies in the two exchange rate regimes are analyzed in the flow equilibrium model. Furthermore, Fleming, in his paper, develops a number of theorems on the effect of the exchange rate regime on these policies. These theorems are also re-examined. Part 4 examines the Mundell-Fleming theorem, and part 5 the assignment problem. In part 6, the effects of wage rigidities are discussed, and in part 7 the effects of the labor supply regime. Part 8 examines the same questions in a portfolio balance context. Finally, part 9 is the conclusion of the paper. Since the number of questions discussed is large, aiming to set the fundamental issues right with special emphasis on the supply side effects, we will not

experiment with different expectation-generating mechanisms. Part of the reason is , furthermore , the tractability of results. As proposed , we will use two basic definitions of equilibrium , the momentary flow equilibrium and the portfolio balance equilibrium.

2. The General Model

We will analyze a small open economy, with exogenous foreign goods prices and interest rates, and the absence of foreign repercussions. The foreign demand curve of domestically produced goods is, however, negatively sloped, as a result of specialization: The country engages in the production of a relatively small number of different goods and exchanges its exports for a larger number of foreign goods. Therefore it (though not its firms) has market power on its export markets but none on its import markets -- a well-known situation for small countries.

The model is a standard open IS-LM model with a supply side. The goods market equation: national income (Y) is the sum of domestic expenditures (E), the trade balance ($T = (P^D X - eP^F M)/P^D$), and government expenditures (G), all in terms of the domestic good:

$$(1) \quad Y = E^X\left(\frac{P^D Y}{P}, r, \frac{V}{P}\right) + T^X\left(E, \frac{P^D}{eP^F}\right) + G$$

$$\qquad\qquad\quad + \; - \; + \qquad\quad - \qquad\quad -$$

where V = nominal wealth, r = the interest rate, e = the exchange rate (units of domestic currency per unit of foreign currency), P^D = the price level of domestically produced goods (GDP deflator), P^F = that of foreign goods, and P = the final expenditure price as defined in (8) below, X = exports and M = imports. E^X and T^X are function operators. The signs below

the arguments of the functions refer to the assumed signs of the respective partials.

The money supply (S) consists of the money supply of the previous period S_{-1}, plus the addition to foreign exchange reserves, i.e. the current balance of payments surplus (R), and domestically provided reserves, i.e. net open market purchases (D). The credit expansion multiplier is set at unity for simplicity. Equilibrium on the money market requires that the money supply equals the quantity of money demanded (L):

$$(2) \quad S_{-1} + D + R = L^{X}\underset{+}{(Y,}\ \underset{-}{r,}\ \underset{+}{P)}$$

The balance of payments is the sum of the trade balance in nominal terms, and the capital account (K):

$$(3) \quad R = T^{X}\left(E, \underset{-}{\frac{P^{D}}{eP^{F}}}\right) \cdot P^{D} + K\underset{+}{(r,}\ \underset{-}{H_{-1}})$$

where H_{-1} is the actual stock of foreign capital in the country at the end of the previous period. (Of course, $H = H_{-1} + K$).

The capital flow function is obtained from a stock adjustment function as follows:

$$(3') \quad K = \alpha[H^{*}(r) - H_{-1}]$$

where H^{*} is the desired stock of foreign capital in the country in the current period and $0 < \alpha \leq 1$. $\alpha = 1$ would imply that the asset markets adjust internationally as fast as, or faster than, the goods market.

The supply side of the economy consists of the production function (4), the labor demand function (5), the labor supply function (6), and the equilibrium condition for the labor market in terms of wages (7):

$$(4) \quad Y = Y(\bar{C}, N)$$

$$(5) \quad W^D = Y_N P^D$$

$$(6) \quad W^S = W(N, P)$$

$$(7) \quad W^S = W^D$$

where $\bar{C}$ = the given capital stock, N = employment, W^D = the demand wage and W^S = the supply wage. Y_N is the partial of Y with respect to N, subscripts always referring to partials. The difference in the price variables in the labor demand and supply functions comes from the fact that the value of the marginal product of labor depends on the prices of domestically produced goods, whereas rational labor behavior calls for the supply wage being a function of the final expenditure price. (See Salop 1974.)

The final expenditure price is a weighted average of domestic and foreign goods prices:

$$(8) \quad P = aP^D + (1 - a)\, eP^F$$

Finally, to complete the structural model, nominal wealth is the sum of real assets, (PC_0), the capitalized annual interest payments on government (or foreign) debt in private hands $(\frac{b}{r})$, denominated in domestic currency for simplicity [1], and the money supply , private domestic bonds of course cancelling out. We get , observing that the government finances its deficits (A) with bond issues, and the central bank provides money by open market operations :

$$(9a) \quad Y = PC_0 + \frac{b}{r} + S$$

$$(9b) \quad \frac{b}{r} = \frac{b_{-1}}{r} - D - K + AP^D$$

$$(9c) \quad S = S_{-1} + D + R$$

This yields, observing (3):

$$(9d) \quad V = C_0 P + \frac{b_{-1}}{r} + (T + A)P^D + S_{-1}$$

The initial values of e, P^D, and P^F, and thereby P, will be set at unity by an appropriate choice of units.

We get from equations 4 through 8 by total differentiation and substitution:

$$(10) \quad dP = a \frac{W_N - Y_{NN}}{Y_N(Y_N - aW_P^S)} dY + (1-a) \frac{Y_N}{Y_N - aW_P^S} de$$

where Y_{NN} is the second derivative or Y with respect to N. Diminishing returns make it negative.

The results are partially sensitive to the structure of the supply side. Therefore, the basic special cases studied are the real and nominal wage models (with the supply of labor as a function of the real wage and the nominal wage, respectively), as in conventional macro analysis.

Examine the real wage model, where W_P^S obtains its highest value proposed. Equation (6) obtains the form: $W^S = W(N) \cdot P$ so that we get from (5) through (8):

$$(11) \quad (W_P^S =) W(N) = Y_N$$

It is seen that $Y_N - aW_P^S > 0$. Thus, the denominators in (10) are positive, keeping P_Y positive and finite in the real wage model. The same is, of

course, true of the money wage model, with $W_P^S = 0$. I.e., the aggregate supply curve of an open economy is rising. This point has another important consequence: the classical dichotomy breaks down in the real wage model of an open economy, the model being simultaneous, as far as the supply side is concerned. Therefore, the common interpretation of the classical (i.e., real wage) model as implying a fixed labor supply does not carry over to the open economy model. (See e.g. Allen and Kenen (1980), and Branson and Buiter (1982). This is caused by the fact that domestic goods prices enter the expenditure price expression with a weight of $a < 1$. Thus, when total demand increases, the labor supply curve shifts up by less than the demand curve because foreign goods prices remain constant.

A similar expression is obtained for domestic goods prices P^D, to whose expression the same comments apply qualitatively:

$$(10') \quad dP^D = \frac{W_N - Y_{NN}}{Y_N(Y_N - aW_P^S)}\, dY + \frac{(1-a)W_P^S}{Y_N - aW_P^S}\, de$$

The model now consists of equations 1, 2, 3, 9d and the level equivalents of 10 and 10' in Y, r, P, P^D, V and either R or e.

Substituting (9d), (10), and (10') into equations (1) and (2), we get equations (12) and (13). We simplify the trade balance expression by ignoring the direct effects, through expenditures, of r, A, and T. This means that the impact effects of these variables on the trade balance are ignored, but the subsequent effects are taken into account through the

effect of expenditures on income. This leaves the signs of the comparative-static derivatives, and thus the conclusions, unaffected.

$$(12)\quad Y = \underset{+}{E}(Y, \underset{+}{r}, \underset{-}{e}, \underset{-}{A}, \underset{+}{T}) + \underset{-}{T}(Y, \underset{+}{e}) + G$$

$$(13)\quad S_{-1} + D + R = \underset{+}{L}(Y, \underset{-}{r}, \underset{+}{e})$$

Most of the new partials are unambiguous, as can be seen from footnotes 2 and 3. E_Y in (12) is assumed to remain positive and smaller than one also in the real wage model partly because of (10), as proposed above. E_e is negative. We will henceforth call the effect of E_e the Pigou effect for simplicity. T_e is positive.

By similar substitution into (3), we get:

$$(14)\quad R = \underset{+}{T}(Y, \underset{+}{e})\, P^D + \underset{+}{K}(\underset{-}{r}, H_{-1})$$

Totally differentiating the model of equations (12), (13) and (14), we get the matrices for the fixed and flexible exchange rate regimes. Since we are not interested in the J-curve effect, we will set the initial trade balance T at zero.

$$\begin{bmatrix} 1 - E_Y - mT_Y & -E_r & 0 \\ L_Y & L_r & -1 \\ T_Y & K_r & -1 \end{bmatrix} \begin{bmatrix} dY \\ dr \\ dR \end{bmatrix} = \begin{bmatrix} mdG + (E_e + mT_e)\, de \\ dD - L_e\, de \\ -T_e\, de \end{bmatrix}$$

and for flexible rates:

$$\begin{bmatrix} 1 - E_Y - mT_Y & -E_r - (E_e + mT_e) \\ L_Y & L_r \quad\quad L_e \\ T_Y & K_r \quad\quad T_e \end{bmatrix} \begin{bmatrix} dY \\ dr \\ de \end{bmatrix} = \begin{bmatrix} mdG \\ dD \\ 0 \end{bmatrix}$$

where $m = 1 + E_{(V/P)}$.

3. The Theorems in the Flow Equilibrium Model.

We get the following values for the derivatives:

[Table 1. here]

We assume for simplicity that the marginal propensity to spend (E_Y) is smaller than unity so that also $1 - E_Y - mT_Y > 0$. This guarantees stability of equilibrium. [4]

D_1 is positive. There, $\frac{1}{1-E_Y-mT_Y}$ is the national income multiplier, and $E_r \frac{T_Y-L_Y}{K_r-L_r}$ the crowding out effect.

$\frac{dY}{dG}$ is positive. The balance of payments effect of fiscal policy $\frac{dB}{dG}$ is ambiguous. If $\frac{L_Y}{L_r} > \frac{T_Y}{K_r}$, or the LM curve is flatter than the BP curve, the balance of payments turns towards deficit, and vice versa. This is in agreement with Fleming's result.

The income effect of monetary policy $\frac{dY}{dD}$ is positive. The balance of payments effect is negative, the current account and the capital account strengthening each others' effects. The trade balance turns into a deficit in response to fiscal as well as to monetary expansion. Of course, to maintain this situation, the monetary authority must sterilize the monetary effects of balance of payments disequilibria during subsequent periods.

The flexible rate case is shown in Table 2.

[Table 2. here]

Table 1. The Policy Effects Under Fixed Exchange Rates

	$dY/$	$dR/$	$d(T \cdot P^D)/$
$/dG$	$\frac{m(K_r - L_r)}{D_1} > 0$	$\frac{m(L_Y K_r - L_r T_Y)}{D_1}$	$\frac{m(K_r - L_r)T_Y}{D_1} < 0$
$/dD$	$\frac{-E_r}{D_1} > 0$	$\frac{-(1-E_Y-mT_Y)K_r - E_r T_Y}{D_1} < 0$	$\frac{-E_r T_Y}{D_1} < 0$

where $D_1 = (K_r - L_r)\left[1 - E_Y - mT_Y + E_r \frac{T_Y - L_Y}{K_r - L_r}\right] > 0$

$m = 1 + E_{(V/P)}$

Table 2: The Policy Effects Under Flexible Exchange Rates

	$dY/$	$d(T \cdot P^D)/$	$de/$	$dr/$
$/dG$	$\frac{m(L_r T_e - L_e K_r)}{D_2}$ (>0)	$\frac{m K_r (L_Y T_e - L_e T_Y)}{D_2}$ (<0)	$-\frac{m(L_Y K_r - L_r T_Y)}{D_2}$	$-\frac{m(L_Y T_e - L_e T_Y)}{D_2} > 0$
$/dD$	$\frac{E_r T_e - (E_e + m T_e) K_r}{D_2}$	$-\frac{K_r[(1-E_Y)T_e + E_e T_Y]}{D_2}$ (>0)	$-\frac{(1-E_Y - mT_Y)K_r + E_r T_Y}{D_2}$ (>0)	$\frac{(1-E_Y)T_e + E_e T_Y}{D_2} < 0$

where $D_2 = (1 - E_Y - m T_Y)(L_r T_e - L_e K_r) + E_r(L_Y T_e - L_e T_Y)$

$- (E_e + m T_e)(L_Y K_r - L_r T_Y)$

A sufficient condition for D_2 being negative is that the third term is non-negative: either $mT_e > |E_e|$ with the BP curve flatter than the LM curve, the LM curve is flatter (since $-mT_eL_rT_Y$ cancels out), or either $|E_e| = mT_e$, or the slopes of the two curves are equal. Otherwise the sign of D_2 is ambiguous. We will in the following assume D_2 to be negative as a necessary condition for the stability of equilibrium.[5]

Fiscal expansion leads to a rise in income and to a trade balance deficit. However, it can be seen that $d(dY/dG)/dK_r$ is negative only if $L_r(E_e+mT_e)-L_eE_r < 0$: the effectiveness of fiscal policy does not necessarily vary inversely with the degree of capital mobility, as conventional wisdom, based on the independence of the price level from the exchange rate, i.e. $E_e = L_e = 0$, suggests(c.f. introduction). Fiscal expansion leads to a depreciation of the exchange rate, i.e., a rise in (e) if the LM curve is flatter than the BP curve. This is the same condition as that on which the balance of payments turns towards deficit under fixed rates, again in agreement with Fleming.

However, monetary expansion leads to a rise in income only if $(E_e + mT_e)$ exceeds $\frac{E_rT_e}{K_r}$. If it reaches this value, monetary policy has no effect, and if it goes below it, monetary expansion will lead to a decline in income. This last statement can particularly well be true e.g. of the real wage model. The reason is that monetary expansion leads to a depreciation of the exchange rate, which improves the trade balance. However, the depreciation also raises the price level, which reduces expenditures through the Pigou effect, contracting income. If this effect exceeds the trade balance effect by more than the income effect of the expansion through the decline in the interest rate, monetary policy has a contractionary effect on income - contrary to Fleming's result and the summary of conventional wisdom by Rodriguez, cited in the introduction: $[d(dY/dD)/dK_r]$ is ambiguous in the general case but becomes positive if $L_r = E_r = 0$.

Three additional theorems critically depend on the assumption of a constant price level, causing Fleming's results to break down:

1. Monetary policy does not always have a stronger income effect under flexible rates than under fixed rates. The reason is again the effects of exchange rate changes, through the price level, on the demand for money and expenditures. This conclusion follows already from the finding that the direction of the effect is ambiguous under flexible rates and positive under fixed rates. E.g. in the real wage model the converse is more likely, i.e. if $L_e > E_e T_E$.

2. Fiscal policy is not always more effective under flexible rates for the same reason: if fiscal expansion leads to a depreciation of the exchange rate, its effect is weakened by the Pigou effect, and strengthened by the trade balance effect under flexible rates. If it leads to an appreciation, the reverse holds.

3. Monetary policy, relative to fiscal policy is not always more or equally effective under flexible rates than under fixed rates. E.g. in the real wage model the reverse is more likely, i.e. if $L_e > E_e T_E$.

In all cases the same conclusions hold also in the model with the money supply, rather than the domestic component of the monetary base, as the policy variable. Since these results follow directly from the above expressions, verification of the critical conditions is left to the reader. It may be pointed out, furthermore, that results different from those obtained with fixed prices are obtainable with realistic parameter values. Accordingly, the real wage assumption is alone sufficient to produce some of them.

4. The Mundell-Fleming Theorem

The Mundell-Fleming theorem is obtained from Tables 1 and 2 by taking the limiting values of the total derivatives as K_r approaches infinity:

[Table 3. here]

Table 3: The Policy Effects Under Perfect Capital Mobility

	Fixed Exchange Rates			Flexible Exchange Rates		
	$dY/$	$dR/$	$dTP^D/$	$dY/$	$d(TP^D)/$	$de/$
$/dG$	$\frac{m}{1-E_Y-mT_Y} > 0$	$\frac{mL_Y}{1-E_Y-mT_Y} > 0$	$\frac{mT_Y}{1-E_Y-mT_Y} < 0$	$\frac{L_e}{D_3} > 0$	$-\frac{m(L_YT_e-L_eT_Y)}{D_3} < 0$	$-\frac{mL_Y}{D_3} < 0$
$/dD$	0	-1	0	$\frac{E_e+mT_e}{D_3}$	$\frac{(1-E_Y)T_e+E_eT_Y}{D_3} > 0$	$\frac{1-E_Y-mT_Y}{D_3} > 0$

$$D_3 = L_e(1 - E_Y-mT_Y) + L_Y(E_e + mT_e)$$

D_3 is assumed to be positive as a necessary condition for the stability of equilibrium.

It is seen that under fixed rates, since crowding out vanishes, monetary policy becomes powerless, and fiscal policy powerful, irrespective of the rest of the parameters, as Mundell-Fleming propose. The assumption of fixed prices is not critical for this result. Only the value of the multiplier would be affected. The mechanism by which this change is brought about is so well known that it requires no further explanation. The balance of payments response is basically that proposed by monetarists, i.e. the change in the demand for money, except that income changes. With monetary policy there is thus perfect offset by the balance of payments. The trade balance turns towards deficit in response to fiscal policy and is uneffected by monetary policy.

However, under flexible rates the theorem breaks down, critically depending on the inconsistent assumption of a fixed price level, i.e. $P_e = P_Y = 0$, or $L_e = E_e = 0$. (If it could be true, monetary policy would in fact have the power it has in the quantity theory world.) With endogenous prices, fiscal expansion remains expansionary. Namely, the capital inflow to buy the securities issued by the government at the exogenous interest rate, appreciates the exchange rate. In the absence of price effects the appreciation would continue until the trade balance deficit so created exactly equals the original expenditure, offsetting the income effect of the measure. However, the appreciation reduces the demand for nominal money balances, which leads domestic residents to buy part of the securities (as well as goods) at the given interest rate. Therefore, only the remainder of the securities is bought by the foreigners, and the appreciation falls short of offsetting the income effect of the fiscal expansion. The policy effect is also strengthened by the Pigou effect.

Monetary expansion, again, leads to a depreciation, foreigners selling bonds to the central bank at the given interest rate. However, its effect on the trade balance is reduced by the increased demand for nominal balances, due to the price level rise caused by the depreciation: all of the securities bought by the central bank do not come from abroad, but domestic citizens sell a part. This is augmented by the Pigou effect. Only the remainder of the securities then comes from abroad, which is matched by a smaller trade balance surplus than would have been the case in the absence of the price level effect on the demand for money and goods. This weakens the income effect of monetary policy to such an extent as to make it ambiguous. If the Pigou effect dominates the trade balance effect, monetary expansion has a contractionary income effect, as is the case in the real wage model. As seen from footnote [3], $T_e = T_E E_e$ in that model, where T_E is somewhat higher than the marginal propensity to import. As a result, the expression for dY/dD becomes negative.

Are there any acceptable assumptions under which the Mundell-Fleming theorem or its reverse could be generated under flexible exchange rates? In the money wage model, if $W_P^S = 0$ is substituted into the total derivatives via equations A1 and A2, our result still holds. Sachs (1980) forced the Mundell-Fleming result by making the demand for money a function of the output, rather than expenditure price. This assumption implies that a rise in the imported good price would leave the demand for money unaffected. (However, his labour supply function is, correctly, a function of the expenditure price.) As seen from equation (10'), $P_e^D = 0$ in the money wage model, which makes $L_e = 0$. Furthermore, the Pigou and Laursen-Metzler effects have to be abstracted from, to keep monetary policy effective. Consequently, the Mundell-Fleming theorem cannot be generated without inconsistent assumptions concerning the price level one way or another.

The reverse Mundell-Fleming holds if $T_e = E_e = 0$. Since in the real wage model $T_e = T_E^* E_e$, this result could be generated in this model by setting $E_e = 0$, i.e. abstracting from the Pigou and Laursen-Metzler effects.

5. The Assignment Problem

It can be verified from Table 1 that under fixed exchange rates

$$\frac{dY/dG}{dY/dD} > \frac{dR/dG}{dR/dD}$$

so that the economy is not in optimum in the Niehans (1968) sense, as is plausible when the policies are entrusted to different authorities, jealous of their authority on their own fields.

As with so many cases with fixed exchange rates, the Mundell (1962) assignment rule continues to hold: assign fiscal policy to internal, and monetary policy to external balance. With flexible rates, however, the situation changes. First, if the LM curve is flatter than the BP curve or the curves have equal slopes ($L_Y K_r - L_r T_Y \leq 0$), the Mundell rule holds. If the BP curve is flatter, the critical condition is close to the reverse of the stability condition of this case, or $D_2 + mT_e L_Y K_r > 0$. In general, of course, the rule depends on parameter values. E.g. if $E_e = 0$, the reverse of the Mundell rule results: fiscal policy should be assigned to exchange rate management. Under perfect capital mobility, the critical condition for the Mundell rule to hold is : $mL_Y(E_e + mT_e) + L_e(1 - E_Y - mT_Y) < 0$. This is almost identical to the

reverse of the stability condition of this case ($D_3 > 0$), L_Y being multiplied by m (or about 1.06) instead of one. Therefore, the reverse of the Mundell rule holds almost whenever the equilibrium is stable. A reason for the critical condition is, of course, the effect that the exchange rate change , resulting from fiscal policy, has on the effectiveness of this policy.

6. Wage Rigidities in the Model

Wage rigidity makes $W_N = 0$. This reduces the value of dP/dY and dP^D/dY. E_Y declines if the Laursen-Metzler effect dominates the Pigou effect in E_Y, and increases if the reverse is true (equation A 1). The absolute value of T_Y declines, unless $T_{PD/e}$ is non-negative (equation A 2). $L_Y = L_Y^* + L_P^* P_Y$ declines unambiguously. Therefore, in the open model, wage rigidities unambiguously increase the multiplier (and the policy effects on income) under fixed rates only if the Laursen-Metzler effect dominates or cancels the Pigou effect and $T_{PD/e}$ is non-positive. Under flexible rates their effect depends on the parameter values. Rigidity does not cause qualitative changes in the policy effects. Money wage rigidity means furthermore that $W_P^S = 0$, while real wage rigidity means that $W_P^S = Y_N$. These cases are therefore qualitatively the same as the money wage and classical models.

7. The Effects of the Labor Supply Regime

The effect of the degree of money illusion in the labor supply function is obtained by differentiating the total derivatives with respect to W_P^S. Of course, an increase in W_P^S is a move towards the real wage model.

The following results are obtained by straightforward if tedious algebra, after the actual values of the partials have been substituted into the expressions from equations A1 and A2, and observing that $L_Y = L_Y^* + L_P^* P_Y$ and $L_e = L_P^* P_e$. In interpreting the results, it is assumed for simplicity that the Marshall-Lerner condition holds.

Under fixed exchange rates, in the general case, the income effects of monetary and fiscal policies are weakened by an increase in W_P^S if the Pigou effect dominates or offsets the Laursen-Metzler effect in E_Y and $(K_r - L_r)(1 + mT_E) - E_r T_E > 0$. The same result follows if the reverse inequality holds and the Laursen-Metzler effect dominates.

The effects on the balance of payments effects are ambiguous. Expansionary policies further weaken the trade balance if the Laursen-Metzler effect dominates in E_Y or the two effects offset each other , and $E_r\ T_Y^*\ L_P^*$ is dominated by the other terms in the expression , as seems likely. (There are several terms in the expression that normally dominate it.) Otherwise the effect is ambiguous.

Under perfect capital mobility the income effect of fiscal policy is weakened if the Pigou effect dominates or the price effects cancel out in E_Y . The balance of payments effect is ambiguous, whereas fiscal expansion further weakens the trade balance if the Laursen-Metzler effect dominates or the price effects cancel out in E_Y . Otherwise the effect is ambiguous.

Monetary policy effects are, of course, unaffected by the labor supply regime.

Under flexible exchange rates, the expressions get very complicated. Taking the difference between the total derivatives in the money and real wage models it turns out that the income effect of fiscal policy is weaker in the real wage model under perfect capital mobility if the Pigou effect dominates or the price effects cancel out in E_Y.

5. The Portfolio Balance Equilibrium

A. The Policy Effects

The short-run equilibrium is only a momentary one. Whenever a balance of payments disequilibrium results, the money supply changes (equation 13), which shifts the equilibrium the following period. Secondly, it is seen from equation 13 that whenever the trade balance is in disequilibrium, total wealth changes, affecting expenditures and shifting the equilibrium during the following period. Thirdly, part of the gap in the foreign capital function (3') has closed so that the value of K_r changes. Therefore, in a stationary state both the overall balance of payments and the trade balance have to be in equilibrium, because total wealth and its components must be in equilibrium.

The portfolio balance equilibria can then be obtained by constraining $dR = 0$, and either $dT = T_Y dY + T_e de$ (the endogenous supply of bonds), or dK to

zero, the other side of the transaction being forced to zero by (14), with $dR = 0$. We will do the latter to get the expressions in terms of the trade balance partials, our main interest, observing the stock adjustment term in the capital flow function, which now implies $H^X - H_{-1} = K = dK = K_r dr = 0$ in equilibrium. This makes element 32 in the Jacobians zero. We then get the statements for the portfolio balance equilibrium by substituting zero for K_r in the matrices, deleting the money market equation in the fixed rate case. It can be seen that the permanent income effects of fiscal and monetary policies go to zero under fixed exchange rates.

In analyzing the adjustment from momentary equilibrium to portfolio balance , we will assume that a balance of payments surplus leads to a decline in the interest rate in the portfolio balance context , an excess demand on the goods market raising income , as in earlier stability analyses. This makes the equilibrium stable.

Fiscal expansion initially moves the IS curve to the right to position IS' in Figure 1. (We are assuming constant prices for simplicity here.) Themomentary equilibrium at point b, the intersection of the IS and LM curves, is one with a higher income and interest rate, and a trade balance deficit. The balance of payments is in deficit or surplus, depending on the slopes of the LM and BP curves, as shown in the analysis of Table 1. The trade balance deficit starts moving the IS curve back in (equation 12), while the LM curve moves in or out, depending on whether the balance of payments is in deficit or surplus. At the

same time, the BP curve starts getting steeper, pivoting around point a and becoming vertical in the long run, because K_r declines (equation 3'). So sooner or later it also becomes steeper than the LM curve, which at the latest pushes the overall balance of payments into deficit, and starts pushing the LM curve, and the momentary equilibrium point, in. These three movements shift the equilibrium back in, to eventually reach point c at the original income but a higher interest rate ($dr/dG = -\frac{m_1}{m_{1r}} > 0$) than originally. The higher interest rate is necessary in order that the greater amount of securities be willingly held. The shape of the trajectory depends, of course, on the relative speeds of adjustment and the initial slopes of the curves, which define the resulting differential equation. Of course, permanent fiscal surpluses or deficits are inconsistent with portfolio balance in a stationary state.

[Figures 1. and 2. here]

Monetary expansion initially shifts the LM curve to LM', lowering (r) and raising (Y), pushing the trade balance and the capital account, and thus the overall balance of payments, to a deficit, as shown in the general case. The momentary equilibrium shifts from point a to point b in Figure 2. Due to the balance of payments deficit, the LM curve starts moving back in. The trade balance deficit again causes a decline in real wealth (equation 12). This shifts the IS curve down. Furthermore, the BP curve gets steeper.

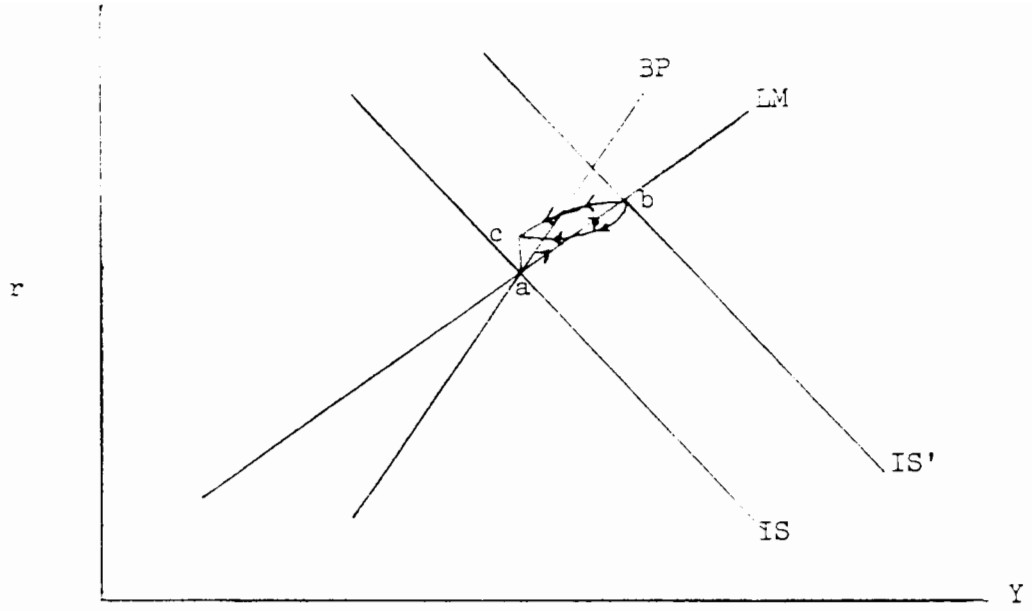

Figure 1. The Effects of Fiscal Expansion in the Short and Long Runs

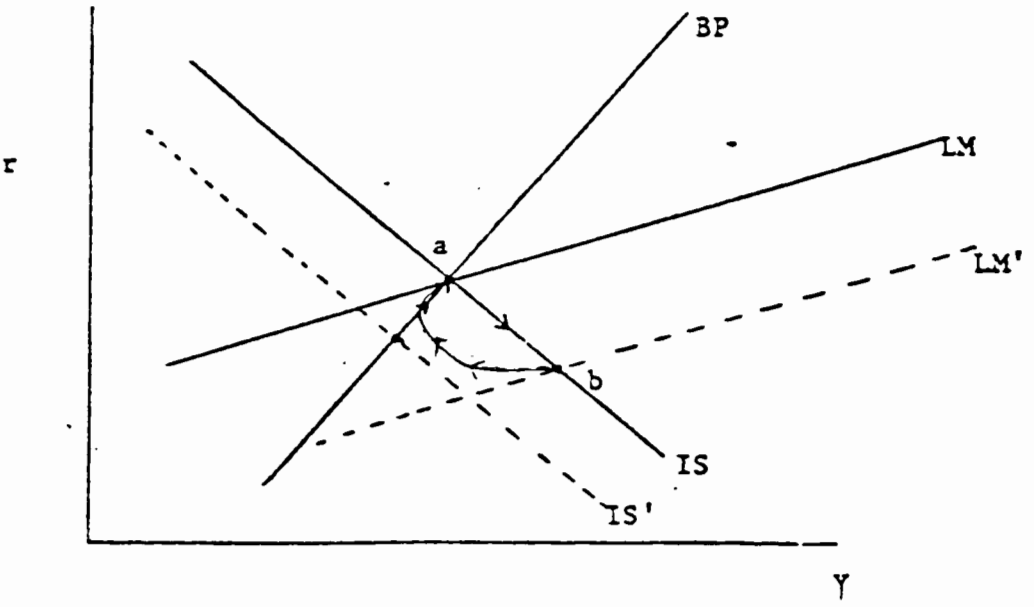

Figure 2. The Effects of Monetary Expansion in the Short and Long Runs

The momentary equilibrium then shifts in with the two curves so that the IS curve continues its downward shift, as long as the momentary equilibrium is to the right of point a. After income has declined below its original level, the trade balance turns into surplus, which starts pushing up the IS curve. This development continues until the original equilibrium point has been reached, with the original real assets, i.e. until the early accumulated trade balance deficits have been offset by surpluses. Therefore, while the interest rate first declines and then rises, income first rises, then falls below its equilibrium level, and finally rises to find its original level.[6] Again, the exact trajectory can be determined when the speeds of adjustment are known.

Why will the above opposite effects of the wealth effect and the interest rate rise lead to an expansionary income response in the final stage of the adjustment? A trade balance surplus is an addition to total assets, which calls for a rise in the interest rate in order that the whole addition "be willingly held" in the bond portfolio. The partials, with respect to the interest rate, of the demands for the individual assets in the portfolio of the public have to add up to zero through the budget constraint. The partials of real goods and money being negative, the sum of their absolute value has to equal that of bonds. Therefore, the trade surplus does not completely "crowd out" private expenditures because desired money balances decline. So a net increase in income takes place. (This result is really subject to the substitution effect dominating the wealth effect in the money demand function, but we omitted the latter from that function because empirical evidence lends support to our specification, see Goldfeld (1973)).

[Table 4. here]

Table 4. The Policy Effects in Portfolio Balance Equilibrium Under Flexible Exchange Rates

	dY/	dr/	de/
/dG	$\frac{mL_r T_e}{D_4} > 0$	$-\frac{m(L_Y T_e - L_e T_Y)}{D_4} > 0$	$\frac{mL_r T_Y}{D_4} > 0$
/dD	$\frac{E_r T_e}{D_4} > 0$	$\frac{(1-E_Y)T_e + E_e T_Y}{D_4} < 0$	$-\frac{E_r T_Y}{D_4} > 0$
/dT_1	$\frac{-E_e L_r + E_r L_e}{D_4} > 0$	$\frac{(1-E_Y)L_e + E_e L_Y}{D_4}$	$-\frac{(1-E_Y)L_r + E_r L_Y}{D_4} < 0$

$D_4 = L_r(1-E_Y)T_e + E_r(L_Y T_e - L_e T_Y) + L_r T_Y E_e < 0$, and

dT_1 = exogenous change in the trade balance.

The flexible rate case is obtained from the general case (Table 2) by setting $K_r = 0$. It is shown in Table 4. It can be seen that D_4 is negative and the equilibrium stable. So the long-term derivatives are all positive, except for the negative de/dT_1 and dr/dD, and the ambiguous dr/dT_1. Thus, expansionary policies lead to a rise in income and a depreciation of the exchange rate, fiscal policy raising, and monetary policy lowering the interest rate. The rise in income also in the real wage model results from the effect of depreciation on total wealth and the demand for money, which reduces expenditures and pushes the trade balance towards surplus (equation A2). So an increase in income is necessary to restore trade balance equilibrium. As can be seen by taking $d[(de,dY)/dG,dD)]/dK_r$ in the general case (Table 2), the exchange rate undershoots in response to fiscal, and overshoots in response to monetary policy. The income effect of monetary policy undershoots whereas that of fiscal policy is ambiguous in the general case.

The dynamic adjustment path in response to fiscal expansion is the following. The expansion raises income and the interest rate , which cause a trade balance deficit and a capital inflow. The last two responses cause depreciation or appreciation depending on which dominates , i.e. whether the LM curve is flatter or steeper than the BP curve. The trade balance deficit causes a decline in real wealth , which is strengthened or weakened by the exchange rate change. However , the stock adjustment term in the capital flow function lowers K_r and the capital inflow at any given interest rate , sooner or later turning the exchange rate change into

depreciation . So real wealth will eventually begin to decline and the trade balance deficit as well. Income , the trade deficit, and the capital inflow continue to decline until the last two reach zero at a higher level of income , interest rate and exchange rate (e) than originally.

Monetary expansion lowers the interest rate , which induces a capital outflow , depreciating the exchange rate , and pushing the trade balance into surplus. The former effect reduces real wealth , lowering expenditures , which is at least partly responsible for the trade balance surplus. Expenditures and the trade balance have opposite effects or income , whose change is ambiguous. The following period the stock adjustment term in the capital flow function makes the BP curve steeper, reducing the capital outflow. This appreciates the exchange rate , stimulating expenditures. This wealth effect on expenditures is strengthened by the trade balance surplus , now smaller than originally. The appreciation continues , increasing expenditures and reducing the trade balance surplus until the surplus has been eliminated. This takes place at a higher income , lower interest rate and a depreciated exchange rate compared to the initial situation.

Earlier studies have generally obtained zero income responses in the real wage model. This results from their specification of the classical model as implying a constant labor supply rather than the real wage model , which we showed not to carry over from the closed economy model. This shows the danger of such a specification , since the results are directly comparable. Furthermore, the exchange rate

response to fiscal expansion is ambiguous in their model. They get the same result if domestic and foreign bonds are viewed as poorer substitutes than domestic bonds and money; in fact, the wealth effect of the bond issue ($E_{y/p}$.dB) will have to dominate the substitution effect (dr) in the demand for foreign bonds.[7] The reason is again the fact that we left out the wealth variable from the money demand function. So the bond rate rising enough to make the whole new bond issue willingly held, the demand for money declines. This increase is therefore not enought to crowd out private expenditures by a corresponding amount, leaving the trade balance in deficit, and the foreign exchange market in an excess demand situation. So depreciation is needed to do the rest via the Pigou effect -- at the same time restoring the trade balance.

However, an exogenous trade balance surplus leads to a rise in income and an appreciation of the exchange rate. The interest rate change is ambiguous, the appreciation reducing the demand for nominal cash balances, tending to lower the rate. On the other hand, its effect on real wealth increases expenditures, and the resulting rise in income increases the demand for money, which work in the opposite direction.

Earlier studies get a matching appreciation, which restores the value of foreign securities, leaving everything else unchanged. The reason is again the absence of the wealth effect on expenditures and the effect of the exchange rate on the demand for money (Allen and Kenen)[8].

It is seen that, to get these results, it is not necessary to assume the Marshall-Lerner condition, as the students of the asset market approach do. T_e is positive also in the real wage model (equation A2), because depreciation, in reducing real wealth, improves the trade balance so that an increase in income is needed to restore trade balance equilibrium. The wealth effect also guarantees stability of equilibrium in a general equilibrium context.

The results are of course independent of which market is treated as implicit in the model. Therefore, our approach, which treats the bond market as the implicit market, should yield the same results as the portfolio balance approach proper, which treats the goods market as implicit, if the behavior assumptions are the same. As seen, only the effects of exogenous trade balance disequilibria, and the policy effects in the classical model, are significantly different in our models - for identifiable reasons.

B. The Additional Theorems

The theorems about the policy effects under the two exchange rate regimes become simple in portfolio balance equilibrium. Since monetary and fiscal policies have an income effect under flexible rates, and none under fixed rates, they are both stronger under flexible rates.

The assignment problem is also simple. Since the income effects of policies are zero and external balance is an equilibrium condition under fixed rates, the problem vanishes. Under flexible rates, the Mundell rule holds.

Wage rigidities, of course, affect the flexible rate case only. The income effects are increased in the general case if the price effects in E_Y cancel out or they are abstracted from. In the real wage model the same holds also if the Laursen-Metzler effect dominates the Pigou effect in E_Y. Otherwise, the effects depend on the parameter values. All the derivatives are, however, only quantitatively affected.

Again, the labour supply regime does not affect the results of the fixed rate case. Under flexible rates, the partial derivatives get very complicated, and no results were obtained.

9. Conclusion

There are two Laursen-Metzler effects, one in response to income changes and one in response to exchange rate changes. The former runs counter to the Pigou effect, while the latter strengthens it.

The propositions of the theorems on economic policy effects are changed substantially when the inconsistent assumption of fixed prices is relaxed. In the flow equilibrium model, the propositions for the fixed exchange rate regime generally continue to hold qualitatively, only the values of the derivatives changing.

However, under flexible rates, a number of the propositions break down. Accordingly, in the general model, the income effect of monetary policy becomes ambiguous, depending on the relative strengths of the effects of exchange rate changes on domestic expenditures and on the trade balance. Thus, monetary expansion can well have a contractionary effect on income. This is unambiguously so in the real wage model under perfect capital mobility. Therefore, monetary policy is not always effective, let alone stronger than under fixed rates. Fiscal expansion leads to an increase in income, but it is not always more effective than under fixed rates. Furthermore, its effectiveness under flexible rates varies inversely with the degree of capital mobility only if $L_r(E_e + mT_e) - L_e E_r < 0$. Therefore, monetary policy, relative to fiscal policy, is not always at least as effective under flexible rates as under fixed rates.

Fiscal expansion leads to a trade balance deficit, and monetary expansion to a surplus. The former leads to a depreciation of the exchange rate if the LM curve is flatter than the BP curve, and to an appreciation if the reverse is true. Monetary expansion leads to depreciation.

The Mundell-Fleming theorem holds qualitatively under fixed rates, but breaks down under flexible rates. The basic reason is the change in the demand for nominal cash balances and private expenditures, caused by an exchange rate change. Therefore, under flexible exchange rates, fiscal policy remains effective but monetary expansion can well have a contractionary income effect ,particularly if capital is perfectly mobile.This is unambiguously so in the real wage model. Indeed, the Mundell-Fleming result cannot be generated without inconsistent assumptions concerning the price level one way or another. The reverse result is possible in the real wage model by special assumptions.

The assignment problem has the Mundellian solution under fixed exchange rates. Under flexible rates this is true if the LM curve is flatter than the BP curve or the curves have equal slopes. If the BP curve is flatter, the rule depends on parameter values. E.g. if E_e is zero, the reverse of the Mundell rule results. Under perfect capital mobility the reverse of Mundell holds almost always if the equilibrium is stable.

The above results are qualitatively robust to different labour market specifications, and thus hold for the real and nominal wage models alike. The same holds for wage rigidities in both models. A move towards the real wage model weakens the income effects of policies in the general case under fixed rates under special assumptions concerning the relative strength of the Laursen-Metzler and Pigou income effects. If the price effects on expenditures are abstracted from, the weakening is unambiguous. Expansionary policies lead to further trade balance deterioration under similar conditions. The balance of payments effects are ambiguous. Under flexible rates, the income effect of

fiscal policy is weakened in the real wage model under perfect capital mobility if the Pigou effect dominates or the price effects are absent. The rest of the effects appear ambiguous.

In portfolio balance equilibrium, fiscal and monetary policies have no income or trade balance effects under fixed exchange rates. Fiscal expansion only leaves the interest rate higher, to make the greater amount of securities willingly held, after initially overshooting its long-run level. Monetary expansion first increases income, then pushes it below its equilibrium level, and finally makes it reach its original level.

Under flexible rates, expansionary policies lead to a rise in income and a depreciation of the exchange rate, fiscal policy raising, and monetary policy lowering, the interest rate. The income rise also in the real wage model results from the effect of depreciation on total wealth and the demand for money, which reduces expenditures and pushes the trade balance towards surplus. So an increase in income is necessary to restore trade balance equilibrium. The exchange rate undershoots in response to fiscal, and overshoots in response to monetary policy. The income effect of monetary policy undershoots, whereas that of fiscal policy is ambiguous in the general case.

An exogenous trade balance surplus also leads to a rise in income and to an appreciation of the exchange rate. The reason is again the wealth effect of the exchange rate change. The wealth effect also makes the Marshall-Lerner condition an unnecessary condition for devaluation improving the trade balance, and for the stability of equilibrium.

The assignment problem vanishes in portfolio balance equilibrium under fixed exchange rates. Under flexible rates, the Mundell rule holds. Wage rigidities increase the income effects of policies only under special assumptions, e.g. if the Laursen-Metzler and Pigou effects cancel out or are abstracted from.

The above results emphasize the importance of a careful specification of the supply side, and the feedback from exchange rate changes to the general price level and thereby to expenditures and the demand for money. They also underscore the danger of representing the real wage model as one with a constant income. It was generally these factors that caused conventional wisdom to break down.

Footnotes

1. Qualitatively the same results hold also with foreign-denominated bonds as long as $\frac{B^F}{B + B^F + S} \cdot 1 - a$, where B^F is foreign bonds. The percentage on the L.H.S. is in the single numbers in the countries known to the author, while that on the right is tens of per cent.

2. The expression for the change in expenditures reads:

$$(A1) \quad dE = \{E_Y^x + \frac{W_N - Y_{NN}}{Y_N(Y_N - aW_P^S)} [E_Y^x(1-a)Y - E_{(V/P)}((V-C_0)a - A - T)]\}dY$$

$$+ (E_r^x - E_{(V/P)}\frac{b_{-1}}{r^2})dr$$

$$- \frac{1-a}{Y_N - aW_P^S} \{E_Y^x(Y_N - W_P^S)Y + E_{(V/P)}[(V-C_0)Y_N - (A+T)W_P^S]\}de + E_{(V/P)}(dA+dT).$$

In the multiplier of dY, which is the new E_Y, the multiplier of the second term in the brackets is positive and finite, as shown. In the square brackets, all net nominal assets $(V-C_0)$ are a multiple of the possible net addition (A+T) of the current period so that the expression is negative. Ando and Modigliani (1963) have obtained the value of .06 for $E_{(V/P)}$. This real wealth or Pigou effect is weakened by the terms of trade (Laursen-Metzler (1950) effect on expenditure (the first term), which comes from the expression $Y(P_Y^D - P_Y)$): the income rise, by causing a rise in domestic goods prices, including that of income, raises real income further in terms of the expenditure price, given the foreign goods prices. Check on data on a few countries suggests that this effect dominates the Pigou effect in this term. It will be assumed that E_Y continues to be positive and smaller than one. E_r is strengthened by the wealth effect. E_e is unambiguously negative, the Laursen-Metzler $[Y(P_e^D - P_e)]$ and Pigou effects strengthening each other. Its value also

depends on the labor market specification. It is thus seen that there are two Laursen-Metzler effects, that in response to income change running counter to the Pigou effect, while that in response to exchange rate changes strengthens it.

3. The expression for the change in T is obtained from (1), (10), and (10'):

$$(A2) \quad dT = (T_E^X E_Y + T_{pD/e} \frac{W_N - Y_{NN}}{Y_N(Y_N - aW_P^S)})dY + (T_E^X E_e - T_{pD/e} \frac{Y_N - W_P^S}{Y_N - aW_P^S})de$$

The multiplier of dY, or T_Y is negative. That of de, or T_e, is positive also in the real wage model, since in that model ($Y_N = W_P^S$), making the value of $T_{pD/e}$, or the Marshall-Lerner condition irrelevant. In the general case, if this condition does not hold, making $T_{pD/e}$ non-negative, the wealth effect on expenditures guarantees an improvement in the trade balance in response to devaluation, provided, of course, it dominates the second term.

It may be added that the positiveness of T_e results from our specification of the trade balance as a function of E, rather than Y. The latter specification would be appropriate if imports consisted exclusively of raw materials. Then T_e would go to zero in the real wage model. In our specification, imports consist of final goods. Reality is normally a combination of the two. As long as any final goods are imported, T_e is positive and our qualitative conclusion holds.

4. We get from the endogenous-variable matrix A of the adjustment equation:

$$\text{Tr } A = -(1-E_Y-mT_Y)+L_r-1 = \lambda_1+\lambda_2+\lambda_3 < 0; \quad A_2 = 1-E_Y-mT_Y-L_r(2-E_Y-mT_Y) + K_r-E_rL_Y$$

$$= \lambda_1\lambda_2 + \lambda_1\lambda_3 + \lambda_2\lambda_3 > 0,$$

and $A_3 = |A| = -(K_r-L_r)(1-E_Y-mT_Y) + E_r(L_Y-T_Y) = \lambda_1\lambda_2\lambda_3 < 0$, where λ_i are the eigenvalues of A.

5. To get the adjustment equations for the stability conditions, the balance of payments equation has to be transposed to make the adjustment parameter on $(e - \bar{e})$ positive (where bar denotes the equilibrium value): it is a balance of payments deficit that makes $\dot{e}$ positive. This changes the signs in the bottom row of the Jacobian, changing its sign. We get:

   $\mathrm{Tr}\, A = -(1-E_Y-mT_Y) + L_r-T_e < 0;$

   $A_2 = -L_r(1-E_Y-mT_Y) - E_rL_Y-L_rT_e+L_eK_r+T_e(1-E_Y) + E_eT_Y > 0$, and

   $A_3 = |A| = (1-E_Y-mT_Y)(L_rT_e-L_eK_r) + E_r(L_YT_e-L_eT_Y) - (E_e+mT_e)(L_YK_r-L_rT_Y) < 0$

   by assumption.

6. Obstfeld (1980) obtains a contractionary long-term effect from monetary expansion. This is produced by an increase in interest payments abroad on the initial trade balance deficit, which we abstracted from. If the wealth effect on expenditures is added to Obstfeld's model, the result becomes ambiguous. Adding the interest payments to our model, in turn, shifts the IS and BP curves in over and above the shift in the IS curve already discussed. The trade surplus during the latter part of the adjustment, however, shifts back both curves. The effect of monetary policy then depends on whether current account equilibrium is reached at a lower or higher income level than originally. Generally, one sees the wealth effect or foreign interest effect in the literature but not both, since then the determinant would become ambiguous, unless the country is a net creditor.

7. See Branson (1979), p. 195, Dornbusch (1975), Allen and Kenen (1980), pp. 115- . Branson and Buiter (1982).

8. See Allen and Kenen, pp. 95-97. However, Dornbusch and Fischer (1980), p. 963, get an increase in external assets in response to such an increase, when the resulting decline in saving restores trade balance equilibrium. This mechanism is the counterpart of our income rise.

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