

Ahtiala, Pekka

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## Economic Policy in an Open Macro Model with Rational Labor Behavior

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DISCUSSION PAPER NO. 487  
ECONOMIC POLICY IN AN OPEN MACRO MODEL  
WITH RATIONAL LABOR BEHAVIOR

by

Pekka Ahtiala\*

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\* Northwestern and Princeton Universities and the University of Tampere, Finland. I wish to thank Peter Kenen, Lawrence Officer and John Pomeroy for stimulating comments.

1. Introduction

Much of the literature on the effects of economic policy measures in an open economy is based on the assumption of fixed prices or fixed income. The first assumption implies that neither income nor the exchange rate affects the price level. The former implication requires, as will be shown, that the supply of labor is perfectly elastic with respect to the nominal wage (i.e. money illusion) and there are constant returns to labor in production. The assumption of the independence of the price level on the exchange rate is inconsistent, since foreign goods prices enter the price index by definition in an open economy, often with a substantial weight.

The assumption of a constant income has been carried over from closed real wage models: if labor is rational, labor supply is a function of the real wage, as is the demand for labor. As a consequence, both functions are linearly homogeneous in the price level so that prices cancel out in the labor market equation: income is determined on the labor market. As will be shown, this classical dichotomy breaks down in an open economy so that also the assumption of constant income is unjustified there.

In the past, this general topic has been analyzed, in the Meade (1951) - Alexander (1952) tradition of fixed prices, by Mundell (1963), Fleming (1962) and others. Tsiang (1961), concentrating on the effects of devaluation, added the notion that if the nominal money supply is held constant (i.e. perfect monetary sterilization), real balances are reduced by devaluation through its effect on the price level. This monetary tightening contracts income and improves the trade balance. Helliwell (1969, 1974), provides a synthesis of the literature of the 1960's. Salop (1974) introduced a supply side in its real

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wage version to analyze the effects of devaluation. She gets the same results as Tsiang, assuming a constant money supply. Kyle (1976) also uses a correctly specified supply side to analyze a fixed rate regime in the absence of capital flows and the Pigou effect. Quite a few of his results, however, depend on his special assumptions.

Another line of attack has been the endogenization of expectations. Mathematical tractability has, however, forced these studies back to the fixed price or fixed income characterization of the supply side. At the present state of the art, it seems that mathematical tractability has made a fully specified supply side and endogenous expectations alternatives, and it is not clear which works out better empirically. Since both should give the same long-run effects, we know, however, which results to choose when they differ.

The purpose of the present paper is to analyze policy effects in an open economy with rationality on the labor market, i.e. in a real wage model. An aim is to highlight the effects of the fundamental structural interrelationships, presently overlooked, which ought to be set right before proceeding to new issues. The following features will be incorporated into the model, which have not appeared simultaneously in any of the papers dealing with the problem, including the most recent contributions, such as Argy and Salop (1979), Branson and Buiter (1982), Rodriguez (1979), Sachs (1980), and Takayama (1978), though they follow from consistency requirements or are generally accepted macro relationships:

1. The definitional relationship between the exchange rate and the domestic price level.
2. Explicit supply side with rationality on the labor market.
3. The Pigou effect (which according to Ando and Modigliani (1963), is 6 percent of the change in the value of nominal assets and thus potent in face of exchange rate changes), as well as the Laursen-Metzler effect.
4. An endogenous money supply (with fixed rates), with its domestic component as the policy variable.
5. Endogenous terms of trade.

In such a model, a number of unexpected policy effects result. Accordingly, monetary expansion can well have a contractionary income effect under flexible rates. This is unambiguously true under perfect capital mobility. Then devaluation leads to a contraction in income. 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 Mundell-Fleming theorem also breaks down under flexible rates. Indeed, it cannot be generated without some inconsistencies concerning the price level, whereas its reverse can under special assumptions. Also the Mundell assignment rule breaks down partially under flexible rates. The relative effectiveness of policies in different exchange rate regimes is also substantially changed from that of conventional wisdom. In portfolio balance equilibrium policies do have effects under flexible rates, and so does devaluation.

The paper will proceed as follows. In Section 2, the model is developed. In Section 3 the effects of economic policies are analyzed in a flow equilibrium first in the general case and then under perfect capital mobility. Section 4 studies the assignment problem and section 5 the effects of wage rigidities. Section 6 studies the same problems in a portfolio balance context. Finally, section 7 is the conclusion of the paper. Our flow equilibrium results are then equivalent to the rational expectations equilibrium with perfect information, when the planning horizon of agents is the short run, while the portfolio balance results are of course the same irrespective of the expectation-generating system.

## 2. The Model

We will analyze a small open economy, with exogenous foreign goods prices and interest rate, 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 ( $T = (P^D X - e P^F M) / P^D$ ), and government expenditures ( $G$ ), all in terms of the domestic good:

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

+   -   +                      -                      -

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 ( $R$ ), plus domestically provided reserves, i.e. the 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 ( $L$ ):

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

+   -   +                      +   -   +

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

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

-   -                      +                      -

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 international capital flows adjust 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):

$$(4) \quad Y = Y(C, N)$$

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

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

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

where  $C$  = 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 price 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 initial government (or foreign) debt in private hands  $(\frac{b}{rP})$ , denominated in domestic currency for simplicity<sup>1</sup>, and the money supply, private domestic bonds of course cancelling out. We get, by observing that the government finances its deficits (A) with bond issues and the central bank provides money by open

$$(9a) \quad V = P C_O + \frac{b}{r} + S$$

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

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

This yields , observing (3) :

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

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

Looking at the supply side, we get from (5) through (8):

$$(10) \quad (W_P^S) = W(N) = Y_N$$

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

$$(11) \quad dP = a \frac{\frac{W_N}{Y_N} - \frac{Y_{NN}}{Y_N^2}}{Y_N^2(1 - a)} dY + de$$

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

It is seen that the denominator of the first term is positive. This keeps  $P_Y$  positive and finite. I.e., the aggregate supply curve of an open economy is rising. This point has another important consequence: the classical dichotomy breaks down in 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 Buiters (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 unchanged.

A similar expression is obtained for domestic goods prices  $P^D$ , to whose expression the same qualitative comments apply. It is notable that relative prices cannot be changed by devaluation in the real wage model, except through income change, domestic goods prices rising by the amount of devaluation.

$$(11') \quad dP^D = \frac{W_N - Y_{NN}}{Y_N^2 (1-a)} dY + de$$

The model consists of equations 1, 2, 3, 9d and the level equivalents of 11 and 11' in  $Y, r, P, P^D, V$ , and either  $R$  or  $e$ .

Substituting (9d), (11), and (11') 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.

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

+   -   -   +   +     -   +

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

+   -   +

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 partly because of (11) as promised above. The absolute value of  $E$  is increased by the wealth

effect. As to  $E_e$ , as proposed in the introduction, devaluation reduces the real value of all net nominal assets. This makes  $E_e$  negative. We will, henceforth, call the effect of  $E_e$  the Pigou effect for simplicity.  $T_e$  is positive and independent of the Marshall-Lerner condition, since relative prices cannot be changed by devaluation in a real wage model, except through income changes, as can be seen from equation (11').

By similar substitution into (3) we get :

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

Totally differentiating the model of equations (12), (13) and (14), we get for the fixed exchange rate regime, observing that  $dA = dG$  for given tax receipts, and substituting  $T_e = T_E E_e$  from equation (A2) in footnote 3. Since we are not interested in the J-curve effect, we will set the initial trade balance  $T$  at zero.<sup>3</sup>

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

and for flexible rates:

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

### 3. The Effects of Economic Policies in the Flow Equilibrium Model

#### a. Fixed Exchange Rates

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.<sup>4</sup>

$D_1$  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  $\frac{dR}{dG}$  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.

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 deficit in response to fiscal as well as to monetary expansion.

As to  $dY/de$ , the absolute value of  $T_E$  is somewhat higher than the marginal propensity to import, generally obtaining values of a third or less. The first term in the brackets is therefore positive. The second term is negative, considering its sign so that the first term as a whole is ambiguous, making the expression ambiguous. The second term is negative. The reason for the ambiguity is that devaluation, in raising the price level, reduces private expenditures through the Pigou effect and increases the demand for nominal balances.<sup>5</sup> It also brings about an improvement in the trade balance by a fraction of the Pigou effect, leaving total demand lower. However, the trade balance effect also increases the money supply. As a result, the interest rate change is ambiguous, leaving the sign of the derivative ambiguous. However, with e.g.  $E_e = 0$ , devaluation would lead to a decline in income, and an improvement in both the balance of payments and the trade balance.<sup>6</sup>

Table 1. The Short-term Policy Effects Under Fixed Exchange Rates

	$dY/$	$dR/$	$d(T \cdot P^D)/$
$/dG$	$\frac{m(K_r - L_r)}{D_1} > 0$	$\frac{m(L_Y K_r - L_r T_Y)}{D_1}$	$\frac{m(K_r - L_r) T_Y}{D_1} < 0$
$/dD$	$\frac{-E_r}{D_1} > 0$	$\frac{-(1-E_Y - mT_Y)K_r - E_r T_Y}{D_1} < 0$	$\frac{-E_r T_Y}{D_1} < 0$
$/de$	$\frac{E_e [(1+mT_E)(K_r - L_r) - E_r T_E] + E_r L_e}{D_1}$	$\frac{f}{D_1}$	$\frac{d}{D_1} > 0$

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

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

$$f = (1 - E_Y - mT_Y)(L_e K_r - L_r T_E E_e) + E_r (L_e T_Y - L_Y T_E E_e) + E_e (1 + mT_E)(L_Y K_r - L_r T_Y)$$

$$d = (K_r - L_r)E_e [(1 - E_Y)T_E + T_Y] + E_r (L_e T_Y - L_Y T_E E_e) > 0$$

The balance of payments response to exchange rate adjustments is ambiguous. A sufficient condition for devaluation improving the balance of payments is that the third term in the expression is nonnegative: the LM curve is flatter than the BP curve or the curves have equal slopes, or, as proposed,  $E_e$  is zero.

As to the trade balance effect, devaluation improves

the balance irrespective of the Marshall-Lerner condition.

Namely, the Pigou effect, by lowering expenditures guarantees the improvement of the trade balance, since changes in relative prices cannot be achieved by devaluation in the real wage model, except through income changes (see equation 11' above). The Marshall-Lerner condition is thus irrelevant in a real wage model.

However, under perfect capital mobility, and  $K_r \rightarrow \infty$  the income effect of devaluation becomes unambiguous: it is contractionary, as can be seen from Table 2. The basic reason is, of course, that then the reason for the ambiguity in the general case disappears: the interest rate remains constant, the Pigou effect remaining. Also the balance of payments effect of fiscal policy becomes unambiguous, being unambiguously positive. The reason is that capital flows financing all trade balance disequilibria, it remains for the balance of payments to satisfy the change in the demand for money. Similarly, the still ambiguous balance of payments effect of devaluation is to satisfy the change in the demand for money from two sources, the direct effect through the price level change, and through the income effect.

[Table 2 here]

Monetary policy is completely offset by capital flows, which renders monetary policy powerless. In other words, we get basically monetarist balance of payments responses, except that income changes. The Mundell-Fleming theorem on the income effects of fiscal and monetary policies holds qualitatively.

Table 2    The Policy Effects under Perfect Capital Mobility

	<u>Fixed Exchange Rates</u>		<u>Flexible Exchange Rates</u>	
	dY/	dR/	dY/	de/
/dG	$\frac{m}{1-E_Y-mT_Y} > 0$	$\frac{mL_Y}{1-E_Y-mT_Y} > 0$	$\frac{L_e}{D_3} (>0)$	$-\frac{mL_Y}{D_3} (<0)$
/dD	0	-1	$\frac{E_e(1+mT_E)}{D_3} (<0)$	$\frac{1-E_Y-mT_Y}{D_3} (>0)$
/de	$\frac{(1+mT_E)E_e}{1-E_Y-mT_Y} < 0$	$L_e + \frac{L_Y E_e (1+mT_E)}{1-E_Y-mT_Y}$		

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

b. Flexible Exchange Rates

The following values are obtained:

(Table 3 here)

In the expressions,  $D_2$  is the negative of the numerator of  $\frac{dR}{de}$  in the fixed rate case. So a sufficient condition for it being negative is that the third term is non-negative: the LM curve is flatter than the BP curve, the curves have equal slopes, or  $E_e$  is zero. 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.<sup>7</sup>

Fiscal expansion leads to a rise in income and to a trade balance deficit. It leads to a depreciation of the exchange rate, i.e., a rise in (e) if the LM curve is flatter than the BP curve. If the BP curve is flatter, an appreciation follows, and if the curves have equal slopes, the exchange rate remains unchanged.

Monetary expansion leads to a rise in income if  $[T_E(E_r - mK_r) - K_r]$  is positive. If it is zero, monetary policy has no effect, and if it is negative, monetary expansion will lead to a decline in income. So monetary expansion is the more likely to have an expansionary effect, the more interest-sensitive expenditures are relative to capital flows. The relative interest inelasticity of capital flows reduces the leakage and thereby the depreciation ( $[d(de/dD)/dK_r] > 0$ ), which reduces the contractionary Pigou and money demand effects ( $[d(dY/dD)/dK_r] < 0$ ). Since  $T_E$  is of the order of a third or less, a contractionary income effect can follow with realistic parameter values. Of course, monetary expansion leads to a trade balance surplus for reasons that have become clear from the above discussion and from the discussion of the effects of exchange rate changes.

It can thus be seen that in this more complete model conventional wisdom, as cited in the Introduction, is radically upset: the effectiveness of monetary policy is far from guaranteed. Furthermore, it is monetary policy whose effectiveness is inversely related to the degree of capital mobility, while that of fiscal policy is positively related to it:  $(d(dY/dG)/dK_r) > 0$ .

Table 3. The Short-term Policy Effects Under Flexible Exchange Rates

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

where  $D_2 = (1-E_Y - mT_Y)(L_r T_E E_e - L_e K_r) + E_r (L_Y T_E E_e - L_e T_Y)$

$$-E_e (1+mT_E)(L_Y K_r - L_r T_Y)$$

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



The reason for the latter is that, with a higher  $K_r$ , a greater proportion of the securities issued is bought by foreigners, leading to a greater appreciation

of the exchange rate. As a result, the Pigou and money demand effects are more expansionary. The conventional result, where monetary policy remains effective (in fact strengthened by capital mobility) and fiscal policy effect inversely affected by it holds in the general model (where the dependence of the supply of labor on the expenditure price is not exactly specified) if  $L_e = E_e = 0$ . In the real wage model, this inconsistent assumption would furthermore lead to singularity: the model has no solution, the elements in the third column of the coefficient matrix going to zero. The economic explanation for this is that in the real wage model the only direct trade balance response to exchange rate changes comes through the Pigou effect, due to the irrelevance of the Marshall-Lerner condition: the domestic goods prices change proportionally to the exchange rate in a partial equilibrium context (footnote 3). If the Pigou and cash balance effects should go to zero, no variables are functions of the exchange rate. Thus there is nothing equilibrating the foreign exchange market.<sup>8</sup>

It follows naturally that under perfect capital mobility the Mundell-Fleming theorem breaks down. Monetary expansion has a contractionary, not a strong expansionary, income effect, provided the conditions for the stability of equilibrium are met ( $D_3 > 0$ ) as can be seen from Table 2: its only direct effect is to depreciate the exchange rate, because of the ensuing capital outflow. This activates the Pigou and cash balance effects, which contract income until the trade balance surplus equals the capital outflow. Likewise, fiscal expansion is not ineffective, but leads to a rise in income. 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 there would be nothing responding to the exchange rate change, as proposed. With the price effects, 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 is bought by foreigners, and the appreciation falls short of offsetting the income effect of the fiscal expansion. The income effect is strengthened also by the Pigou effect. It is of interest that with flexible exchange rates the reverse Mundell-Fleming effect can be produced by ignoring the Pigou and Laursen-Metzler effects. The Mundell-Fleming result itself cannot be generated even in the money wage model without inconsistent assumptions concerning the price level one way or another.<sup>9</sup>

c. The Exchange Rate Regime and the Effectiveness of Policies

As the reader can readily verify by comparing the respective expressions, fiscal policy is more effective under fixed than under flexible exchange rates if  $L_e > T_E E_e$  and the LM curve is flatter than the BP curve [i.e.  $L_Y K_r < L_r T_Y$ ]. The reverse is true if the BP curve is flatter. The first condition can be expected to hold, since  $L_e$  is a large number. In the real wage model,  $dP = de$  so that the demand for nominal balances can be expected to change proportionally to the exchange rate, when income does not change.  $T_E$  is a third or less and  $E_e$  six percent of all private net nominal assets (plus the Laursen-Metzler effect) (equation A1, footnote 2).

The basic reason for the condition on the LM and BP curves is the change in the exchange rate. If fiscal expansion leads to a depreciation under flexible rates, as in the first case, the Pigou and money demand effects weaken the expansionary income effect, while the trade balance improvement is limited to the import share of the Pigou effect. This weakens fiscal policy in the flexible rate case. If the converse is true about the slopes of the curves, fiscal policy is strengthened under flexible rates. This result contrasts with the Fleming (1962) result that fiscal policy is always more effective under flexible rates. His result,

Fiscal expansion leads to a greater trade balance deficit under fixed rates if the LM curve is flatter and to a smaller deficit if it is steeper. The reason is, of course, the income change brought about by the expansion.

Monetary expansion is more effective under fixed rates if  $L_e > T_E E_e$ . Since the expansion unambiguously depreciates the exchange rate, the contractionary effect of the depreciation weakens monetary policy under flexible rates. (Fleming's result is that monetary policy is always more effective under flexible rates.)

Of course, since monetary expansion leads to a trade balance deficit under fixed rates and to a surplus under flexible rates, the effect can be said to be smaller under fixed rates.

Finally, monetary policy, relative to fiscal policy, is more powerful under fixed exchange rates if  $L_e > T_E E_e$ . (Fleming has monetary policy always more or equally effective under flexible rates.)

Under perfect capital mobility, the relative effects of fiscal policy in the two regimes is ambiguous. (Mundell (1963)-Fleming: fiscal policy is powerless under flexible rates and powerful under fixed rates.) Since monetary policy is powerless under fixed rates, and monetary expansion has a contractionary income effect under flexible rates, the regime under which it is more powerful depends on how power is defined. (Mundell-Fleming: monetary policy is powerless under fixed, and powerful under flexible rates.) The same conclusion also applies to the power of monetary policy relative to that of fiscal policy under the two regimes.

#### 4. The Assignment Problem

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

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

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 for the rule is close to the reverse of the stability condition of this case, or  $D_2 + m T_E E_Y L_Y K_R > 0$ . 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 :

$m L_Y E_e (1 + m T_E) + L_e (1 - E_Y - m T_Y) < 0$ . 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.

#### 5. Wage Rigidity 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  $T$  declines unless  $T$  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 in  $E_Y$  and  $T_P D/e$  is non-positive. Under flexible rates their effect depends on the parameter values. Rigidity does not cause qualitative changes in the policy effects.

## 6. 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 setting  $dr = 0$ , 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 from Table 4 that the permanent income effects of fiscal and monetary policies go to zero under fixed exchange rates.  
[ Table 4 here ]

However , devaluation does increase income in the long run - contrary to conventional wisdom - in such a way that the devaluation effect on the trade balance is exactly offset by the income effect. The reason is that devaluation reduces real wealth and thereby expenditures , pushing the trade balance into surplus. Therefore an income rise is needed to restore trade balance equilibrium. This stimulus to expenditures is given by a decline in the interest rate.

In the literature , devaluation , as well as other policies , have been found to have no effects at all. This is partly due to the omission of the wealth effect , and partly due to the incorrect inference that the real wage model implies a fixed real income.<sup>10,11.</sup>

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 continuing to raise 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.) The momentary 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

Table 4. The Policy Effects in Portfolio Balance Equilibrium

Under Fixed Exchange Rates

	$dY/$	$dr/$
$/dG$	0	$-\frac{m}{E_r} > 0$
$/dD$	0	0
$/de$	$-\frac{T_E E_e}{T_Y} > 0$	$-\frac{E_e [T_E (1-E_Y) + T_Y]}{E_r T_Y} < 0$

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 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.



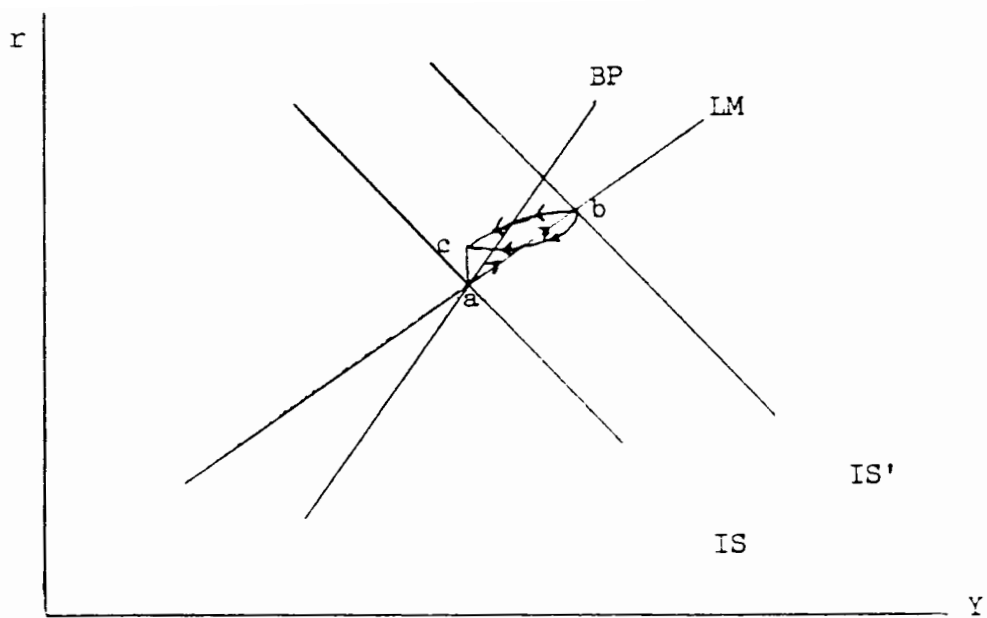


Figure 1. The Effects of Fiscal Expansion in the Short and Long Runs

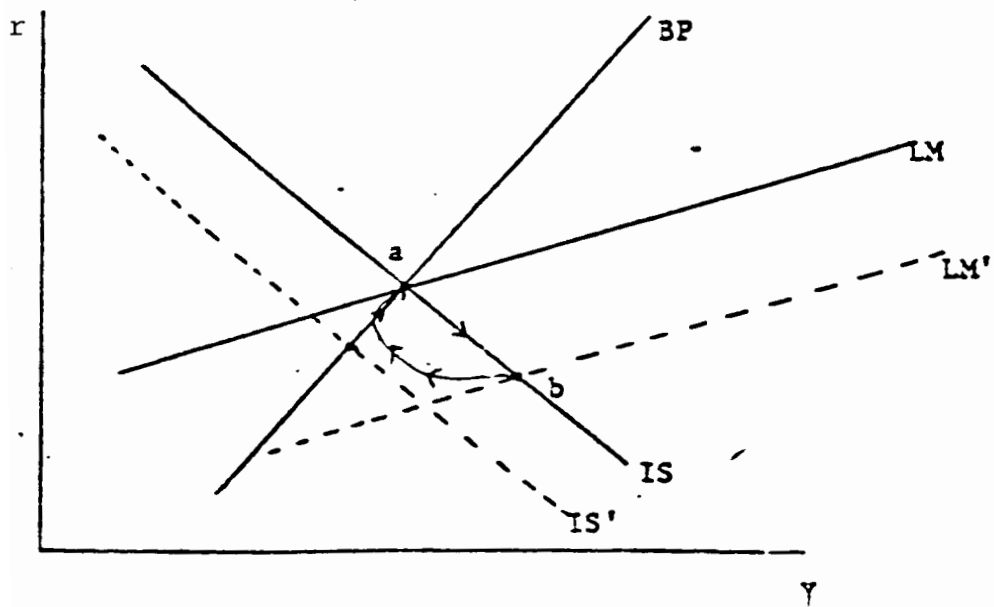


Figure 2. The Effects of Monetary Expansion in the Short and Long Runs

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.<sup>12</sup> 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 at 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 this specification, see Goldfeld (1973)).

With devaluation , all the curves are affected by opposite or ambiguous forces in the short run, the major opposite forces being the responses of the demand for money and expenditures, to finally reach a higher income and lower interest rate level than originally. Therefore , the only unambiguous adjustment path is that of the trade balance , which overshoots to return to equilibrium. In the absence of wealth effects , however , income would undershoot (i.e. decline) , to return to its original level. The interest rate would overshoot , to return to its original level.

The flexible rate case is obtained from the general case (Table 2) by setting  $K_r = 0$ . It is shown in Table 5. It can be seen that  $D_5$  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

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 overshoots. The trajectory of the interest rate depends on the the parameter values.

[ Table 5 here ]

Table 5. The Policy Effects in Portfolio Balance Equilibrium Under Flexible Exchange Rates

	$\frac{dY}{dG}$	$\frac{dr}{dD}$	$\frac{de}{dT_1}$
	$\frac{mL_r T_E^E}{D_5} > 0$	$-\frac{m(L_Y T_E^E - L_e T_Y)}{D_5} > 0$	$\frac{mL_r T_Y}{D_5} > 0$
	$\frac{E_r T_E^E}{D_5} > 0$	$\frac{E_e[(1-E_Y)T_E + T_Y]}{D_5} < 0$	$-\frac{E_r T_Y}{D_5} > 0$
	$\frac{-E_e L_r + E_r L_e}{D_5} > 0$	$\frac{(1-E_Y)L_e + E_e L_Y}{D_5}$	$-\frac{(1-E_Y)L_r + E_r L_Y}{D_5} < 0$

$$D_5 = L_r E_e[(1-E_Y)T_E + T_Y] + E_r(L_Y T_E^E - L_e T_Y) < 0, \text{ and}$$

$dT_1$  = exogenous change in the trade balance.

the following. The expansion raises income and the interest rate , which cause a trade balance deficit and a capital inflow. The last two changes 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.

This reduces real wealth , lowering expenditures and pushing

the trade balance into surplus. Expenditures and the trade balance have opposite effects on income , whose change is ambiguous. The next period the stock adjustment term in the capital flow function makes the BP curve steeper.

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 trade balance equilibrium is reached. 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.

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 has been found to be ambiguous. 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 ( $E_{(V/P)} \cdot dG$ ) will have to dominate the substitution effect ( $dr$ ) in the demand for foreign bonds.<sup>13</sup> 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 enough 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 definition of the classical model as implying a constant labour supply rather than the real wage model, and the absence of the wealth effect on expenditures and the effect of the exchange rate on the demand for money.<sup>14</sup>

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 (equation A2) and the condition irrelevant in the real wage model, 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.

#### 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 weaken the income effect of devaluation if the Laursen-Metzler effect dominates the Pigou effect in  $E_v$ , the two cancel out or the price effects are abstracted from. Under flexible rates, the income effects are increased in the general case on the same condition, otherwise, the effects depend on the parameter values. All the derivatives are however only quantitatively affected

## 7. Conclusion

When the definitional relationships between price variables and the rationality of labor market behavior are correctly incorporated into an open macro model, many of the commonly accepted notions on the effectiveness, and even the direction, of the effects of economic policies are substantially changed.

First, the classical dichotomy breaks down in an open macro model: the model is simultaneous. Therefore, the fixity of income does not carry over from the closed economy model.

The Laursen-Metzler effect works in response to income changes but is zero in response to exchange rate changes. The latter is a result of the fact that relative prices cannot be changed by devaluation in a real wage model, except through income changes, since domestic prices increase proportionally to devaluation.

The Marshall-Lerner condition is irrelevant for the same reason. The trade balance improvement is brought about by the interaction of the Pigou, money demand and money supply effects. However, the income effect of devaluation is ambiguous.

It appears that double-digit inflation in destroying money illusion and leading to the real wage model, has seriously weakened the trade balance effects of exchange rate changes, by eliminating their most powerful component, expenditure switching. In doing so it has led to the dynamic counterparts of our comparative-static adjustment, i.e. the vicious or virtuous circles of exchange rate - wage behavior that we have observed.

Under flexible exchange rates, monetary expansion can well have a contractionary income effect, particularly if capital flows, relative to expenditures, are sensitive to interest rates. Monetary expansion is unambiguously contractionary under perfect capital mobility. Then it depreciates the exchange rate, whereas fiscal expansion appreciates it. Under perfect capital mobility devaluation leads to a decline in income.



Concerning the effect of capital mobility on the effectiveness of policies under flexible exchange rates, the conventional result, cited in the introduction, is reversed: It is monetary policy whose effectiveness is inversely related to the degree of capital mobility while that of fiscal policy is positively related to it. In fact, the assumptions necessary for the conventional effect to hold even in a general model are inconsistent. Besides, they would make the real wage model singular: no variables would be functions of the exchange rate.

The relative effectiveness of policies under different exchange rate regimes is also changed. The relative effectiveness of fiscal policy depends on the relative slopes of the LM and BP curves. Monetary policy can normally be expected to be more effective under fixed, rather than flexible, exchange rates. Likewise, monetary, relative to fiscal policy, is normally more effective under fixed exchange rates.

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 has a contractionary income effect when capital is perfectly mobile.

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  $E_0$  is zero, the reverse of the Mundell rule results. The same is practically always

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. However, devaluation increases income in such a way that the devaluation effect on the trade balance is exactly offset by the income effect.

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

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 overshoots. The trajectory of the interest rate depends on the parameter values.

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 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 in  $E_Y$  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 the capital gains on these bonds, caused by devaluation are dominated by capital losses on all nominal assets, including these bonds, i.e. as long as

$$\frac{B^F}{B + B^F + S} < 1 - a, \text{ where } B^F \text{ is the market value of foreign bonds.}$$

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:

$$(A1) \quad dE = \{E_Y^X + \frac{W_N - Y_{NN}}{Y_N^2(1-a)} [E_Y^X(1-a)Y - E_{(V/P)}((V-C_0)a-A-T)]\}dY$$

$$+(E_r^X - E_{(V/P)} \frac{b}{r^2})dr$$

$$-E_{V/P}(V-C_0-A-T)de + E_{V/P}(dA+dT)$$

In the multiplier of  $dY$ , which is the new  $E_Y$ , the multiplier of the second term in the brackets is positive, 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 expenditures (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. As to  $E_e$ , the Laursen-Meltzer effect is zero in the real wage model, domestic prices rising by the amount of devaluation (equation 11'). The Pigou effect, however, guarantees that this partial is negative. Its effect is emphasized by the fact that  $dP = de$  so that  $E_e$  equals six percent of the net nominal assets, according to Ando and Modigliani.

<sup>3</sup> We get from (1), by totally differentiating  $T^X$  and then substituting 11':

$$(A2) \quad dT = (T_E^X E_Y + T_{(P^D/e)}) \frac{W_N - Y_{NN}}{Y_N^2 (1-a)} dY + T_E^X E_e de$$

The multiplier of  $dY$ , or  $T_Y$ , is negative, since both its terms are negative,  $T_{(P^D/e)}$  being negative due to the Marshall-Lerner condition (though this condition is not necessary, as long as the first term dominates) That of  $de$ , or  $T_e$  is positive due to the wealth effect on expenditures. It is notable that in the real wage model, the Marshall-Lerner condition does not affect the value of  $T_e$ , since domestic goods prices change proportionally to the exchange rate.

We obtained the wealth effect, and the positiveness of  $T_e$  by making imports a function of  $E$  rather than  $Y$ , when  $T_e$  would have been zero. This implies that imports are finished goods rather than raw materials. Reality being a hybrid of the two cases, as long as any finished goods are imported,  $T_e$  is positive.

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

$$\begin{aligned} \text{Tr } A &= -(1 - E_Y - mT_Y) + L_r - 1 = \lambda_1 + \lambda_2 + \lambda_3 < 0; \quad A_2 = 1 - E_Y - mT_Y - L_r (2 - E_Y - mT_Y) + K_r - E_r L_Y \\ &= \lambda_1 \lambda_2 + \lambda_1 \lambda_3 + \lambda_2 \lambda_3 > 0, \end{aligned}$$

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  $\lambda_i$  are the eigenvalues of  $A$ .

5. The latter is the Tsiang (1961) effect.

6. This is essentially why

Salop gets an unambiguous fall in income (and an improvement in the trade balance).

7. 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:

$$Tr = A - (1 - E_Y - mT_Y) + L_r - T_E E_e < 0 ;$$

$$A_2 = -L_r(1 - E_Y - mT_Y) - E_r L_Y - L_r T_E E_e + L_e K_r + E_e [T_E(1 - E_Y) + T_Y] > 0$$

$$A_3 = |A| = (1 - E_Y - mT_Y)(L_r T_E E_e - L_e K_r) + E_r(L_Y T_E E_e - L_e T_Y) - E_e(1 + mT_E)(L_Y K_r - L_r T_Y) < 0$$

by assumption.

8. In a model with a general form of the labor supply function the condition for the positiveness of  $[d(dY/dG)/dK_r]$  is  $L_r(E_e + mT_e) - L_e E_r > 0$ . The conventional result is obtained if the price level is independent of the exchange rate, i.e.  $L_e = E_e = 0$ .

<sup>9</sup> Sachs (1980) generates the Mundell-Fleming theorem in the money wage model by making the demand for money a function of the domestic good, rather than expenditure, price. This implies that a rise in the imported good price has no effect on the demand for money. In the money wage model,  $P_e^D = 0$ , which makes  $L_e = 0$ . His labor supply is, correctly, a function of the expenditure price.

<sup>10</sup> Dornbusch (1975) studies the equivalent of a traded-non-traded goods model, assuming a fixed labor supply, full employment, and flexible relative prices. His results are on the whole in line with

ours except that he gets no real effects from devaluation. This seems to stem from his labor market assumptions, which fix income. Allen ja Kenen got the same result in their classical case for the same reason (p.152). Branson and Buiter (1982) follow the same tradition , along with almost everyone else.

<sup>11</sup>Of course , one could fix income by assuming a perfectly inelastic labor supply function ( $W_N \rightarrow \infty$ ). Alternatively, fixed relative prices in the real wage model would produce the same result. This would imply :  $dP^D = de$ . Substituting this into (11') gives:

$$\frac{W_N - Y_{NN}}{Y_N^2 (1-a)} dY = 0$$

12. 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.

13. See Branson (1979), p. 195, Dornbusch (1975), Allen and Kenen (1980), pp. 115- . Branson and Buiter (1982).
14. 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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