A Simple World Model of Monetary Union - A Note

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The economic debate about European monetary union is often conducted as if the problem were one of choosing between a fixed or a flexible exchange rate system (for example, see Sirc (1977)). This approach has been largely unsatisfactory, because it fails to get to grips with the main characteristic of monetary union, which is neither of these two extremes, but is a combination of both with pegged exchange rates within the union, and with the union jointly floating against the rest of the world. It is clear that most models analysed in the literature, whether small-open-economy models or even two-country world models, are unable to get a handle on this special feature.

In order to characterise monetary union it is necessary to construct a three-country model. I propose in this paper to set up and examine a very simple model of a two-country monetary union which has a floating exchange-rate with the rest of the world. In this context a monetary union simply involves the pegging of the exchange rate between the member countries and the universally held expectation that the parities will be maintained. It is assumed that the members of the union are large in relation to each other, but the union is small in relation to the rest of the world. These rather unrealistic country-size assumptions have the advantage of keeping the analysis tractable. They allow us to take into account the repercussions within the union, but to abstract from any feedbacks from the union to the rest of the world.

The Model

The model closely follows the short run model developed by Mundell (1968) in which prices (and money wages) are fixed and the supply of output is elastic. Countries $i = 1,..,n$ together comprise a monetary

union and country $n + 1$ is the rest of the world. The model is set out and discussed below using the following notation:

y =	income	S =	saving
D =	domestic credit	s =	marginal propensity to save
M =	money supply	L =	demand for money
R =	foreign reserves	I =	investment

G = Government investment expenditure

e = rate of exchange between the union members (by appropriate choice of units $e = 1$)

x = union exchange rate with the rest of the world

B = trade balance with the rest of the union

C = trade balance with the rest of the world

m = marginal propensity to import from the rest of the union

n = marginal propensity to import from the rest of the world

Exogenous variables are indicated by a bar $\bar{\ }$. All country $n + 1$ variables enter the model exogenously.

$$(1) \quad I_i(r) + \bar{G}_i - S_i(y_i) + B_i(y_1 \ldots, y_n, x) + C_i(y_i, \bar{y}_{n+1}, x) = 0, \; i = 1 \ldots, n.$$

Equation (1) is a standard goods market equilibrium equation, with the net exports of each country to its partner country and to the rest of the world expressed in separate terms.

$$(2) \quad M_i = L_i(r, y_i) \;, \; i = 1, \ldots, n.$$

Equation (2) is a standard L.M. curve.

$$(3) \quad M_i = \bar{D}_i + R_i$$

Equation (3) is a money supply equation, where domestic money is composed

of domestic credit and foreign exchange reserves. The balance of payments between the union as a whole and the rest-of-the-world is assumed to be cleared by the floating exchange rate. Therefore the only reserve flows are between members of the union.

$$r = \bar{r} \tag{4}$$

Finally, the interest rate is assumed to be determined in the rest of the world, and that all securities in the system are perfect substitutes.

In addition it is assumed that the union/rest of world exchange rate follows a random walk. This is a strong assumption, but it eliminates from the model all problems of exchange rate expectations, speculation and forward exchange markets etc.

The policy determined parameters are G_i and D_i. We shall analyse the simplest case of a two-country monetary union (n=2). Equations (3) and (4) can be eliminated. Differentiation results in the following system, which is easily solved for the effects of policy changes.

$$* \begin{bmatrix} -(s_1+m_1+n_1) & m_2 & 0 & (B_{x,1} + C_{x,1}) \\ m_1 & -(s_2+m_2+n_2) & 0 & -(B_{x,1} - C_{x,2}) \\ L_{y,1} & 0 & -1 & 0 \\ 0 & L_{y,2} & 1 & 0 \end{bmatrix} \begin{bmatrix} dy_1 \\ dy_2 \\ dR_1 \\ dx \end{bmatrix} = \begin{bmatrix} -d\bar{G}_1 \\ -d\bar{G}_2 \\ d\bar{D}_i \\ d\bar{D}_2 \end{bmatrix}$$

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* All signs are normal, i.e. $s,m,n,L_y, \quad C=i, > 0, \quad B_{x,1}?$

Fiscal Policy

Fiscal policy in this case takes the form of a change in government investment expenditure, which is financed by an increase in the public debt. The effects of an increase in government expenditure by country 1. are as follows:*

$$\frac{dy_1}{d\bar{G}_1} = \frac{L_{y,2}(B_{x,1} - C_{x,2})}{\Delta} > 0, \quad \frac{dy_2}{d\bar{G}_i} = -\frac{L_{y,1}(B_{x,1} - C_{x,2})}{\Delta} < 0$$

$$\frac{dx}{d\bar{G}_1} = \frac{L_{y,1}(s_2+m_2+n_2)+m_1L_{y,2}}{\Delta} < 0, \quad \frac{dR_1}{dG_1} = L_{y,1}L_{y,2}(B_{x,1}-C_{x,2}) > 0$$

where $\Delta = -L_{y,1}\left[C_{x,2}m_2 + C_{x,1}(s_2 + m_2 + n_2) + B_{x,1}(s_2 + m_2)\right]$

$$- L_{y,2}\left[C_{x,1}m_1 + C_{x,2}(s_1 + m_1 + n_1) - B_{x,1}(s_1 + n_1)\right]$$

$\Delta < 0$

These results are shown diagramatically in Figure 1, which was adapted from a diagram by Dornbusch and Krugman (1979). The IS and LM curves for the union members are drawn in the N.E. and S.W. Quadrants. The AA curve shows the relationship between y_1 and y_2 in money market equilibrium. Similarly, WW shows the relationship between y_1 and y_2 in goods market equilibrium. The AA curve is derived by combining the

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* Assuming $(B_{x,1}-C_{x,2}) < 0$ (This is assumed throughout the paper).

L.M. equations for countries 1 and 2. The slope is determined by the relative income elasticities of demand for money, while the intersect depends on the interest rate, the relative interest elasticities of demand for money, and the total union money supply.

The W.W. curve is in turn derived by combining the two IS equations. The relative savings and import propensities determine the slope and the position of the curve is determined by the interest rate and the common exchange rate. A rise in the interest rate, or a fall (appreciation) of the exchange rate will shift the WW curve back towards the origin.

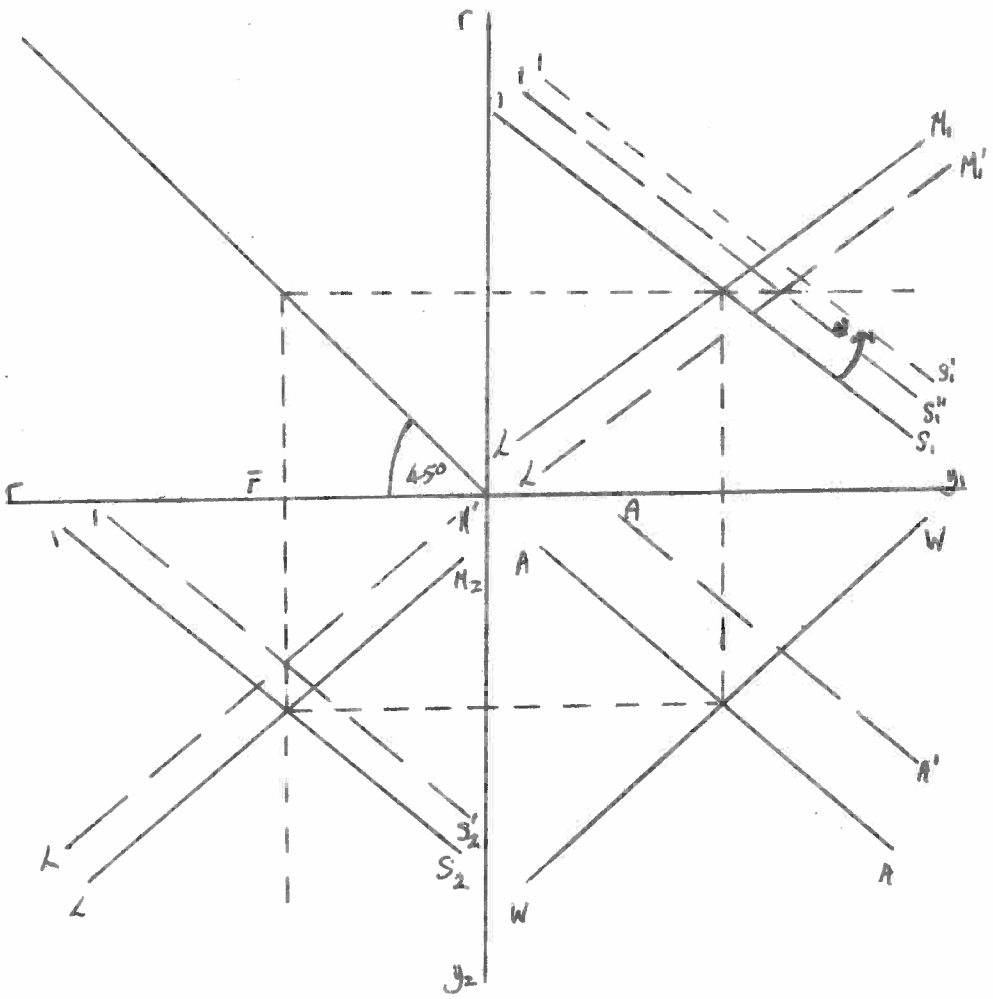

FIGURE 1

The increase in government expenditure will raise domestic income, and by creating a tendency for domestic interest rates to rise, will cause an appreciation of the union/rest-of-the-world exchange rate. This will dampen the rise in income in country 1 and will lower income in country 2. A rise in the income demand for money in country 1 is met by an inflow of reserves, from country 2, shifting LM_1 outwards and LM_2 up. Thus, while fiscal policy can have the desired effect on income in the active country, this is only at the expense of its partner country. This is perhaps a surprising result which can be compared with Mundell's (1968) conclusion, that a rise in government expenditure by one country in a two-country world model, has an indeterminate effect on the income of the second country, when exchange rates are pegged. The impact of fiscal policy on domestic income is not as large as would be obtained by a small-open economy, under the same behavioural assumptions, in a fixed exchange rate regime. It is more effective for such a country in a monetary union than in a flexible exchange rate system, where we have the well known result that fiscal policy has no effect on domestic income. However, its adverse effects on the other members of the monetary union make fiscal policy an instrument of dubious benefit.

Of course, we would not expect one country within a union to positively accept a cut in its domestic income through a fiscal policy action by another union member. Country 2 can retaliate by increasing its own government expenditure to offset the change in income caused by country 1's action. This will in turn reduce country 1's income. One obvious way to eliminate the cycle of action and counter action would be to introduce cooperation between the union members. Let us assume that there is an identical increase in government expenditure in both countries.

The results are as follows:

$$\frac{dy_1}{d\bar{G}_1} + \frac{dy_1}{d\bar{G}_2} = \frac{L_{y,2}(C_{x,1} - C_{x,2} + 2B_{x,1})}{\Delta}$$

$$\frac{dy_2}{d\bar{G}_1} + \frac{dy_2}{d\bar{G}_2} = \frac{L_{y,1}(C_{x,2} - C_{x,1} - 2B_{x,1})}{\Delta}$$

An expansionary fiscal policy by the countries will have a small but positive effect on the income of the country whose net exports are least sensitive to changes in the union/rest-of-the-world exchange rate. The outcome for the other country will be a small cut in domestic income. It is possible that there will be a small net gain in income* for the union, so that there is scope for compensatory payments to the adversely affected country. If the two countries are identical a fiscal expansion will have no effect on either country's income.

Monetary Policy

Now let us assume that there is a domestic credit expansion by country 1. The outcome of this action is reported below and shown diagramatically in Figure 2.

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* as $(Ly_1 - L_{y2})\ (C_{x,1} - C_{x,2} - 2B_{x,1}) \gtrless 0$.

$$\frac{dy_1}{d\bar{D}_1} = - \frac{[\bar{B}_{x,1}(s_2+n_2) + C_{x,2}m_2 + C_{x,1}(s_2 + m_2 + n_2)]}{\Delta} > 0$$

$$\frac{dy_2}{d\bar{D}_1} = - \frac{[C_{x,2}(s_1+m_1+n_1) + C_{x,1}m_1 - B_{x,1}(s_1+n_1)]}{\Delta} > 0$$

$$\frac{dR_1}{d\bar{D}_1} = - \frac{L_{y,1}[B_{x,1}(s_1+n_1) + C_{x,1}m_1 - C_{x,2}(s_1 + m_1 + n_1)]}{\Delta} < 0$$

$$\frac{dx}{d\bar{D}_1} = - \frac{[(s_1+m_1+n_1)(s_2+m_2+n_2) - m_1m_2]}{\Delta} > 0$$

The increase in domestic credit by country 1 shifts the LM_1 curve out, and by causing a capital outflow, depreciates the union exchange rate. This shifts both IS curves outwards. The trade balance between country 1 and country 2 moves into deficit (from a position of initial balance), and shifts LM_2 outwards and LM_1 back to lie nearer to its original position.

As we can see, a domestic credit expansion by country 1 has the expected positive effect on domestic income and also has a positive spillover effect on country 2's income. Any increment to the total money supply of the union will be shared between its members through the reserve linkage. These effects do not depend on which of the union members initiated to change. However, the country that pursues an expansionary monetary policy will suffer a loss of reserves. To avoid

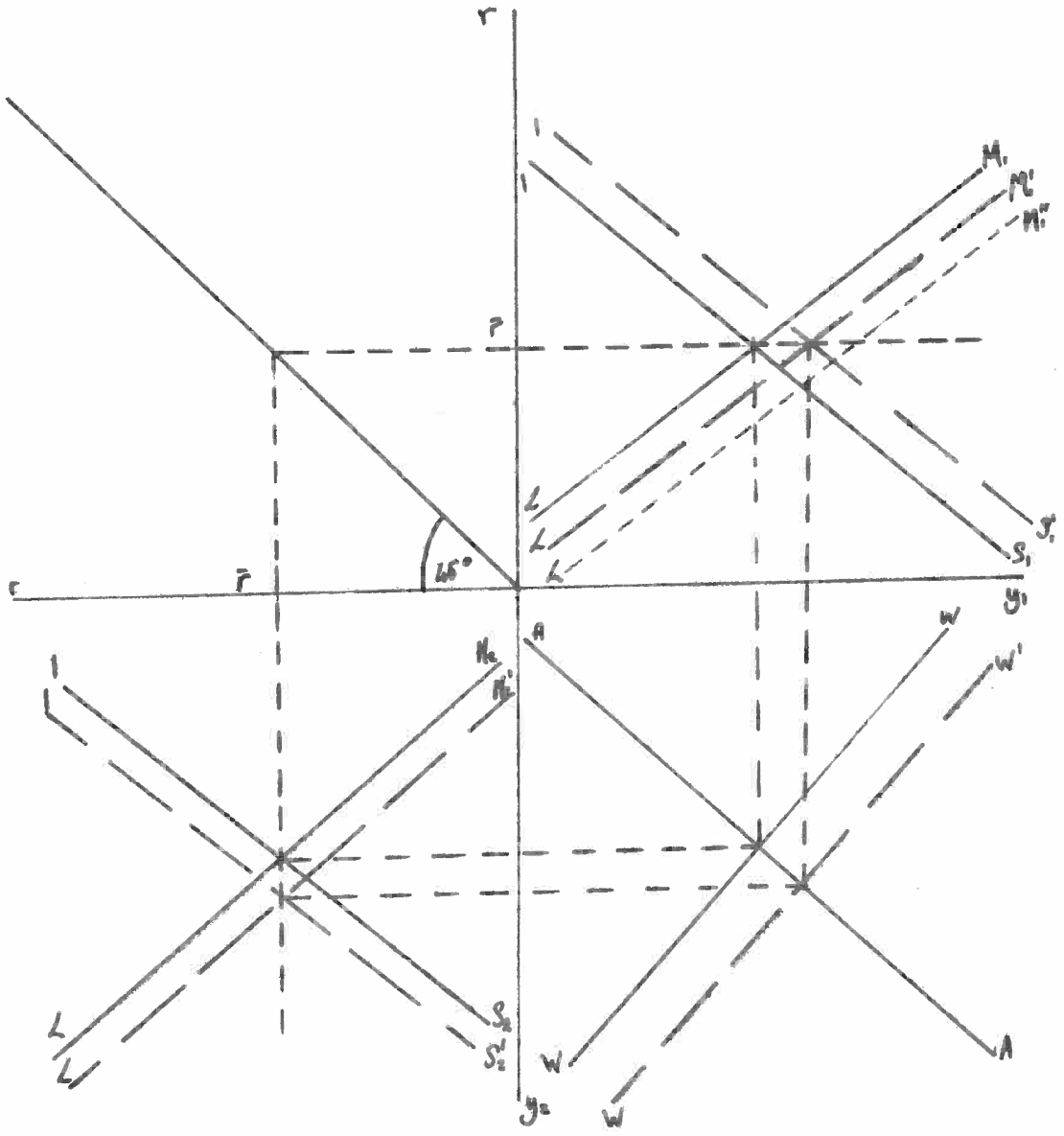

FIGURE 2

this problem the member countries can simultaneously create domestic credit. Such co-operation implies a coincidence of preferences, which is a trivial matter in this simple model, but is obviously of much greater significance when we consider the longer run aspects of the policy action. This problem is however beyond the scope of this paper.

Monetary policy in this model derives its power, not from its ability to reduce the interest rate, but by causing a capital outflow and therefore a depreciation of the exchange rate and so an improvement in the trade balance. This is the same mechanism that operates when we consider the use of monetary policy by a small open economy (again under the same behavioural assumptions), in a flexible exchange rate system. Monetary policy has less impact on the active country within a monetary union than one under a flexible exchange rate system, because part of its effect flows abroad to the rest of the union. The power of a union member to change domestic income by using monetary policy depends on its ability to significantly affect the money supply of the union as a whole. Again we can compare our findings with the well known result that the use of monetary policy, by a small open economy with a pegged exchange rate has no effect on domestic income.

Conclusion

Is this note an attempt has been made to construct a model that recognises that monetary union is a combination of both a flexible and a fixed exchange rate system. As we might have expected, the results of policy actions by a country within a monetary union were found to be not as extreme as those that would be obtained by the same country acting within either of the two polar systems. Perhaps the most surprising

result was that fiscal policy by one member had a beggar-thy-neighbour effect on the rest of the union.

Although the model is extremely simple and has many limitations, due mainly to its concentration of the short-run, and the assumptions concerning capital mobility, and exchange rate expectations, I feel that it offers some useful insights into the workings of a monetary union, and that it represents a useful starting point for further work.

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