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A TWO-COUNTRY MODEL WITH ASYMMETRIC PHILLIPS CURVES AND INTERVENTION IN THE FOREIGN EXCHANGE MARKET

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ABSTRACT

In this paper simulation methods are employed on a two-country, rational expectations continuous-time model to explore the consequences of asymmetrical wage-price processes. As an additional feature the effects are explored of reductions in the degree of financial integration between the two countries. The set up is designed to mimic the asymmetry within the European Monetary System between the wage-price process in Germany and that in the other member countries. The results demonstrate that country differentiation in respect of the wage-price process has important leverage on the response to a variety of shocks and that reduced financial integration (mimicking foreign exchange controls) is an uncertain offset.

JEL classification: 420, 431

Keywords: Two country model, asymmetric Phillips curves, foreign exchange controls, European Monetary System

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NON-TECHNICAL SUMMARY

Empirical research strongly suggests that the behaviour of wages and prices in Germany is significantly different from that in other EMS countries. German wages seem to respond less sensitively to changes in prices but are more sensitive to changes in unemployment in Germany (corresponding to a more steeply sloped Phillips curve). In this paper we use a formal simulation model to explore the effects of differences in wage-price processes in two countries which are otherwise similar in structure and which strive, through foreign exchange market intervention, to preserve a fixed real exchange rate between themselves. Thus much of the paper can be thought of as modelling the relationship between Germany and the rest of the EMS.

Most of the experiments concern two countries who intervene on the foreign exchange markets to smooth variations in the real exchange rate between them (i.e. the relative price of goods in the two countries, rather than the relative price of the two currencies). A second set of simulations explores the effects of reducing the financial integration of the two economies. This mimics the effects of exchange controls, which are often advocated as a method of limiting the transmission of shocks between countries. The paper sounds a cautionary note: it indicates that reduced financial integration is not a reliable method of dampening the transmission of shocks. Predicting the effects of integration involves the evaluation of a number of effects, which interact in a complex fashion: previous discussions of this reduced integration have tended to make assumptions which rule out these important interactions.

We begin with a two-country dynamic model (formulated in continuous time). The structures of the two economies are initially identical, but we vary the model's parameters to allow the slopes of the Phillips curves to differ between the two countries. Varying another parameter allows us to simulate changes in the degree of financial integration. Expectations in the model are a mixture of backward- and forward-looking components.

We then simulate the model in order to explore the effects of the wage-price asymmetries and the changes in financial integration. We first simulate the effects for the case of identical structures, which serves as a baseline from which comparisons are made. The model is then subjected to the same set of shocks, while the slope of the Phillips curve in one country is varied.

The full results of the simulations are complicated and not easy to summarize. Some of the more striking include:

(1) In the symmetric case an increase in domestic government spending produces an appreciation of the real exchange rate. If domestic wages are more sensitive to unemployment, however, then an increase in government expenditure at home increases the extent of this appreciation.

(2) Connected with (1), an increase in domestic government expenditure has a smaller effect on domestic output and a greater effect on foreign output if domestic wages are more sensitive to unemployment; the expansionary efforts of "Germany" are therefore likely to be exported.

(3) An increase in inflation in the domestic country has an impact on the real exchange rate which becomes smaller as wages become more sensitive to unemployment at home.

The simulations also indicate that the effects of a steeper Phillips curve depend in general on the origin of the shock (demand or supply) and the sector in which the effect is observed (real or financial).

It is less easy to summarize the remaining simulations, involving variations in the relative sensitivity of wages to prices and in the degree of financial integration. However, the analysis strongly suggests that one cannot infer the combined effects of different asymmetries by adding together their separate effects. Nor is it the case that a lower degree of financial integration will reliably offset the asymmetry effects.

These results suggest that further investigation of these issues is necessary, and that policy prescriptions in this area should be cautious and piecemeal since the outcome of policy changes is subject to complex interaction effects which are not easily foreseen.

Introduction

In a previous paper (Artis and Gazioglu, 1986) we described a symmetrical two country simulation model and used it to highlight the role of currency substitution.

In the present paper, a version of the same basic model is employed to highlight the effect of asymmetry in the wage-price sectors of the two countries, in a context in which the authorities are intervening in the foreign exchange market to dampen fluctuations in competitiveness.

The motivation for this departure derives from the fact that asymmetries seem historically to characterize exchange rate systems, as Giavazzi and Giovannini (1986) have recently argued, and from some recent findings (Artis et al. (1984), (1986) that suggest that a significant example of such asymmetries within the actual and potential membership of the European Monetary System (EMS) lies in the nature of wage determination in these countries. In our basic model, wage determination is represented by an overlapping contracts formulation of a type made familiar by Taylor (1979, 1980), Calvo (1980, 1985) and by Buiter and Miller (1985), embodying terms in expectations and the pressure of demand. In line with a stylized representation of the empirical findings, adjustments to the 'base case' parameters of the wage equations provide an asymmetrical version of our simulation model.

The significance of the asymmetry is then assessed through the medium of simulating the impact of a set of pre-specified shocks on the model.

Given the basic motivation of the paper, a degree of exchange rate intervention is assumed throughout, whilst at a later stage the effect of imposing impediments on the free flow of funds between countries (thus mimicking in a stylized way the effect of the presence of exchange controls on the degree of financial integration) is also explored.

The rest of the paper proceeds as follows. In the next section there is a description of the basic model employed; this is followed by a discussion of the results of simulations designed to highlight the effects of exchange market intervention; following this there is an account of the asymmetry in wage behaviour which it is desired to characterize; then come the simulations on the asymmetric model. In the final section a few conclusions are presented, together with an agenda for further work.

The Model

The basic model, which is in continuous time, is defined for a two-country set-up, described by the following thirty equations (with dashed equations referring to the second country and the prefix I denoting an identity). Foreign or second country variables are indicated by an asterisk and all variables are measured in logarithms unless otherwise stated. A glossary of terms appears in an Appendix. For convenience, we discuss these equations in blocks, the first being represented by equations (1) - (4') below.

$$\dot{\Pi} = h_1 \ (q - \Pi) \qquad (1)$$

$$\dot{\Pi}^* = h_1^* \ (q^* - \Pi^*) \qquad (1')$$

$$\dot{q} = [h_2 \ (q - \Pi) - h_o h_2 \ (y - \bar{y})] \qquad (2)$$

$$\dot{q}^* = \left[h_2^* \,(q^* - \Pi^*) - h_o^* h_2^* \,(y^* - \bar{y}^*)\right] \qquad (2')$$

$$p_d = h_o \,(y - \bar{y}) + \Pi + u_4 \qquad (3)$$

$$p_d{}^* = h_o^* \,(y^* - \bar{y}^*) + \Pi^* + u_4{}^* \qquad (3')$$

$$P = d_o P_d + (1 - d_o)(E + P_d{}^*) = P_d + (1 - d_o)e \qquad (4)$$

$$P^* = d_o^* P_d{}^* - (1 - d_o^*)(E + P_d) = P_d^* - (1 - d_o^*)e \qquad (4')$$

Equations (1) - (4) represent the wage-price sector of the model. (4) and (4') represent consumer prices (P, P*) as Cobb-Douglas functions of GDP deflator or domestic value added prices (P_d,P_d^*) and foreign prices, where E is the nominal and e the real, exchange rate, defined as the domestic price of foreign currency. (3) and (3') give GDP deflator inflation (p, p*) as a Phillips Curve function of deviations from natural rate output ($y - \bar{y}$, $y^* - \bar{y}^*$), and of 'core' inflation (Π,Π^*). u_4 is a shock parameter. Wage inflation and core inflation are determined in (1), (1') and (2), (2'). Taking account of (3), (3'), wage inflation depends partly on a backward looking expectations generator, partly on a forward looking component and on deviations from the natural rate of output.

The equations listed as I (5) to I (10') below are all identities. I (5) identifies the current account surplus of one country as the deficit of the other, Φ being a parameter representing relative size whilst I (10, 10') defines the budget deficit of each country (in ratio to GDP), g representing government expenditure, s an income tax parameter while I (6, 6') define the private sector's wealth identity in terms of the government deficit and current account surplus. The intervening equations pertain to the issue and distribution of debt. The debt in question is a non-interest-bearing government liability ("money"); I (7, 7') show that debt is issued to cover the budget deficit, net of any reduction in the government's holding of overseas debt - the domestic government's debt is denoted H, that of the foreign government L, subscripts g and p pertaining to the sector (government, private) holding the debt. I (8, 8') describe the distribution of outstanding debt at any time - which is held by the private sectors of each of the two countries and by the government of the opposing country; I (9, 9') exhausts the net acquisition of foreign debt between the various components. The μ parameters have the interpretation of being ratios to output.

$$cab^* = -\phi cab \qquad \text{I(5)}$$

$$\mu_2 \dot{H}_p + \mu_3 \dot{L}_p = (def+cab) \qquad \text{I(6)}$$

$$\mu_2^* \dot{L}_p^* + \mu_3^* \dot{H}_p = (def^* + cab^*) \qquad \text{I(6')}$$

$$\mu_1 \dot{H} - \mu_4 \dot{L}_g = def \qquad \text{I(7)}$$

$$\mu_1^* \dot{L}^* - \mu_4^* \dot{H}_g^* = def^* \qquad \text{I(7')}$$

$$\mu_1 H = \mu_2 H_p + \mu_3^* \phi^{-1} H_p^* + \mu_4 \phi^{-1} H_g^* \qquad \text{I(8)}$$

$$\mu_1^* L^* = \mu_2^* L_p + \mu_3 \phi L_p^* + \mu_4 \phi L_g \qquad \text{I(8')}$$

$$\mu_3 \dot{L}_p + \mu_4 \dot{L}_g - \phi^{-1}(\mu_3^* \dot{H}_p^* + \mu_4^* \dot{H}_g^*) = cab \qquad \text{I(9)}$$

$$\mu_3^* \dot{H}_p^* + \mu_4 \dot{H}_h^* - \phi(\mu_3 \dot{L}_p + \mu_4 \dot{L}_g) = cab^* \qquad \text{I(9')}$$

$$def = g - sy \qquad \text{I(10)}$$

$$def^* = g^* - sy^* \qquad \text{I(10')}$$

The next block of equations is predominantly behavioural. Equations (11, 11') describe the determination of the current account surplus as dependent upon incomes in the two countries, and the real exchange rate. u_1 is a shock parameter. (12, 12') and (14, 14') are asset demand functions, dependent on real wealth (W−P, W*−P*), income and expected exchange rate depreciation ($\dot{E}^e$), u_1 being another shock parameter. I (13, 13') are identities which ensure that exchange rate revaluations are captured in the wealth terms. Finally (15, 15') below describe the formation of aggregate demand in the two countries; this depends on government spending, the current account surplus (determined in (11, 11'), real wealth, expected inflation and expected depreciation.

$$cab = -k_1y+k_1{}^*\phi^{-1}y^*+k_2(E+P_d-P^*_d)+u_1 \tag{11}$$

$$cab^* = -k_1y^*+k_1\phi y-k_2\phi(E+P_d-P^*_d)-\phi u_1 \tag{11'}$$

$$(H_p-P) = (a_1(W-P)+a_2y) - a_3\dot{E}^e+u_2 \tag{12}$$

$$(L_p{}^*-p^*) = (a_1{}^*(W^*-P^*)+a_2{}^*y^*) + a_3{}^*\dot{E}^e+u_2{}^* \tag{12'}$$

$$(\mu_2+\mu_3)W = \mu_2H_p+\mu_3(L_p+E) \qquad I(13)$$

$$(\mu_2{}^*+\mu_3{}^*)W^* = \mu_2{}^*L_p+\mu_3{}^*(H_p{}^*-E) \qquad I(13')$$

$$(L_p+E-P) = \left[(1+\mu_3\mu_3{}^{-1}(1-a_1)\ (W-P)-\mu_3{}^{-1}\mu_2a_2y\right] + \mu_3{}^{-1}\mu_2a_3\dot{E}^e-\mu_3{}^{-1}\mu_2u_2 \tag{14}$$

$$(H_p{}^*-E-P^*) = \left[1-\mu_3{}^{-1}\mu_2{}^*(1-a_1{}^*)\ (W^*-P^*)-\mu_3{}^{-1}{}^*\mu_2{}^*a_2{}^*y^*\right]$$
$$+ \mu_3{}^{-1}{}^*\mu_2{}^*a_3{}^*\dot{E}^e-\mu_3{}^{*-1}\mu_2{}^*u_2{}^* \tag{14'}$$

$$y = d_1(g+cab)+d_2(W-P) + d_3\dot{P}^e+d_4\dot{E}^e+u_3 \tag{15}$$

$$y^* = d_1{}^*(g^*+cab^*)+d_2{}^*(W^*-P^*) + d_3{}^*\dot{P}^e{}^*-d_4{}^*\dot{E}^e+u_3{}^* \tag{15'}$$

The option of intervention to stabilize or dampen the exchange rate is expressed in (16, 16'), where L_g, $H_g{}^*$ are respectively the domestic and foreign country's foreign exchange reserves and E** is a target exchange rate.

$$\dot{L}_g = f_1(-f_2E-E^{**})-L_g) \quad (16)$$

$$\dot{H}_g^* = f_1(f_2^*(E-E^{**})-H_g^*) \quad (16')$$

Given a value for f_1, setting f_2 to zero eliminates intervention and allows the model to solve under the assumption of flexible exchange rates.

No explicit equations are listed for the determination of expectations since these are assumed to be rational and the model is solved under this assumption, using the PRISM package (Al-Nowaihi, et al. (1984)). For this purpose, the exchange rate and the rate of wage inflation (q) are treated as jump variables. To ensure non-explosive solutions, it was found convenient to work with price-deflated variables throughout; this implies inter alia that when intervention is switched in ($f_2 \neq 0$), the target is a real exchange rate. Basic case parameter values are listed in the Appendix.

Simulation Properties and the Effect of Intervention (Table 1)

We leave on one side a discussion of the long run properties of the model (those are reviewed in Artis and Gazioglu (1986a)) and proceed to examine the effects of foreign exchange market intervention. This is done by way of computing the effects of a pre-specified set of disturbances with and without intervention. The results are shown in Table 1, where the left hand column under each shock pertains to the floating rate regime, the right hand one to a regime in which foreign exchange market intervention takes place. Five types of disturbances are considered; a government spending shock, a capacity shock, a net export shock (u_1), an asset demand shock (u_2) and an aggregate demand shock (u_3). The results are then shown as the impact and (in parentheses) the long run effect, computed as the deviation from base. In order to generate the results shown for the intervention case, the f_2 parameter in the intervention equation was chosen so as to minimize the short run impact on the real exchange rate of the u_2 (asset demand) disturbance. Clearly, a different choice criterion could have been chosen; this one was appealing because exchange rate targeting has been advocated as especially suitable for cases where the predominant disturbances are in asset demands (see e.g. McKinnon (1983)), and indeed it seemed interesting to enquire what consequences would follow from having chosen to intervene on such grounds when the shocks turn out to be of a different nature. We now turn to each of the shocks in turn.

A Government Spending Shock (g) The long run effects of the spending shocks are not significantly altered by intervention, but it is evident that the short run impact is substantially changed. The real exchange rate appreciates less[1] and partly in consequence there is a more pronounced expansionary impact on domestic output and a less pronounced deflationary one on foreign output, whilst inflation is increased more in the home country and less in the foreign country. The budget deficit accordingly rises less in the home country and falls more in the foreign country.

A Capacity Shock ($\bar{y}$) The capacity shock requires a long run depreciation of the real exchange rate (essentially to stimulate the additional demand required to meet the added supply); the extent of this, however, is less in the case where the exchange rate is smoothed through intervention. There is a bigger fall in inflation, which helps to create additional private sector demand in this case, foreign inflation now rising, not falling. Short run differences in impact are quite pronounced, the much smaller real depreciation

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1. There is a long run appreciation in the real exchange rate following fiscal expansion, as discussed in detail in Artis and Gazioglu (1986). In brief, with output tied in the long run to the natural rate this "Reaganomics" result comes about as a rise in government demand requires an accommodating fall in net exports, and this in turn is achieved through an appreciation of the real exchange rate.

leading to a more modest increase in domestic output and a smaller fall in foreign output, and to a larger decline in inflation at home, but a smaller one overseas.

A Net Exports Shock (u_1) The exchange rate intervention makes a considerable difference to the impact effect of the net export shock; with a much reduced appreciation under intervention the net export shock is transmitted into considerably higher output, more inflation and a lower budget deficit in the short run with opposing impacts on the foreign country. Indeed these effects spill over into the model's "long run" solution.[1]

An Asset Demand Shock (u_2) The asset demand shock causes the real exchange rate to appreciate on impact, resulting in some decline in domestic output and inflation and a consequential rise in the budget deficit and deterioration in the balance of payments. In the long run, the shock washes out and leaves no trace. The intervention regime simply dampens all the short run responses as the initial departure of the exchange rate is reduced.

An Aggregate Demand Shock (u_3) The aggregate demand shock under free floating raises domestic output and inflation, reduces the budget deficit and leads to a deterioration in the current account of the balance of payments. Nonetheless, the exchange rate appreciates, as the domestic inflation differential makes foreign assets more attractive unless there is a compensating exchange rate gain in prospect. The rise in the exchange rate helps to damp out the

1. This is arbitrarily fixed at 30 "periods" but the analytical properties of the model require output deviations to go to zero in the long run (inflation surprises cannot be indefinitely maintained under rational expectations).

expansion and in the long run the output and inflation effects tend towards zero. Intervention tends to dampen the initial departure of the exchange rate, raising the domestic output and inflation effects in the short run with compensating reductions in the overseas impacts and consequential effects on the budget deficit at home and overseas as well as on the current account deficit.

Overall, intervention has a marked effect on the model, uniformly reducing (real) exchange volatility, but thereby increasing output and inflation impacts in those cases where an induced appreciation is serving to dampen these impacts, whilst reducing the output and inflation declines which would otherwise be associated, through exchange rate appreciation, with an asset demand shock.

Asymmetries in Wage Behaviour

In the simulation model used in this paper the key parameters of wage behaviour are those which pertain to the sensitivity of wage inflation to the pressure of demand (h_o, h_o*) and those which pertain to the responsiveness of wages to prices (h_1, h_2, h_1*, h_2*). Available empirical evidence suggests that asymmetries in wage behaviour, as between Germany on the one hand and other members of the EMS on the other, can conveniently - if loosely - be stylized as the possession by Germany of a high degree of responsiveness to labour market excess demand (Phillips Curve slope) and a relatively low degree of responsiveness of wages to prices. In Artis et al. (1984, 1986) this emerges in a particularly stark form since the estimation procedure submits to test at an early stage of the work the propriety of assuming long run dynamic homogeneity of wages in prices in a generously specified model of the wage process and this restriction is decisively rejected for Germany, though accepted for each of the other countries

TABLE 1: SHORT (AND LONG RUN) EFFECTS ON SELECTED VARIABLES OF SPECIFIED SHOCKS: BASIC CASE PARAMETER VALUES [(a)], UNDER FREE FLOAT (FF) AND INTERVENTION (I)

Shock	g		$\bar{y}$		u_1		u_2		u_3	
Regime	FF	I	FF	I	FF	I	FF	I	FF	I
Real Exchange Rate	-0.139 (-0.091)	-0.034 (-0.078)	0.198 (0.170)	0.049 (0.141)	-0.312 (-0.333)	-0.076 (-0.274)	-0.146 (0.0)	-0.043 (-0.001)	-0.046 (0.0)	-0.016 (-0.001)
Output:										
domestic	0.879 (0.0)	1.105 (-0.001)	0.486 (1.000)	0.161 (1.002)	0.044 (0.0)	0.557 (0.005)	-0.295 (0.0)	-0.071 (0.0)	0.517 (0.0)	0.620 (0.0)
foreign	0.758 (0.0)	-0.531 (0.001)	-0.395 (0.0)	-0.071 (-0.002)	-0.044 (0.0)	-0.557 (-0.005)	0.295 (0.0)	0.071 (0.0)	0.392 (0.0)	0.289 (0.004)
Inflation:										
domestic	0.176 (1.009)	0.221 (1.090)	-0.103 (-0.404)	-0.168 (-0.576)	0.009 (0.0)	0.111 (0.355)	-0.059 (0.0)	-0.014 (-0.008)	0.103 (0.001)	0.124 (-0.007)
foreign	0.152 (0.103)	0.106 (0.021)	-0.079 (-0.041)	-0.014 (0.131)	-0.009 (0.0)	-0.111 (-0.355)	0.059 (0.0)	0.014 (0.008)	0.078 (-0.001)	0.058 (0.007)
Budget Deficit:										
domestic	0.649 (1.000)	0.538 (1.000)	-0.194 (-0.400)	-0.065 (-0.401)	-0.018 (0.0)	-0.223 (0.002)	0.118 (-0.0)	0.029 (0.0)	-0.207 (0.0)	-0.248 (0.0)
foreign	-0.303 (0.0)	-0.213 (0.0)	0.158 (0.0)	0.028 (0.001)	0.018 (0.0)	0.223 (-0.002)	-0.118 (0.0)	-0.029 (0.0)	-0.157 (0.0)	-0.115 (0.0)
Balance of Payments on Current Account	-0.464 (-0.274)	-0.333 (-0.232)	0.242 (0.109)	0.053 (0.020)	0.028 (0.0)	0.325 (0.183)	-0.202 (0.0)	-0.073 (-0.004)	-0.241 (0.0)	-0.181 (-0.004)

(a) Listed in the Appendix. In the basic case domestic & foreign parameter values are maintained identical to each other.

examined (viz Italy, France, Netherlands, U.K. and Belgium);[1] indeed, no significant role at all is found for inflation expectations (however modelled - and the 1984 study tests four alternative models) in the German wage equation, though static homogeneity is confirmed. As to the presence of a demand effect, in the 1984 study it was only in the German case that the level of unemployment was found to exert a significant negative effect on wage inflation, though for France the level of vacancies and for the UK a combined set of unemployment and vacancy terms also were found significant. In the 1986 paper an extension of the earlier model broadly confirmed these results.

Further support for the view that the parameters of the German wage inflation process mark it off from the processes to be encountered in other EMS countries can be found in the work of Coe & Gagliardi (1985) who study the determinants of wage inflation in the OECD countries. They note that in a wage equation of the form $\dot{w} = a_o + a_1\dot{p} + a_2u + a_3\dot{q}$ where $\dot{w}$ is the rate of wage growth, $\dot{p}$ is price inflation and $\dot{q}$ is productivity growth, a general expression for 'real wage rigidity' or the sacrifice of unemployment required to dampen out an inflation shock can be found by setting the differential to zero, yielding

$$du = \frac{a_1 d\dot{p} + a_3 d\dot{q}}{a_3}$$

Given that they find estimates of a_3 significant only in the case of Germany, the resultant values for this expression for a unit inflation shock are derived by them as:

1. In the case of Belgium the data accept the imposition of short run homogeneity.

real wage rigidity (%):	France	3.03
	UK	5.82
	Italy	1.62
	Netherlands	4.09 - 5.87[1]
	Germany	0.61[1]

The differing approaches to the measurement of the wage inflation process in the different studies preclude a more definite comparison and the empirical questions undoubtedly deserve more attention. For the present purpose it is sufficient that there is some presumption of asymmetries between the wage processes of members of the EMS.

Simulating the effects of Phillips Curve asymmetries (Tables 2A, 2B)

Within the framework of the present model, these asymmetries can be mimicked by suitable variations in the parameters h_o, h_1 and h_2 (and/or their foreign counterparts). The slope of the Phillips Curve is represented by h_o, set at 0.2 in the basic case where both countries are treated as identical.

As a first step, therefore, we ask how the behaviour of the model is affected by an asymmetry in h_o. Specifically, in Tables 2A and 2B, we report the simulation results of the model as h_o is varied from 0.15 through 0.25 to 0.275. In contrast to later results to be discussed, the degree of financial integration is taken to be high, this being represented by a value of 3.0 for the parameter a_3 in the asset demand function which determines the substitutability of the foreign and domestic assets. Because only h_o is varied, h_o* being kept at the 'basic case' value of 0.2; the three cases show what happens as the 'domestic' country's Phillips Curve is (Case I) slightly flatter,

1. The former figure in the case of the Netherlands is derived assuming mean levels of unemployment in the estimation period and the latter figure, as well as that for Germany, by assuming the unemployment levels of the first half of 1984.

Table 2A. Financial Integration with Asymmetry in the Phillips Curve Slopes: short and (long run) effects on the real exchange rate and output of specified shocks.*

Shock	I: $h_o = 0.15$ Real Exchange Rate	I: Output Domestic	I: Output Foreign	II: $h_o = 0.25$ Real Exchange Rate	II: Output Domestic	II: Output Foreign	III: $h_o = 0.275$ Real Exchange Rate	III: Output Domestic	III: Output Foreign
g	0.001 (0.108)	1.200 (1.176)	0.465 (-0.000)	-0.085 (0.055)	0.982 (0.869)	0.632 (-0.000)	-0.164 (-0.043)	0.807 (0.292)	-0.501 (-0.001)
g^*	0.278 (0.115)	1.074 (0.131)	0.586 (0.000)	0.202 (0.109)	0.882 (0.097)	0.734 (0.000)	0.129 (0.099)	0.721 (0.033)	0.891 (IO.001)
$\bar{y}$	0.128 (0.090)	0.323 (0.528)	-0.248 (0.000)	0.175 (0.111)	0.442 (0.651)	-0.339 (0.000)	0.215 (0.151)	0.531 (0.833)	-0.424 (0.000)
$\bar{y}^*$	-0.269 (-0.179)	-0.556 (-0.052)	0.634 (1.000)	-0.230 (-0.177)	-0.458 (-0.039)	0.560 (1.000)	-0.193 (-0.173)	-0.376 (-0.013)	0.479 (1.000)
u_1	-0.313 (-0.333)	0.045 (0.001)	-0.044 (0.000)	-0.315 [illegible]	0.038 (0.001)	-0.039 (0.000)	-0.315 (-0.333)	0.038 (0.000)	-0.039 (0.000)
u_2	-0.104 (-0.001)	-0.214 (-0.002)	0.209 (-0.000)	-0.093 (-0.001)	-0.184 (-0.002)	0.188 (-0.000)	-0.092 (-0.000)	-0.182 (-0.001)	0.188 (-0.000)
u_2^*	0.104 (0.001)	0.214 (0.002)	-0.209 (0.000)	0.093 (0.001)	0.184 (0.002)	-0.188 (0.000)	0.092 (0.000)	0.182 (0.001)	-0.188 (0.000)
u_3	-0.012 (0.000)	0.639 (0.003)	0.285 (0.000)	-0.052 (0.000)	0.535 (0.002)	0.362 (0.000)	-0.082 (0.000)	0.467 (IO.001)	0.426 (IO.000)
u_3^*	0.118 (-0.000)	-0.516 (0.001)	0.405 (0.000)	0.085 (-0.000)	0.432 (-0.001)	0.468 (-0.000)	0.055 (-0.000)	0.366 (-0.000)	0.531 (-0.000)
u_4	0.246 (-0.006)	0.540 (-3.351)	-0.528 (-3.333)	0.218 (0.146)	0.466 (-2.477)	-0.476 (-3.333)	0.113 (0.238)	0.241 (-3.151)	-0.249 (-4.545)

* Notes: (1) a_3 is the substitution parameter in the asset demand functions (cf. equations (12), (12)'), with a value of 2.0 in the basic case (Table 1), and of 3.0 here, representing a high degree of financial integration.

(2) h_o is the slope of the Phillips curve (cf. equations (3), (3)'), with a value of 0.2 in the basic run (Table 1). Here the Phillips Curve slope of the domestic country is varied, while that of the foreign country is held at the basic case value.

Table 2B. Financial Integration with Asymmetry in the Phillips Curve slopes: short and (long-run) effects on inflation of specified shocks.*

	I : $h_o = 0.15$		II : $h_o = 0.25$		III : $h_o = 0.275$	
	Inflation		Inflation		Inflation	
Shock	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
g	0.180 (0.529)	0.093 (0.059)	0.245 (0.651)	0.126 (0.073)	0.260 (0.609)	0.132 (0.134)
g^*	0.096 (0.001)	0.057 (-0.000)	0.220 (0.074)	0.147 (0.998)	0.234 (0.179)	0.151 (0.900)
$\bar{y}$	-0.102 (-0.212)	-0.050 (-0.023)	-0.139 (-0.261)	-0.068 (-0.029)	-0.148 (-0.251)	-0.071 (-0.063)
$\bar{y}^*$	-0.083 (-0.023)	-0.073 (-0.400)	-0.115 (-0.029)	-0.088 (-0.400)	-0.122 (-0.064)	-0.090 (-0.373)
u_1	0.007 (0.000)	-0.009 (-0.001)	0.010 (0.000)	-0.008 (-0.001)	0.010 (0.007)	-0.008 (-0.009)
u_2	-0.032 (-0.001)	0.042 (0.002)	-0.046 (-0.001)	0.038 (0.002)	-0.049 (-0.019)	0.031 (0.024)
u_2^*	0.032 (0.001)	-0.042 (-0.002)	0.046 (0.001)	-0.038 (-0.002)	0.049 (0.019)	-0.037 (-0.024)
u_3	0.096 (0.001)	0.057 (-0.000)	0.134 (0.002)	0.072 (-0.000)	0.142 (0.016)	0.075 (-0.012)
u_3^*	0.077 (-0.001)	0.001 (0.003)	0.108 (-0.001)	0.094 (0.003)	0.115 (-0.016)	0.095 (0.032)
u_4	0.081 (1.491)	-0.106 (1.490)	0.116 (1.142)	-0.095 (1.451)	0.124 (1.126)	-0.093 (1.508)

* For table notes, see Table 2A.

(Case II) slightly steeper or (Case III) much steeper than that of the foreign country. Because of the asymmetry which is now introduced, certain shocks are no longer symmetrical in their effects and the list of disturbances to be considered is increased in consequence. To ease the expositional burden the number of endogenous variables considered has been reduced to five - the real exchange rate, domestic and foreign output and domestic and foreign inflation. We now turn to consider how the response of these variables to the various shocks varies according to the slope of the Phillips Curve.

Effects on the Real Exchange Rate The relative slope of the Phillips Curve is clearly of considerable consequence to the behaviour of the real exchange rate. The case of the domestic government spending shock is particularly notable in this respect. As the Phillips Curve slope is increased the real exchange rate impact of this shock is changed from one of depreciation to one of appreciation; elsewhere the real exchange rate impact varies monotically with h_o, except in the case of the u_1 (net exports) shock where the real exchange rate effect seems to be inelastic with respect to the Phillips Curve slope. For the asset demand (u_2) shock, the effects are symmetrical between foreign and domestic shocks; for the u_3, aggregate demand, shock however the effects are only qualitatively symmetrical. The inflation shock (u_4) has a smaller (depreciation) impact on the real exchange rate the bigger the Phillips Curve slope. The effects of the capacity shocks on the real exchange rate, whilst qualitatively symmetrical, now depend heavily on their source. A domestic capacity shock creates a depreciation impact on the real exchange rate which is smaller than the appreciation impact of a foreign capacity shock: but the differences appear to diminish as the relative slope of the domestic country's Phillips Curve is increased.

Output Effects The effects of Phillips Curve asymmetry on output are similarly marked. A domestic fiscal expansion (g-shock) has smaller impact on domestic output (and larger impact on foreign output) the larger the Phillips Curve slope of the domestic country. A foreign fiscal shock, similarly, has less effect on domestic output the larger is the domestic country's relative Phillips Curve slope. (As might be expected, the higher the Phillips Curve slope, the greater the inflation response - **see Table** 2B - to fiscal stimulus and the more the appreciation of the real exchange rate. Thus, the Phillips Curve slope plays an important role in the crowding out of fiscal policy).[1]

The Phillips Curve slope also plays an important role in mediating the effects of the capacity shock, where a higher slope is favourable to a larger rise in domestic output and a bigger fall in foreign output in the short run.[2] Foreign capacity shocks have less expansionary effects on foreign output and less contractionary effects on domestic output as the domestic Phillips Curve is steepened.

The effect of the net export shock on output in the two countries is only very mildly sensitive to the Phillips Curve slope, with the expansionary impact on domestic output rising slightly as the slope increases and the **contractionary** impact on foreign output diminishing;

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1. It will be seen that the "long run" domestic output effects of this shock are quoted as non-zero values, so that the model has not fully converged after 30 "periods". The natural rate property of the model ensures analytically that the long run effect of a demand shock is zero.

2. Once again, as with the domestic output effects of a domestic fiscal shock, it is evident that the "long run" domestic capacity shock effects are not as analytically they should be (identically unity in this case). Note that the discrepancy appears to be confined to the 'domestic' country effects of the capacity shocks.

but these effects are only visible as the slope is raised from 0.15 to 0.25 and vanish at the higher value.

The symmetry of the asset demand (u_2) shock is wholly unaffected by the variations in the Phillips Curve slope examined in Table 2, which effect the output impacts only in a mild way.

For the aggregate demand (u_3) shock, however, there is some evidence of asymmetry, though surprisingly it does not appear to be the case that the country with the relatively lower Phillips Curve slope necessarily evinces a stronger expansionary effect on output from an aggregate demand shock - compare cases I and III where this is so, with Case II where it is not.[1] Evidently, the absolute, as well as the relative levels of the parameter are important.

Effects on Inflation

Table 2B reports the effects on domestic and foreign inflation of the same shocks, when the asymmetry in the Phillips Curve slope is introduced. Not surprisingly, the domestic inflation impact of domestic demand shocks (g, u_1, u_3) rises as the Phillips Curve slope is increased: only a little less obviously, perhaps, the same is true also of the foreign inflation impact of these same shocks except, naturally, where the shock is distributive as in the case of a shock to net exports. As the countries are intervening on the real exchange rate a degree of accomodation of inflation shocks is implied. The capacity shocks (u, y^*) mutatis mutandis, are similarly affected by an increase in the domestic country's Phillips Curve slope: the resultant deflationary impact is thereby increased, in both countries. The asset demand (u_2) shock, which again has a distributive character, is associated with an increasingly deflationary domestic but increasingly inflationary foreign impact as the Phillips Curve slope is increased (and vice versa for u_2^*). The inflation shock per se (u_4) produces an

1. Recall that h_o^* is maintained at 0.2, the basic case value.

increasingly inflationary impact at home, and an increasingly deflationary impact abroad as the Phillips Curve slope is raised.

Simulating the Effects of Exchange Controls (Tables 3A, 3B)

A practical means of limiting exchange rate variation without intervention is exemplified by the use of exchange controls. Whilst these may take many forms and can be analysed from different points of view accordingly, it is common to regard them as reducing the degree of financial integration (see Johnston (1979), Otani and Tiwari (1981) for examples). In the framework of the present model this can be mimicked by reducing the value of a_3, the parameter on the expected exchange rate, in the asset demand function.

Thus in Tables 3A and B we present results for the case where a_3 has been reduced to a value of 0.2 from the value of 3.0 it held in Tables 2A and B. Two variants for values of h_o are presented, 0.25 and 0.275, corresponding to cases II and III of Tables 2A and 2B with which the results shown in Table 3 may be compared.

Upon doing so, we see that the values of a_3 and h_o are in fact highly interactive in a number of cases. Comparing the results first for the real exchange rate in Case II (Table 2A) and II' (Table 3A), it can be seen that the impacts are dampened by lower financial integration in every case except that of the asset demand shock. This seems to be, broadly, what we might expect. The imposition of a lower degree of financial integration generally serves to make the exchange market more sluggish, but the effect of a shock in the asset market itself is an inversion of this sluggish behaviour and actually makes for a more disruptive response. Comparing Case III and III' however, for a higher value of h_o, reveals four additional cases in which the real exchange rate impact effect is increased by reducing the degree of financial integration. Whilst entirely possible in principle, the extent

Table 3A. Asymmetry in the Phillips Curve slopes with reduced financial integration: short & (long-run) effects on the real exchange rate and output of specified shocks.*

Shock	II': $h_o = 0.25$ Real exchange rate	II': Output Domestic	II': Output Foreign	III': $h_o = 0.275$ Real exchange rate	III': Output Domestic	III': Output Foreign
g	−0.078 (0.059)	0.997 (0.874)	0.617 (0.000)	−0.094 (0.048)	0.955 (0.820)	0.649 (−0.000)
g^*	0.186 (0.107)	0.850 (0.091)	0.768 (0.000)	0.172 (0.106)	0.815 (0.086)	0.794 (0.000)
$\bar{y}$	0.168 (0.110)	0.428 (0.650)	−0.324 (0.000)	0.177 (0.114)	0.452 (0.671)	−0.342 (0.000)
$\bar{y}^*$	−0.220 (−0.176)	−0.436 (−0.036)	0.537 (1.000)	−0.213 (−0.176)	−0.418 (−0.034)	0.523 (1.000)
u_1	−0.307 (−0.333)	0.054 (0.000)	−0.056 (0.000)	−0.308 (−0.333)	0.052 (0.000)	−0.054 (0.000)
u_2	−0.133 (−0.000)	−0.263 (−0.001)	0.269 (−0.000)	−0.130 (0.000)	−0.254 (−0.001)	0.263 (0.000)
u_2^*	0.133 (0.000)	0.263 (0.001)	−0.269 (0.000)	0.130 (0.000)	0.254 (0.001)	−0.263 (0.000)
u_3	−0.050 (0.000)	0.540 (0.002)	0.357 (0.000)	−0.057 (0.000)	0.520 (0.002)	0.372 (0.000)
u_3^*	0.079 (0.000)	0.420 (0.000)	0.479 (−0.000)	0.172 (0.106)	0.815 (0.086)	0.794 (−0.000)
u_4	0.204 (0.145)	0.438 (−2.478)	−0.448 (−3.333)	0.199 (0.171)	0.424 (−2.327)	−0.439 (3.333)

* Notes : Parameter a_3 set at 0.2 to characterize low financial integration (cf. Table 2); parameter h_o, the Phillips Curve slope in the domestic country is varied from 0.25 to 0.275 (cf. Table 2 for a more extended variation).

Table 3B. Asymmetry in the Phillips Curve slope with reduced financial integration: short and (long-run) effects on inflation of specified shocks*

	II' : h_o = 0.25		III' : h_o = 0.275	
	Inflation		Inflation	
Shock	Domestic	Foreign	Domestic	Foreign
g	0.249 (0.655)	0.123 (0.069)	0.263 (0.677)	0.130 (0.071)
g^*	0.212 (0.069)	0.154 (1.005)	0.224 (0.071)	0.159 (1.005)
$\bar{y}$	−0.143 (−0.263)	−0.065 (−0.027)	−0.151 (−0.271)	−0.068 (−0.028)
$\bar{y}^*$	−0.109 (−0.027)	−0.093 (−0.403)	−0.115 (0.028)	−0.095 (−0.403)
u_1	0.014 (0.000)	−0.011 (−0.000)	0.014 (0.000)	−0.011 (−0.000)
u_2	−0.066 (−0.001)	0.054 (0.001)	−0.070 (−0.001)	0.053 (0.001)
u_2^*	0.066 (0.001)	−0.054 (−0.001)	0.070 (0.001)	−0.053 (−0.001)
u_3	0.135 (0.001)	0.071 (0.000)	0.143 (0.001)	0.074 (0.000)
u_3^*	0.105 (∓0.0)	0.096 (0.0)	0.111 (∓0.000)	0.098 (0.002)
u_4	0.109 (1.141)	−0.090 (1.451)	0.117 (1.080)	−0.088 (1.445)

* For notes, see Table 3A.

of this interaction effect is somewhat surprising, producing the result in this instance that g^*, $\bar{y}^*$, u_3^* and u_4 shocks are all more disruptive in their real exchange rate impacts under a low degree of financial integration than under a high degree. These results suggest caution in appealing to the "second best" theorem to justify the use of exchange controls in a world of sticky wages and prices.

Inspection of the results for output, again comparing Cases II and II', III and III' between Tables 2A and 3A reinforces this impression. In the former case there are several instances in which the output deviation is greater under a lower degree of financial integration; in the latter case, this is true for the majority of shocks considered.

The difference in inflation impacts can be studied by comparing Tables 2B and 3B. Here, it appears that a lowering of the degree of financial integration has the effect of bottling up inflationary impacts domestically - thus, the inflationary response to the g, u_1 and u_3 shocks is increased, as is the deflationary impact of domestic capacity shocks. On the other hand, the response of domestic inflation to foreign shocks (g^*, u_3^*, $\bar{y}^*$) is diminished. Reciprocally, where the impact on domestic inflation is increased, that on foreign inflation is reduced.

The Price Responsiveness of Wages (Tables 4A-4C)

Tables 4A-C introduce an additional source of asymmetry in wage behaviour, this time in respect of the response of wages to prices. In the model this is represented by the parameters h_1, h_2. In the earlier discussion, we found that the distinctive character of the German wage inflation process appeared to reside in its comparative lack of response to prices as well as in a high degree of response to excess demand in the labour market. Thus, in terms of our present model set-up to mimic this requires endowing the country with the relatively high

h_o parameter value with comparatively low values of the h_1, h_2 parameters - or equivalently, to endow the 'other' country with relatively high h_1*, h_2* values. This latter is what is done in Tables 4A-C.

In these tables we report the impacts on the real exchange rate, domestic and foreign output, as the parameter sets h_o, h_1*, h_2* and a_3 are varied for a single (domestic fiscal) shock. The choice of shock is illustrative.

As might be expected, for this shock, the two parameter variations have broadly opposing impacts. As the relative slope of the domestic country's Phillips Curve is increased (h_o rising), the real exchange rate appreciation impact is increased, and as the relative price-response parameters are reduced (h_1*, h_2* rising) the appreciation impact is reduced. In a similar way, the output impacts are also opposing.

For given values of h_1*, h_2* and h_o = 0.3, it seems clear that the lower the degree of financial integration the lower the amount of exchange rate overshooting, though the sensitivity of overshooting to the degree of financial integration as the h_1*, h_2* parameters are raised tends to decline the higher the degree of financial integration. Variations in the h_o parameter, however, are capable of overturning this picture; with a low value (0.15), for this parameter, for example, overshooting appears to *decrease* with the degree of financial integration whilst for the next two higher variations of this parameter (h_o = 0.2, 0.251), the largest degree of overshooting is to be found in the 'middle' range of financial integration.

The output impacts seem more straightforward; the broad picture is, as might be expected for this shock, that a higher domestic Phillips Curve slope reduces the domestic output impact and raises the foreign output impact, for all degrees of financial integration. At the same time, a reduction in the relative degree of wage indexation raises the domestic output and reduces the foreign output impacts. An increase in the degree of financial integration, broadly, reduces the domestic output impacts and raises the foreign output impact.

Conclusions

The motivation of the paper was provided by evidence from the EMS that wage-price behaviour is marked by strong asymmetries between member countries. As is well known, two of the leading EMS members dispose of exchange controls which reduce the degree of financial integration between them, and it seemed pertinent therefore to enquire simultaneously into the effects of wage-price asymmetries and the effects of high and low degrees of financial integration.

Because of the source of the motivation, we also assumed a degree of exchange rate intervention.[1]

The simulations reviewed do not yield a simple set of conclusions. Perhaps this is the most important conclusion itself to stress. There is a high degree of interaction between the parameter values under consideration, and it often proved incorrect to infer the effect of a combined change in parameter values from the effects of changes in parameters taken singly. In particular, we did not find that a lower degree of financial integration was a reliable offset to the effects of asymmetry in wage - price behaviour, even though reduced financial integration generally did dampen exchange rate volatility.

1. Because of the set-up of the model, the exchange rate in question is the real exchange rate - however, the smoothing of the real exchange rate is accomplished by financial intervention and to this extent mimics an indexed form of EMS-type arrangements.

TABLE 4A: ASYMMETRIES IN PHILLIPS CURVE SLOPES (h_o) & PRICE RESPONSIVENESS (h_1*, h_2*) WITH VARIATION IN THE DEGREE (a_3) OF FINANCIAL INTEGRATION: SHORT AND (LONG RUN) EFFECTS ON THE REAL EXCHANGE RATE OF A DOMESTIC FISCAL (g) SHOCK. *

	Higher financial integration (a_3 = 0.3)				Lower financial integration (a_3 = 0.2)				Minimal financial integration (a_3 = 0.1)			
$h_1^* = h_2^*$	1.5	1.25	1.15	1.10	1.5	1.25	1.15	1.10	1.5	1.25	1.15	1.1[illegible]
h_o = 0.3	+	-0.149 (-0.003)	-0.167 (-0.030)	-0.178 (-0.047)	-0.109 (0.040)	-0.139 (-0.020)	-0.156 (0.028)	-0.167 (-0.045)	-0.089 (0.040)	-0.114 (0.001)	-0.128 (-0.028)	-0.13[illegible] (-0.04[illegible]
h_o = 0.275	+				-0.094 (0.048)				-0.074 (0.048)			
h_o = 0.251	0.085 (0.055)				-0.078 (0.186)				-0.059 (0.057)			
h_o = 0.2	-0.046 (0.078)				-0.040 (0.079)				-0.024 (0.080)			
h_o = 0.15	0.001 (0.108)				-0.040 (0.079)				0.018 (0.110)			

* Notes: h_o* and h_1, h_2 are maintained at their base values (viz: 0.2, 1.0, 1.0)

\+ System does not solve.

TABLE 4B: ASYMMETRIES IN PHILLIPS CURVE SLOPES (h_o) & PRICE RESPONSIVENESS (h_1*, h_2*) WITH VARIATION IN THE DEGREE OF FINANCIAL INTEGRATION (a_3): SHORT AND (LONG RUN) EFFECTS ON DOMESTIC OUTPUT OF A DOMESTIC FISCAL (g) SHOCK.*

	Higher financial integration ($a_3 = 0.3$)				Lower financial integration ($a_3 = 0.2$)				Minimal financial integration ($a_3 = 0.1$)			
$h_1^* = h_2^*$	1.5	1.25	1.15	1.10	1.5	1.25	1.15	1.10	1.5	1.25	1.15	1.10
$h_o = 0.3$	+	0.833 (0.526)	0.795 (0.371)	0.772 (0.271)	0.916 (0.773)	0.854 (0.530	0.818 (0.373)	0.795 (0.272)	0.959 (0.774)	0.906 (0.531)	0.876 (0.374	0.856 (0.273
$h_o = 0.275$	+		0.807 (0.292)		0.955 (0.820)				0.996 (0.822)			
$h_o = 0.25$	0.980 (0.869)				0.997 (0.874)				1.037 (0.875)			
$h_o = 0.20$	1.080 (1.000)				1.093 (1.004)				1.128 (1.006)			
$h_o = 0.015$	1.199 (1.176)								1.237 (1.182)			

* Notes: h_o* & h_1, h_2 are maintained at their basic values (viz 0.2, 1.0, 1.0)

\+ System does not solve.

TABLE 4C: ASYMMETRIESIN PHILLIPS CURVE SLOPES (h_o) & PRICE RESPONSIVENESS (h_1*, h_2*) WITH VARIATION IN THE DEGREE OF FINANCIAL INTEGRATION (a_3): SHORT AND (LONG RUN) EFFECTS ON FOREIGN OUTPUT OF A DOMESTIC FISCAL (g) SHOCK.*

	Higher financial integration (a_3 = 0.3)				Lower financial integration (a_3 = 0.2)				Minimal financial integration (a_3 = 0.1)			
	1.5	1.25	1.15	1.10	1.5	1.25	1.15	1.1	1.5	1.25	1.15	[illegible]
h_o = 0.3	+	0.765 (-0.000)	0.805 (-0.001)	0.829 (-0.001)	0.678 (0.0)	0.744 (-0.000)	0.782 (-0.000)	0.805 (-0.000)	0.634 (∓0.000)	0.689 (∓0.000)	0.721 (-0.000)	[illegible]
h_o = 0.275	+		0.801 (-0.001)		0.649 (-0.0)				0.606 (∓0.000)			
h_o = 0.25	0.632 (-0.000)				0.617 (-0.0)				0.576 (∓0.000)			
h_o = 0.20	-0.557 (-0.000)				0.543 (-0.000)				0.508 (-0.000)			
h_o = 0.15	0.465 (-0.000)								0.428 (-0.000)			

* Notes: h_o* and h_1, h_2 are maintained at their basic values (viz: 0.2, 1.0, 1.0).

\+ System does not solve.

Appendix

Notation

Foreign counterparts are indicated by *; lower case counterparts to upper case variables are deflated (real) values.

P, P^*	domestic (foreign) consumer price index
Pd, Pd^*	domestic (foreign) value added deflator
E, E^{**}	nominal exchange rate and 'target' nominal exchange rate defined in units of domestic currency per unit of foreign currency
π, π^*	core inflation
q, q^*	contract (foward looking) inflation
p_d, p_d^*	domestic foreign price (value added) inflation
y, y^*	output
$\bar{y}$, $\bar{y}^*$	natural rate of output
H, h	total stock of domestic money (deflation by domestic prices)
L^*, l^*	total stock of foreign money (deflated by foreign prices)
H_p, hp	part of H held by domestic private sector (deflated by foreign prices)
L_p^*, l_p^*	part of L* held by foreign private sector (deflated by foreign CPI)
H_g^*, h_g^*	part of H held by foreign government (deflated by domestic CPI)
L_g, l_g	part of L* held by domestic government (deflated by domestic CPI)
def, def*	government deficit as proportion of mean domestic/foreign output
s, s^*	proportional rate of income tax
cab, cab*	current account surplus as proportion of mean domestic/foreign output
g, g^*	government spending as proportion of average domestic/foreign output
W, W^*; w, w^*	domestic/foreign private sector financial wealth deflated by domestic/foreign consumer prices

cont'd -

Appendix

Cont'd -

Notation

e**	real exchange rate target
e	real exchange rate (defined with respect to producer prices) i.e. $e = E - Pd + Pd^*$ and a real devaluation causes a rise in e
u_i, u^*_i	shock variables

......

Parameters

μ_1	ratio of domestic money stock to domestic output
μ_1^*	ratio of foreign money stock to foreign income
μ_2	ratio of domestic private sector holding of domestic money to domestic output
μ_2^*	ratio of foreign private sector holdings of foreign money to foreign output
μ_3	ratio of domestic private sector holdings foreign money to domestic output
μ_3^*	ratio of foreign private sector holdings of domestic money to foreign output
ϕ	ratio of domestic income to foreign income
μ_4	ratio of foreign money stock held by domestic government to foreign output
μ_4^*	ratio of domestic money stock held by foreign government to domestic output

$$\mu_1 = \mu_2 + \mu_3^* \phi + \mu_4^* \phi$$

$$\mu_1^* = \mu_2^* + \mu_3 \phi^{-1} + \mu_4 \phi^{-1}$$

Basic Case Parameter Values

Cont'd -

Parameters

In the 'basic case' runs of the model, the following parameter values are assigned, identical values being assumed for the foreign country.

$\phi = 1$	$k_1 = 0.4$	$d_1 = 0.5$
$\mu_1 = 1$	$k_2 = 3$	$d_2 = 0.5$
$\mu_2 = 0.7$	$d_0 = 0.75$	$d_3 = 0.5$
$\mu_3 = 0.2$	$a_1 = 1$ (1, 10)	$d_4 = 0.1$
$\mu_4 = \mu_1 - \mu_2 - \mu_3 = 0.1$	$a_2 = 0$	$f_1 = 0$
$s = 0.4$	$a_3 = 2$ (1, 10)	$f_2 = 0$
$h_1 = 1.0$	$h_o = 0.2$	$h_2 = 1$

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