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The international transmission of economic shocks in a three-country world under mixed exchange rates

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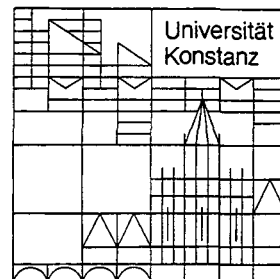
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Fakultät für Wirtschafts-
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UNDER MIXED EXCHANGE RATES***

**Nikolaus K. A. Läufer
Srinivasa Sundararajan**

*With Comments by
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Abstract

The international transmission of economic disturbances is analysed in a three-country world where two countries have no macroeconomic impact on a third country but are large enough to influence each other under a system of mixed exchange rates - a system that combines the fixed exchange rates (FERs) among two EC member countries (Germany and France) and the flexible exchange rates (FLERs) towards a third country, the rest of the world (USA). We find that a positive output demand shock originating in Germany or France has a positive effect on domestic output, but, due to a special third country effect, is likely to produce a *contractionary* impact on foreign output (negative transmission) while the total effect on the world economy is *expansionary*. Money supply shocks in either Germany or France have identical effects on the output of the two countries. The FLER component of the MER regime serves as an important tool for dampening the impact of US shocks on the output of the EC.

The International Transmission of Economic Shocks in a Three-Country World under Mixed Exchange Rates

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I Introduction

Modern stochastic macroeconomic theory¹ asserts that economic disturbances and policies are, in general, transmitted across countries, although the channels of transmission and the exact way in which economies respond to foreign shocks – whether the transmission is positive or negative – may depend on the type of exchange rate regime, the type of shock and the degree of capital mobility. Of particular concern has also been the extent to which an economy is insulated from foreign disturbances under a flexible exchange rate (FLER) regime. But researchers have preferred to analyse the transmission of real and monetary shocks² in pure exchange rate regimes, either the FER or the FLER regime.

Long before the inception of the current system of managed exchange rates, a number of studies with open economy macroeconomic models suggested that transmission effects may be smaller under FLERs than under FERs, given the greater insulation properties of the former³. These results suggest that the small transmission effects found in previous research for the OECD area depend largely on the existence of FLERs among the countries of this region. One is also led to suspect that the degree of interdependence and the transmission of economic shocks may be much larger among the countries forming the European Monetary System (EMS). The EMS region is, in fact, characterised by a very high degree of openness, pegged exchange rates and economic integration between the member countries. But the EMS is really a system of mixed exchange rates (MERs) – a system that combines FERs among EC member countries and FLERs towards the rest of the world, especially the USA – a feature that so far has not been analyzed sufficiently.

A review of the literature clearly reveals that studies of MER regimes are conspicuously rare. In particular, because of the lacuna that exists in the literature concerning the international transmission of real and monetary shocks under MERs, the purpose of the present paper is to extend LS's (1992) analysis of a three-country world in order to examine the

¹We thank the German Research Foundation through Special Research Project 178 for financial assistance.

²The interested readers are referred to Laursen and Metzler (1950), Branson and Rotemberg (1980), Cox (1980), Schmid (1982), Corden and Turnovsky (1983) and Argy and Salop (1983) for studies of negative transmission of foreign monetary disturbances.

³See Friedman (1953), Meade (1950), Mundell (1963, 1968), Dornbusch (1976), Mussa (1977), Turnovsky and Kingston (1977), Turnovsky (1981), Marston (1984), Argy et al. (1989), and Läufer and Sundararajan (=LS) (1992).

domestic impact and the international transmission of real and monetary shocks. Each of these disturbances has potential effects that depend on several factors like the degree of wage indexation, the type of exchange rate regime etc. The model used in this paper differs from other existing three-country models in several aspects. Firstly, we replace Marston's three-country assumption of a small open economy facing two large economies on which it has no impact. Instead, we assume that two countries have no macroeconomic impact on a third country, but are large enough to influence each other. Secondly, we also remove Marston's (1984) worrisome asymmetry between the degrees of wage indexation at home and abroad, as suggested by Kenen (1984) in his comments on Marston's model.⁴ Thirdly, we extend Marston's supply side specification and thus avoid the fixed price assumptions of the MER analysis of Levin (1983). Fourthly, we distinguish between real and nominal interest rates and allow for expected changes of the flexible exchange rates. Thus we avoid money illusion and static exchange rate expectations and the exogeneity of the interest rate built into the MER analyses of Feuerstein and Siebke (1990) and Feuerstein (1992).

Section II presents our model, section III derives comparative static solutions for output, producer prices, consumer prices, exchange rates, reserve stocks, and nominal and real interest rates under MERs, and sections IV, V and VI discuss the analytical results. In particular, we clarify the possibility of a *contractionary* impact of positive domestic output demand (or fiscal) shocks on the foreign output (negative international transmission).

In our three-country world, we discover an additional channel by which a negative international transmission of real shocks may occur. The additional channel is given by the FLERs between the two small countries and the rest of the world. A positive real shock in one of the two countries raises the interest rate in both small countries and causes an appreciation of the exchange rates with respect to the large third country. In both small countries, the appreciation will reduce exports to, and increase imports from country c, and thus reduce the demand for their output. With the additional channel, a negative transmission from one (small) country to the other (small) country is now much more likely than in Mundell's two-country world where a relatively high interest elasticity of investment demand is required in the country to which the real shock is transmitted.

II The Model and its Solution

Consider a world consisting of three countries (a, b and c). For simplicity, we assume that countries a and b are identical (symmetric). That is, the structural parameters in the output demand and supply functions, and in the financial equations are the same for both countries. We further assume that countries a and b have no macroeconomic impact on country c but are large enough to influence each other. Thus the behaviour of country c is not modelled explicitly. Following LS's (1992) structure, the model of each country consists of three basic equations: aggregate demand and supply equations for the output produced in a country, and an equation describing equilibrium in financial behaviour. Perfect substitutability is assumed for the non-money assets of all three countries.

⁴See Kenen (1984), p. 441.

II.A The Model

The model is set out as follows:

Demand for Output

$$(1) \quad Y_t^{id} = \alpha_0 + \alpha_1 Y_t^{jd} + \alpha_2 Y_t^c - \alpha_3 r_t^i + \alpha_4 (e_t^{ij} + P_t^j - P_t^i) + \alpha_5 (e_t^{ic} + P_t^c - P_t^i) + u_t^{di},$$

Consumer Price Index

$$(2) \quad q_t^i = h_1 P_t^i + h_2 (e_t^{ij} + P_t^j) + h_3 (e_t^{ic} + P_t^c),$$

Supply of Output

$$(3) \quad Y_t^{is} = \theta (P_t^i - \omega_1 E_{t-1} P_t^i) - \theta b (q_t^i - E_{t-1} q_t^i) - \omega_2 E_{t-1} q_t^i + \theta_0,$$

Money Markets

$$(4) \quad (P_t^i + Y_t^i) - \beta_1 n_t^i + \beta_0 = M_t^{fsi} + \overline{M}_t^{dsi} + u_t^{mi},$$

Equilibrium Condition

$$(5) \quad Y_t^{id} = Y_t^{is} = Y_t^i,$$

Interest Rate Arbitrage Conditions

$$(6) \quad n_t^i = n_t^c + (E_t e_{t+1}^{ic} - e_t^{ic}),$$

$$(7) \quad r_t^i = n_t^i - (E_t q_{t+1}^i - q_t^i),$$

Triangular Arbitrage Condition

$$(8) \quad e_t^{ic} = e_t^{ij} + e_t^{jc},$$

FER Part of the MER Regime

$$(9) \quad e_t^{ab} = \overline{k}^{ab},$$

$$(10) \quad M_t^{fsa} + (e_t^{ab} + M_t^{fsb}) = \overline{f}^a,$$

Rest of the World Sector

$$(11) \quad Y_t^c = \overline{Y}^c + u_t^{yc},$$

$$(12) \quad P_t^c = \overline{P}^c + u_t^{pc},$$

$$(13) \quad n_t^c = \overline{n}^c + u_t^{nc},$$

where $i, j \in \{a, b\}$ and $i \neq j$. Apart from interest rates, all variables are in logarithms, where superscripts d and s denote demand and supply. All coefficients are positive.

Y^k	real output in country k .
$q^i (E_{t-1}q_t^i)$	actual (expected) consumer price index in country i , defined as the weighted average of domestic and foreign producer prices.
$M^{di} (M^{si})$	money demand (supply) in country i .
$M^{fsi} (\overline{M}^{dsi})$	foreign (exogenous domestic) component of the money supply in country i .
$n^k (r^i)$	nominal (real) interest rate in country k (i).
$u^{di} (u^{mi})$	output demand (money supply) disturbance in country i .
$e^{ik} (E_t e_{t+1}^{ik})$	actual (expected) exchange rate of currency i per unit of currency k .
$P^k (E_{t-1}P_t^i)$	actual (expected) producer prices in country k (i).
F^A	exogenous arithmetic average of the reserve (=foreign) components of the money supplies in countries a and b expressed in currency units of country a .
\overline{f}^a	$2 \ln F^A$.
\overline{k}^{ab}	exogenous value of the exchange rate between countries a and b .
$\overline{Y}^c (\overline{P}^c, \overline{n}^c)$	exogenous value of output (producer prices, nominal interest rates) in country c .
$u_t^{yc} (u_t^{pc}, u_t^{nc})$	output (price, interest rate) disturbance in country c .
$\alpha_1, \dots, \alpha_5$	export, real interest rate, and relative price elasticities of output demand (for theoretical details see Marston (1984), pp. 434-37).
β_1	nominal interest rate elasticity of the money demand.
h_k	expenditure weight in country i for country k 's good.
b	indexation parameter.
λ	elasticity of labour supply with respect to real wages.
$1 - \theta'$	exponent of labour in a Cobb-Douglas production function.
θ	$(1 - \theta')/\theta'$
θ_0	$(1 - \theta')\lambda \ln(1 - \theta')/(\theta'\lambda + 1)$.
ω_1	$1/(\theta'\lambda + 1)$.
ω_2	$\lambda(1 - \theta')/(\theta'\lambda + 1)$.
C_1	$\theta'\lambda/(\theta'\lambda + 1)$.

Equation (1) represents the demand for output in country i . The demand is a function of foreign output, relative prices of foreign and domestic goods, and the real interest rate. In addition, each country is exposed to a real output demand disturbance (u_t^{di}).⁵

Equation (3) explains the supply side of the economy. The supply behaviour is based on a labour contract lag of one period with partial or complete indexation of wages to current prices. Output is responsive to nominal wages relative to domestic prices, but the former is partially or fully indexed to the consumer price index, which is a weighted average of domestic and foreign producer prices. The supply function (3) is derived from a Cobb-Douglas production function, the labour market equilibrium condition determining the contract wage, and the wage indexation equation. The contract wage, reflecting expectations at $t - 1$, is

⁵In equilibrium analysis a positive (negative) output demand disturbance is equivalent to a negative (positive) output supply disturbance.

based on labour demand and supply.⁶ The actual wage rate may differ from the contract wage rate if the indexation parameter is different from zero.⁷

While only domestic prices affect output supply when there is no indexation, domestic as well as foreign producer prices influence output supply (via the consumer price index) if wages are partially or fully indexed.

Equation (4) is a conventional money market equilibrium condition. Real money demand is a positive function of real income and a negative function of the nominal interest rate. The behaviour of money supply in the MER regime is assumed to be a function of an endogenously determined reserve component and an exogenously given domestic component of the money supply. Each country is also exposed to a money supply disturbance (u_t^{mi}).⁸

Equation (5) describes the goods market equilibrium condition. According to equation (6), the domestic interest rate is equal to the foreign interest rate plus the expected rate of depreciation of the domestic currency. The real interest rates in equation (7) is defined as the nominal interest rate minus the expected rate of inflation.

Equation (8) defines the exchange rate between i and c as a residual cross rate. Equations (9) and (10) describe the exogenous values of the exchange rate and reserve components of the money supply in the MER regime⁹

Equations (11) to (13) explain that all the variables referring to country c are exogenously determined. They are expressed as a sum of a constant and a disturbance term.

II.B Solving the Model

Assuming that expectations follow long-run equilibrium values, we solve the equation system by using Aoki's (1981) method¹⁰

to obtain comparative static solutions for seven endogenous variables: Y^i , P^i , q^i , e^{ic} , M^{fsi} , n^i and r^i . Aoki's method permits us (i) to decompose the system into averages and differences of the relevant variables¹¹ and (ii) to calculate the impact of a shock on a

⁶The supply of labour is assumed to be an increasing function of real wages.

⁷See Gray (1976), Fischer (1977), Sachs (1980), Flood and Marión (1982), Turnovsky (1983), Aizenman and Frenkel (1985, 1986) and Devereux (1988) for studies of wage indexation behaviour.

⁸In equilibrium analysis a positive (negative) money supply disturbance is equivalent to a negative (positive) money demand disturbance.

⁹The specification of equation (10) needs some explanation. By definition

$$F^A \stackrel{def}{=} \frac{\tilde{M}_t^{f sa} + \tilde{e}_t^{ab} \tilde{M}_t^{f sb}}{2},$$

where \tilde{M} and \tilde{e} are non-logarithmic equivalents of M and e. If $\tilde{M}_t^{f sa} = \tilde{e}_t^{ab} \tilde{M}_t^{f sb}$, which we assume to be the case in initial equilibrium, the arithmetic mean is equal to the geometric mean. Taking logarithms of the latter, we obtain:

$$\frac{1}{2} \ln \tilde{M}^{f sa} + \frac{1}{2} (\ln \tilde{e}_t^{ab} + \ln \tilde{M}_t^{f sb}) = \ln F^A,$$

which is equivalent to equation (10).

¹⁰See Turnovsky (1986) as a useful example for the application of this method.

¹¹The averages and differences for any variable, say Z, are defined as follows:

$$Z^A = \frac{1}{2}(Z^a + Z^b),$$

$$Z^D = \frac{1}{2}(Z^a - Z^b).$$

particular variable. It makes the model analytically tractable. The 13 equations set out above allow us to solve for all of the endogenous variables contained in our three-country world. After several substitutions and totally differentiating the resulting expressions, we can write the system more compactly both for averages and differences as follows:

Averages:

$$(14) \quad \begin{bmatrix} (1 - \alpha_1) & \alpha_5 & \alpha_3 & -\alpha_5 \\ 1 & -\theta & \theta b & \theta b \\ 1 & 1 & 0 & \beta_1 \\ 0 & -h & 1 & h \end{bmatrix} \begin{bmatrix} dY^A \\ dP^A \\ dr^A \\ de^{ic,A} \end{bmatrix} = \begin{bmatrix} 1 & 0 & \alpha_2 & \alpha_5 & 0 \\ 0 & 0 & 0 & 0 & \theta b \\ 0 & 1 & 0 & 0 & \beta_1 \\ 0 & 0 & 0 & (1 - h) & 1 \end{bmatrix} \begin{bmatrix} du^{d,A} \\ du^{m,A} \\ du^{yc,A} \\ du^{pc,A} \\ du^{nc,A} \end{bmatrix},$$

where $h = h_1 + h_2$. The determinant of the average system is denoted by D_1 , where

$$(15) \quad D_1 = (1 - \alpha_1)\theta[b(1 - h) + \beta_1(1 - bh)] + (\alpha_3 h + \alpha_5)[1 + \beta_1 + \theta(1 - b)] > 0.$$

Differences:

$$(16) \quad \begin{bmatrix} (1 + \alpha_1) & (2\alpha_4 + \alpha_5) & \alpha_3 & 0 \\ 1 & -\theta & \theta b & 0 \\ 0 & -\delta & 1 & 0 \\ 1 & 1 & 0 & -1 \end{bmatrix} \begin{bmatrix} dY^D \\ dP^D \\ dr^D \\ dM^{fs,D} \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} du^{d,D} \\ du^{m,D} \end{bmatrix},$$

where $\delta = h_1 - h_2 > 0^{12}$. The determinant of the difference system, D_2 , is:

$$(17) \quad D_2 = (1 + \alpha_1)\theta(1 - b\delta) + \alpha_3\delta + 2\alpha_4 + \alpha_5 > 0.$$

III Comparative Statics: Goods and Money Market Disturbances

Combining the average and difference systems, we obtain a set of partial derivatives which are listed in the appendix. The qualitative results are summarized in a table.

IV Goods Market Disturbances

In this section, we analyse the effects of output demand shocks originating in countries i and j ($i \neq j$) on the output of country i as well as on the world¹³ output.

¹²This sign is consistent with the high values chosen for domestic expenditure shares by McKibbin and Sachs (1986), Ishii et al. (1985) and Argy et al. (1989).

¹³world=country a + country b

IV.A Own-country effects

A positive demand shock in country i increases its real and nominal output (see (A.1) and (A.3))¹⁴. If $b > 0$, producer prices may fall. But even then nominal output will rise. The rise in nominal output causes an increase in the nominal and real interest rates at all degrees of indexation (see (A.6) and (A.7)). As a consequence, the dollar exchange rate (e^{ic}) falls (see (A.5)), while the mark-franc exchange rate (e^{ab}) stays put at the initial level due to interventions in the foreign exchange market. The depreciation of the dollar, the rise in interest rates and the (relative) price changes reduce the original increase in the demand for output in country i without reversing its effect. The impact of the demand shock on the consumer price index (q^i) (see (A.4)), which is also equal to the sum of the impacts on r^i and e^{ic} (see (A.37)), is ambiguous, irrespective of the degree of indexation.

Indexation ($b > 0$) affects the supply of output in two opposing ways (see Figure 1). Firstly, the higher the degree of indexation, the steeper the slope of the supply curve (slope effect). Secondly, the fall of the dollar exchange rate (induced by the rise in interest rates) tends to lower the consumer price index. It therefore shifts the supply curve downwards (shift effect). A comparison of the results for our MER regime with the results of LS (1992) for the pure FER and FLER regimes suggests various patterns. Firstly, for $b = 0$, while output in country i increases more in the pure FER regime than in the MER regime, the increase is lower with pure FLERs than with MERs. Secondly, for partial indexation ($0 < b < 1$), FLERs are still effective in reducing the variability of output but the difference in output variability between the regimes becomes lower as the degree of indexation increases. Finally, for full indexation ($b = 1$), the increase in output in country a is identical in both the pure FER and the MER regime, while a difference remains between the output change in these and the pure FLER regimes.¹⁵

¹⁴Numbers preceded by A refer to equations in the appendix.

¹⁵In LS (1992), these differences in effectiveness with full indexation are explained by a modelling asymmetry: full indexation both in countries a and b but not in c .

Table 1: Impact of Shocks in Country i on Country j

Effects on	Degree of Indexation	Disturbance								
		u^{d1}		u^{m1}	u^{yc}		u^{pc}		u^{nc}	
		$\beta_1 > 0$	$\beta_1 = 0$	$\beta_1 \geq 0$	$\beta_1 > 0$	$\beta_1 = 0$	$\beta_1 > 0$	$\beta_1 = 0$	$\beta_1 > 0$	$\beta_1 = 0$
Y^j	0	+	+	+	+	0	?	0	?	0
		(?)	(-)							
	$1 > b > 0$	+	+	+	+	+	?	-	?	-
		(?)	(?)							
	1	+	+	0	+	+	-	-	-	-
		(?)	(?)							
P^j	0	+	+	+	+	0	?	0	?	0
		(?)	(?)							
	$1 \geq b > 0$?	?	+	?	-	?	+	?	+
		(?)	(-)							
$Y^j + P^j$	$1 \geq b \geq 0$	+	+	+	+	0	?	0	?	0
		(?)	(-)							
Y^w	0	+	0	+	+	0	?	0	?	0
		(?)								
	$1 > b > 0$	+	+	+	+	+	?	-	?	-
		(?)	(?)							
	1	+	+	0	+	+	-	-	-	-
		(?)	(?)							
q^j	$1 \geq b \geq 0$?	?	+	?	-	+	+	+	+
		(?)	(-)							
e^{jc}	$1 \geq b \geq 0$	-	-	+	-	-	?	?	+	+
		(-)	(-)							
n^j	$1 \geq b \geq 0$	+	+	-	+	+	?	?	?	?
		(+)	(+)							
r^j	$1 > b \geq 0$	+	+	-	+	+	+	+	+	+
		(+)	(+)							
	1	+	+	0	+	+	+	+	+	+
		(+)	(+)							
M^{jsj}	$1 \geq b \geq 0$	+	+	-	0	0	0	0	0	0
		(-)	(-)	(+)						

$i, j \in \{a, b\}$. Where the results may differ for $i = j$ and $i \neq j$ those in round brackets hold for $i \neq j$.

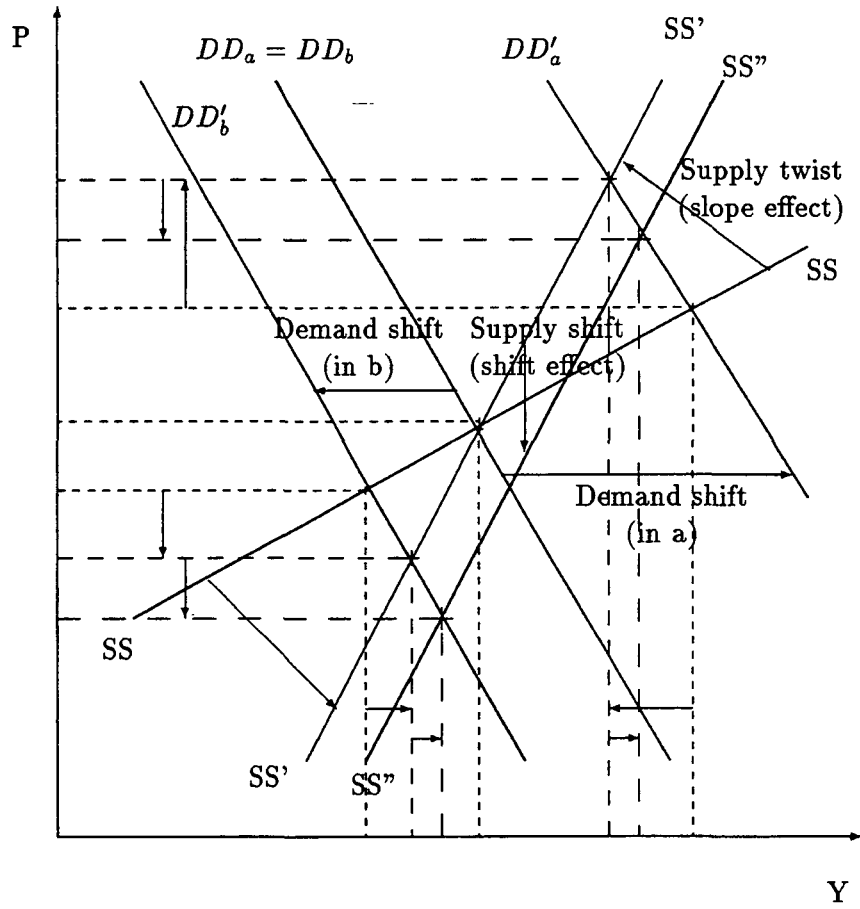


Figure 1: Goods Markets in Countries a and b

IV.B The Cross-Country Effect

One would expect the increased level of country i 's output and prices to stimulate the demand for country j 's commodities and thus to increase output and prices in country j as well. However, we observe from the formulae,

$$(18) \quad \frac{\partial Y^j}{\partial u^{di}} = \frac{\theta}{D_1 D_2} \{ 2\alpha_1 [\beta_1 (1 - bh) + b(1 - h)] (1 - b\delta) \theta \\ - \alpha_3 [\beta_1 (h - \delta) + \theta h (1 - b) (1 - b\delta) + (h - b\delta)] \\ + 2\alpha_4 [b(1 - h) + \beta_1 (1 - bh)] \\ - \alpha_5 [(1 + \theta - \theta b\delta) (1 - b) + b(h - \delta) (1 + \beta_1)] \} \quad ?,$$

$$(19) \quad \frac{\partial P^j}{\partial u^{di}} = \frac{1}{D_1 D_2} \left\{ \alpha_1 \theta \{ \beta_1 [(1 - b\delta) + (1 - bh)] \right. \\ \left. + b(1 - h) [1 - \theta(1 - b\delta)] \} \right. \\ \left. - \alpha_3 \{ \beta_1 (h - \delta) + h [1 + \theta(1 - b)] + \theta b\delta (1 - h) \} \right. \\ \left. + 2\alpha_4 [\beta_1 - \theta b(1 - h)] - \alpha_5 [1 + \theta(1 - bh)] \right. \\ \left. + \theta b \{ \beta_1 (h - \delta) - (1 - h) [1 + \theta(1 - b\delta)] \} \right\} \quad ?,$$

$$(20) \quad \frac{\partial Y^j}{\partial u^{di}} + \frac{\partial P^j}{\partial u^{di}} = \frac{1}{2D_1} \beta_1 [1 + \theta(1 - bh)] - \frac{1}{2D_2} [1 + \theta(1 - b\delta)] \quad ?,$$

that the impact of a positive demand shock in country i on the output of country j ($i \neq j$) is ambiguous. We identify four forces affecting the output in country j : a positive income effect (see α_1 in (18)), a negative real interest rate effect (see α_3 in (18)), a positive relative price (substitution) effect (see α_4 in (18)) and a negative exchange rate effect (see α_5 in (18)). Since the negative real interest rate and exchange rate effects may be stronger than the positive income and substitution effects, a positive demand disturbance in country i may cause both output and prices in country j ($i \neq j$) to decrease in the MER regime.

How is it possible that an output demand shock coming from country i , which has an expansionary effect on that country's output and prices, may produce a contractionary impact on country j 's output and prices? A positive output demand shock in country i increases not only its output, but also prices (if $b = 0$) and real and nominal interest rates. Due to (perfect) capital mobility, the latter are also transmitted to country j and cause the dollar exchange rate, both in country i and j , to fall. The dollar depreciation causes a decline in exports from country j to the third country (rest of the world=US). This adds to the contractive effect of the rise in real interest rates on the interest sensitive output demand in country j .

While Mundell (1968) has drawn attention to the contractionary impact of interest rates on aggregate demand, our exchange rate effect is due to our three-country framework.¹⁶ Exchange rate changes with a *third* country cannot arise in two-country models. Since

¹⁶Our positive substitution effect is also absent from Mundell's framework due to his fixed price assumptions.

the interest rate factor *may* be sufficient to cause a negative transmission from country i to j , the exchange rate factor is not necessary. But the working of the exchange rate factor increases the likelihood and the extent of a negative transmission. If country j 's output demand is not sensitive to interest rates, then, in Mundell's two-country framework, a negative transmission is not possible, while it is still possible in the present three-country framework since the negative exchange rate effect alone may dominate the positive income and substitution effects.

Lowering the interest rate elasticity of money demand, β_1 , increases the likelihood of a negative transmission. More specifically, for zero indexation ($b = 0$), if $\beta_1 = 0$, the transmission cannot be positive and the demand shock in country i produces definitely a contractionary effect on the output of country j . Consistent with the negative transmission, producer and consumer prices will then definitely fall in country j . The fall of the exchange rate, and the increase in real and nominal interest rates will be higher than in the case of $\beta_1 \neq 0$. The exchange rate appreciation tends to lower the rise in consumer prices in country i caused by the increase in producer prices in the same country without reverting it and reinforces the fall in consumer prices in country j caused by the decrease in producer prices there. Of course, lowering the coefficients of the positive income and substitution effects also increases the likelihood of a negative transmission.

IV.C Effects on the World Economy

Now, we turn to the impact of country i 's demand shock on world real output (Y^w), producer prices (P^w)¹⁷ and nominal output (y^w)¹⁸

$$(21) \quad \frac{\partial Y^w}{\partial u^{dj}} = 2 \left\{ \frac{\theta}{2D_1} [b(1-h) + \beta_1(1-bh)] \right\} > 0,$$

$$(22) \quad \frac{\partial P^w}{\partial u^{dj}} = \left\{ \frac{1}{2D_1} [\beta_1 - \theta b(1-h)] \right\} \quad ?,$$

$$(23) \quad \frac{\partial y^w}{\partial u^{dj}} = \frac{\partial Y^w}{\partial u^{dj}} + 2 * \frac{\partial P^w}{\partial u^{dj}}$$

$$(24) \quad = \frac{\beta_1}{D_1} [1 + \theta(1-bh)] > 0.$$

For any degree of indexation, a positive demand shock in country i produces an *expansionary* effect on nominal and real output of the world economy even if there is a negative transmission on country j . Average producer prices in the world may rise or fall as is the case in individual countries.

Increasing the degree of indexation will, on the one hand, steepen the supply curves (slope effect) which tends to reduce changes in equilibrium output and will, on the other hand, increase the downward shifts of the supply curves caused by a fall of the dollar exchange rate (shift effect) which tends to increase output changes. World real output reactions will therefore either increase or decrease with the degree of indexation.

¹⁷World prices are averages of prices in country a and b.

¹⁸For reasons of symmetry, this effect does not depend on the country (a or b) in which the shock originates.

V Money Market Disturbances

V.A Effects on Individual Countries

Due to perfect capital mobility, the effects of money supply shocks on output and other endogenous variables in either country (a or b) do not depend on the country of origin of the monetary shocks. Foreign reserves are an exception. Both countries a and b cannot increase their foreign reserves at the same time. The country in which an expansionary money supply shock occurs will lose reserves and the other country will gain them.¹⁹

An increase in the supply of money in country i puts pressure on the mark-franc exchange rate, and the intervention in the exchange market, which keeps the exchange rate fixed, results in an offsetting reserve outflow to country j ($i \neq j$). Irrespective of the degree of indexation, a one per cent increase in the money stock of country i results in an offsetting reserve outflow to country j equal to 0.5 per cent of j 's money stock (see (A.16)). The monetary shock lowers interest rates in both countries (a and b) (see (A.14) and (A.15)) and causes a depreciation with respect to country c (see (A.12)). Both effects stimulate the demand for output and lead to an increase of real and nominal output (see (A.9) and (A.11)), as well as of producer and consumer prices (see (A.10) and (A.13)) in the two countries.

The output supply curve exhibits again shift and slope effects. An increase in the indexation parameter b steepens the supply curve (slope effect). The depreciation with respect to country c causes an upward shift in the supply curve (if indexation is not zero), a shift which increases with the degree of indexation. An upward shift in the supply curve of country i may also be caused by an increase of producer prices in country j ($i \neq j$). These slope and shift effects of the supply curve reduce the output expansion more and more as the degree of indexation increases. With full indexation, real output and real interest rates do not respond anymore to the monetary shock.²⁰

While the slope and shift effects of the output supply curve lower the real output reaction to a monetary shock as the degree of indexation rises, they, at the same time, increase the producer price reaction. The reaction of nominal output may therefore rise or fall with the degree of indexation.

The interest rate and exchange rate reactions may be explained by the nominal output reaction. If nominal output reactions rise with the degree of indexation, then the changes in the demand for money rise with the degree of indexation. This would cause the interest rates to fall less and the exchange rate to depreciate less as the degree of indexation increases.

A comparison of our results for MERs with LS' (1992) results for pure FERs and pure FLERs suggests that while the FER regime offers complete insulation of output from monetary shocks in country a or b for all degrees of indexation, the MER regime is more effective than the FLER regime in reducing the variability of output. The difference in output reaction between the pure FER and the MER regime becomes smaller as the degree of indexation rises and disappears for full indexation, while a difference in output reaction still remains between the MER and the pure FLER regime even if indexation is full.²¹

¹⁹This is an equalising difference.

²⁰Prices in a and b and the exchange rate with respect to c rise to the same extent. The movements of the supply curve produce results as if the supply curve were fixed but perpendicular.

²¹As in the case of demand shocks, these differences in effectiveness with full indexation may be explained

V.B Effects on the World Economy

We now consider the effect of monetary shocks in country i on the world economy. Firstly, for no or less than full indexation ($0 \leq b < 1$), the monetary shock in country i increases world real and nominal outputs, and producer prices. Secondly, the higher the degree of indexation, the lower the increase in world equilibrium real output, and the higher the increase in world producer prices. Finally, world real output and real interest rates are completely insulated from monetary shocks if wages are fully indexed to the consumer price index ($b = 1$).

VI Disturbances from Country c

Since the behaviour of country c is not modelled explicitly here, its shocks are grouped as output, price and interest rate shocks rather than as what we have so far called real and monetary shocks.

VI.A Output Demand Disturbances

With no indexation ($b = 0$), a rise in country c 's *output* increases real output and producer prices in countries a and b (see (A.17) and (A.18)). The reaction of the consumer prices is ambiguous (see (A.20)). With indexation ($b > 0$), real output still expands, but now both consumer and producer prices react ambiguously.

These results may be explained with the help of changes in the demand and supply of output. The shift in the demand curve due to the shock from country c causes interest rates to rise and the dollar exchange rate to fall. With $b > 0$, the depreciation of the dollar shifts the supply curve in countries a and b to the right, a shift which tends to lower producer prices while it further increases real output. This shift increases with the degree of indexation. Thus, while the output shock of country c tends to increase producer and consumer prices in countries a and b , the ensuing fall of the dollar exchange rate tends to reduce consumer prices and, under indexation, also producer prices.

Setting $\beta_1 = 0$ results in a complete insulation of *nominal* output in countries a and b from an output shock in country c , irrespective of the degree of indexation (see (A.19)). With no indexation ($b = 0$), the fall of the dollar exchange rates and the rise in interest rates completely offset the original increase in output demand such that *real* output (see (A.17)) and producer prices (see (A.18)) do not change as well. With indexation ($b > 0$), the dollar depreciation shifts the supply curves to the right and causes both an increase in real outputs²² and a decrease in producer prices such that nominal outputs remain unchanged.

by a modelling asymmetry: full indexation both in countries a and b but not in c (see LS (1992)).

²²The slope effect of increasing the parameter b is overruled by the shift effect.

VI.B Price and Interest Rate Disturbances

Higher *prices* in country *c* have two conflicting influences on the demand for output in countries *a* and *b*. Firstly, they tend to raise the demand for output (rightward shift of the output demand curve) through the international relative price mechanism (see α_5 in (A.25)). Secondly, the price shock directly increases current consumer prices in countries *a* and *b* and thus creates deflationary expectations, which shift the real interest rates up and reduce the demand for output (leftward shift of the output demand curve), through the real interest rate mechanism (see α_3 in (A.25)).

With indexation, the price shock from country *c* will move the supply curve to the left (shift effect) and this tends to decrease the equilibrium output (or lower its increase) and to increase equilibrium producer prices (or lower their decrease). Introducing or increasing indexation will also steepen the supply curve (slope effect) and this reduces the change in equilibrium real output and increases the change in equilibrium producer prices caused by an output demand shift. As a net result, the reactions of producer prices, exchange rates and nominal interest rates may be positive or negative at all degrees of indexation (see (A.26), (A.29), and (A.33)). This is different for real output. With full indexation ($b = 1$) output will definitely decline.²³ Obviously, there exists a critical degree of indexation smaller than 1 ($b < 1$), where real output is completely insulated from the price shock. While the relative price effect on output demand (see α_5 in (A.25)) dominates the output reaction below the critical value, the real interest rate effect on output demand (α_3 in (A.25)) dominates the output reaction above the critical value.

A positive shock in country *c*'s *nominal* interest rate has effects which are largely identical to those of a positive price shock. Only the reaction for exchange rates are different (see (A.29), (A.30), and (A.32)). Given perfect capital mobility, the positive shock in the nominal interest rate of country *c* implies a *primary* depreciation of the exchange rates in countries *a* and *b* with respect to country *c* and therefore a primary rise in the real interest rate of countries *a* and *b*. These initial changes either stimulate or reduce the output demand and shift the output supply curve upwards to the same extent as a country *c* price shocks would do if it were equal in size to the primary change in exchange rates. Thus, the effects of the price and the nominal interest rate disturbances in country *c* on output, prices, nominal and real interest rates in countries *a* and *b* are equivalent. The critical difference between the two cases arises in the reaction of the exchange rates. But this is an equalising difference which establishes the equivalence in all other respects.²⁴ Given the equivalence between the price and interest rate shocks, all explanations carry over from one case to the other.

Setting $\beta_1 = 0$ produces results that partially vary with the degree of indexation. With zero indexation ($b = 0$), we obtain a complete insulation of the real and nominal outputs, and of the producer prices of countries *a* and *b* from both interest rate and price shocks in country *c*. Introducing or increasing indexation ($b > 0$) shifts the output supply curve to the left and makes it steeper and leads to negative reactions of the real outputs and to positive reactions of the producer prices while leaving the nominal outputs unchanged. Consumer

²³The supply curve is perpendicular and any output change is determined by the leftward shift of the output supply curve.

²⁴The total (primary and secondary) exchange rate reaction for an interest rate shock in country *c* is equal to the exchange rate reaction for a price shock in country *c* plus 1 (see (A.32)). The 1 represents the primary depreciation mentioned above.

price and real interest rate reactions remain positive, while nominal interest rate reactions remain ambiguous. For the price shock the exchange rate reaction also remains ambiguous. These ambiguities do not depend on the degree of indexation.

Concluding Remarks

We have examined the international transmission of economic shocks in a three-country world in which two countries (a and b or Germany and France) have no macroeconomic impact on a third country (c or the US) but are large enough to influence each other in a MER regime. Solving the model with Aoki's (1981) method, we obtain the following results. Firstly, an increase in output demand in country i increases the output of that country, while it may produce a *contractionary* effect on country j 's ($i \neq j$) real and nominal output and prices²⁵. With an interest inelastic money demand ($\beta_1 = 0$), the transmission is definitely negative if indexation is zero ($b = 0$), while the likelihood of a negative transmission is increased for all other degrees of indexation ($0 < b \leq 1$). Secondly, a positive demand shock in country i produces an *expansionary* effect on world real and nominal output, even when it produces a *contractionary* effect on country j 's output. Thirdly, positive money supply shocks from countries a and b increase their real and nominal outputs but lesser and lesser as the degree of indexation increases. Full indexation *completely* insulates real outputs and real interest rates of countries a and b, and of the world, from monetary shocks. Fourthly, while a positive output demand shock from country c produces a positive effect on the real and nominal outputs of countries a and b, the output effects of price and interest rate shocks from country c are ambiguous as long as the indexation is not full. With full indexation, positive price and interest rate shocks produce a *contractionary* impact on the real outputs of countries a and b. Fifthly, with an interest inelastic money demand ($\beta_1 = 0$) and no indexation ($b = 0$), real and nominal outputs and producer prices of countries a and b are *completely* insulated from the price and interest rate shocks of country c. Still with an interest inelastic money demand ($\beta_1 = 0$) but with positive indexation ($b > 0$), the positive price and interest rate shocks of country c are *negatively* transmitted to real output in countries a and b while nominal output still remains insulated. Sixthly, there exists a critical degree of indexation ($b < 1$) where the real outputs of countries a and b are *completely* insulated from the interest rate and price shocks of country c. Seventhly, as an important contributing factor to the possibility of a negative transmission of real shocks from country i to j ($i \neq j$), we have identified the exchange rates with respect to country c. This is a determinant which cannot occur in two-country models. Finally, while Mundell observed a negative transmission for a sufficiently high interest elasticity of output demand, the exchange rate factor may be sufficient to produce a negative transmission even if the interest elasticity of the demand for output is zero.

²⁵ $i, j \in \{a, b\}$.

Appendix

In the following list of partial derivatives $i, j \in \{a, b\}$. Where the results may depend on whether $i = j$ or $i \neq j$, the signs for $i \neq j$ are stated in brackets. A question mark is given for indetermined signs. The qualitative part of the results is further summarized in the table of the text.

Output Demand Disturbances:

$$(A.1) \quad \frac{\partial Y^i}{\partial u^{dj}} = \frac{\theta}{2D_1} [\beta_1 (1 - bh) + b(1 - h)] + \frac{\theta}{2D_2} (1 - b\delta) \quad \begin{matrix} > 0 \\ (?) \end{matrix}$$

$$(A.2) \quad \frac{\partial P^i}{\partial u^{dj}} = \frac{1}{2D_1} [\beta_1 - \theta b(1 - h)] + \frac{1}{2D_2} \quad \begin{matrix} ? \\ (?) \end{matrix}$$

$$(A.3) \quad \frac{\partial Y^i}{\partial u^{dj}} + \frac{\partial P^i}{\partial u^{dj}} = \frac{1}{2D_1} \beta_1 [1 + \theta(1 - bh)] + \frac{1}{2D_2} [1 + \theta(1 - b\delta)] > 0 \quad \begin{matrix} > 0 \\ (?) \end{matrix}$$

$$(A.4) \quad \frac{\partial q^i}{\partial u^{dj}} = \frac{1}{2D_1} [h(1 + \beta_1 + \theta) - (1 + \theta)] + \frac{\delta}{2D_2} \quad \begin{matrix} ? \\ (?) \end{matrix}$$

$$(A.5) \quad \frac{\partial e^{ic}}{\partial u^{dj}} = -\frac{1}{2D_1} [1 + \theta(1 - bh)] < 0$$

$$(A.6) \quad \frac{\partial n^i}{\partial u^{dj}} = -\frac{\partial e^{ic}}{\partial u^{dj}} > 0$$

$$(A.7) \quad \frac{\partial r^i}{\partial u^{dj}} = \frac{h}{2D_1} [1 + \beta_1 + \theta(1 - b)] + \frac{\delta}{2D_2} \quad \begin{matrix} > 0 \\ (> 0) \end{matrix}$$

$$(A.8) \quad \frac{\partial M^{fsi}}{\partial u^{dj}} = \frac{1}{2D_1} [1 + \theta(1 - b\delta)] \quad \begin{matrix} > 0 \\ (< 0) \end{matrix}$$

Monetary Disturbances:

$$(A.9) \quad \frac{\partial Y^i}{\partial u^{mj}} = \frac{1}{2D_1} (1-b)\theta (\alpha_3 h + \alpha_5) \geq 0$$

$$(A.10) \quad \frac{\partial P^i}{\partial u^{mj}} = \frac{1}{2D_1} [(\alpha_3 h + \alpha_5) + \theta b(1-\alpha_1)(1-h)] > 0$$

$$(A.11) \quad \frac{\partial Y^i}{\partial u^{mj}} + \frac{\partial P^i}{\partial u^{mj}} = \frac{1}{2D_1} \{(\alpha_3 h + \alpha_5)[1 + \theta(1-b)] + \theta b(1-\alpha_1)(1-h)\} > 0$$

$$(A.12) \quad \frac{\partial e^{ic}}{\partial u^{mj}} = \frac{1}{2D_1} [(\alpha_3 h + \alpha_5) + \theta(1-\alpha_1)(1-bh)] > 0$$

$$(A.13) \quad \frac{\partial q^i}{\partial u^{mj}} = \frac{1}{2D_1} [(\alpha_3 h + \alpha_5) + \theta(1-\alpha_1)(1-h)] > 0$$

$$(A.14) \quad \frac{\partial n^i}{\partial u^{mj}} = -\frac{\partial e^{ic}}{\partial u^{mj}} < 0$$

$$(A.15) \quad \frac{\partial r^i}{\partial u^{mj}} = -\frac{\theta h}{2D_1} (1-\alpha_1)(1-b) \leq 0$$

$$(A.16) \quad \frac{\partial M^{fsi}}{\partial u^{mj}} = \begin{matrix} - & \frac{1}{2} & < 0 \\ (+) & & > 0 \end{matrix}$$

Output Demand Disturbance from Country c:

$$(A.17) \quad \frac{\partial Y^i}{\partial u^{yc}} = \frac{\alpha_2 \theta}{2D_1} [\beta_1(1-bh) + b(1-h)] > 0$$

$$(A.18) \quad \frac{\partial P^i}{\partial u^{yc}} = \frac{\alpha_2}{2D_1} [\beta_1 - \theta b(1-h)] ?$$

$$(A.19) \quad \frac{\partial Y^i}{\partial u^{yc}} + \frac{\partial P^i}{\partial u^{yc}} = \frac{\alpha_2 \beta_1}{2D_1} [1 + \theta(1-bh)] > 0$$

$$(A.20) \quad \frac{\partial q^i}{\partial u^{yc}} = \frac{\alpha_2}{2D_1} [h(1 + \beta_1 + \theta) - (1 + \theta)] ?$$

$$(A.21) \quad \frac{\partial e^{ic}}{\partial u^{yc}} = -\frac{\alpha_2}{2D_1} [1 + \theta(1-bh)] < 0$$

$$(A.22) \quad \frac{\partial n^i}{\partial u^{yc}} = -\frac{\partial e^{ic}}{\partial u^{yc}} > 0$$

$$(A.23) \quad \frac{\partial r^i}{\partial u^{yc}} = \frac{\alpha_2 h}{2D_1} [1 + \beta_1 + \theta(1-b)] > 0$$

$$(A.24) \quad \frac{\partial M^{fsi}}{\partial u^{yc}} = 0$$

Price and Nominal Interest Rate Shocks from Country c:

$$(A.25) \quad \frac{\partial Y^i}{\partial u^{pc}} = \frac{\partial Y^i}{\partial u^{nc}} = \frac{\theta}{2D_1} \{ \beta_1 [\alpha_5 - \alpha_3(1-h)] - b[\alpha_3(1-h) + \alpha_5\beta_1] \} \quad ?$$

$$(A.26) \quad \frac{\partial P^i}{\partial u^{pc}} = \frac{\partial P^i}{\partial u^{nc}} = \frac{1}{2D_1} \{ \beta_1 [\alpha_5 - \alpha_3(1-h)] + \theta b(1-h)[\alpha_3 + \beta_1(1-\alpha_1)] \} \quad ?$$

$$(A.27) \quad \frac{\partial Y^i}{\partial u^{pc}} + \frac{\partial P^i}{\partial u^{pc}} = \frac{\partial Y^i}{\partial u^{nc}} + \frac{\partial P^i}{\partial u^{nc}} \\ = \frac{\beta_1}{2D_1} \{ [1 + \theta(1-b)]\alpha_5 + (1-h)[\theta b(1-\alpha_1) - (1+\theta)\alpha_3] \} \quad ?$$

$$(A.28) \quad \frac{\partial q^i}{\partial u^{pc}} = \frac{\partial q^i}{\partial u^{nc}} = \frac{1}{2D_1} \{ \alpha_3(1+\theta)(1-h) + \beta_1[\alpha_5 + \theta(1-\alpha_1)(1-h)] \} \quad > 0$$

$$(A.29) \quad \frac{\partial e^{ic}}{\partial u^{pc}} = \frac{1}{2D_1} \{ \alpha_3(1+\theta)(1-h) - \alpha_5[1 + \theta(1-b)] - \theta b(1-h)(1-\alpha_1) \} \quad ?$$

$$(A.30) \quad \frac{\partial e^{ic}}{\partial u^{nc}} = \frac{1}{2D_1} \{ \alpha_3[1 + \theta(1-bh)] + \beta_1[h\alpha_3 + \alpha_5 + \theta(1-\alpha_1)(1-bh)] \} \quad > 0$$

$$(A.31) \quad \frac{\partial r^i}{\partial u^{pc}} = \frac{\partial r^i}{\partial u^{nc}} = \frac{1}{2D_1} \{ \alpha_5[1 + \beta_1 + \theta(1-b)] + \theta(b + \beta_1)(1-\alpha_1)(1-h) \} \quad > 0$$

$$(A.32) \quad \frac{\partial e^{ic}}{\partial u^{nc}} = 1 + \frac{\partial e^{ic}}{\partial u^{pc}} > 0$$

$$(A.33) \quad \frac{\partial n^i}{\partial u^{pc}} = -\frac{\partial e^{ic}}{\partial u^{pc}} \quad ?$$

$$(A.34) \quad \frac{\partial n^i}{\partial u^{nc}} = 1 - \frac{\partial e^{ic}}{\partial u^{nc}} \quad ?$$

$$(A.35) \quad \frac{\partial n^i}{\partial u^{pc}} = \frac{\partial n^i}{\partial u^{nc}} \quad ?$$

$$(A.36) \quad \frac{\partial M^{fsi}}{\partial u^{pc}} = \frac{\partial M^{fsi}}{\partial u^{nc}} = 0$$

$$(A.37) \quad \frac{\partial q^i}{\partial x} = \frac{\partial r^i}{\partial x} + \frac{\partial e^{ic}}{\partial x}$$

for $x \in \{u^{dj}, u^{mj}, u^{yc}, u^{pc}\}$,

$$(A.38) \quad \frac{\partial q^i}{\partial u^{nc}} = \frac{\partial r^i}{\partial u^{nc}} + \frac{\partial e^{ic}}{\partial u^{nc}} - 1.$$

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Discussion of

Nikolaus K.A. Läufer und Srinivasa Sundararajan

The International Transmission of Economic Shocks in a Three-Country World under Mixed Exchange Rates

One of the most interesting questions in any kind of economic union is whether a rising tide lifts all the boats, or whether a rising tide in one country actually could also sink some boats in another country. The existence of such negative transmissions is one of the main counter arguments against currency or exchange rate unions. The paper by Nikolaus Läufer and Srinivasa Sundararajan (dubbed "LS" in the sequel) addresses this important policy question.

Let me start my discussion with an extraction of the basic features of the paper by Läufer and Sundararajan in order to explain where the important assumptions are and where the policy results are hidden.

The basic setup is as follows:

- Two countries form an exchange rate union with fixed exchange rates.
- This exchange rate union is small relative to the rest of the world.

The authors then address the question how this mixed exchange rate system responds to macroeconomics shocks, such as an exogenous increase in demand in one of the union countries, or a change in the interest rate of the rest of the world, etc. I will comment only on the first kind of shock.

The set-up resembles that of Levin (1983), Rose und Sauernheimer (1983), and Feuerstein and Siebke in several articles (1987, 1990, 1992). LS substantially extend Levin's analysis by allowing for price flexibility. They thus generate additional substitution effects whenever the terms of trade change.

While the model appears rather involved at first sight, it is easily decomposed into two components. There is first the interaction between the exchange union in its entirety with the rest of the world. This building block behaves more or less like a conventional two-country flexible-exchange rate model. Because the union is considered small relative to the rest of the world, the effects are easy to analyze.

Most interesting are the intra-union effects. The main result of the paper is that these two countries cannot be described by the conventional two-country fixed-exchange rate model. Rather, via the feedback through the rest of the world, LS show important deviations such as the possibility that shocks from one country of the union are negatively transmitted to the other country of the union. Negative transmission effects were also features of the models of Levin, Feuerstein and Siebke, and Rose und Sauernheimer. It is helpful to see at least their possibility confirmed and reproduced in the framework of Läufer and Sundararajan.

The decomposition of the model holds in a strict mathematical sense. This is the essential insight of the ingenious method of Aoki (1981). The relation between the exchange rate union and the rest of the world is described by the sum of the endogenous and exogenous variables in the union. The intra-union effects are in turn described by the inter-country differences in the endogenous and exogenous variables. The system is decoupled and -- due to strong symmetry assumptions -- it can be described by a relatively small set of variables.

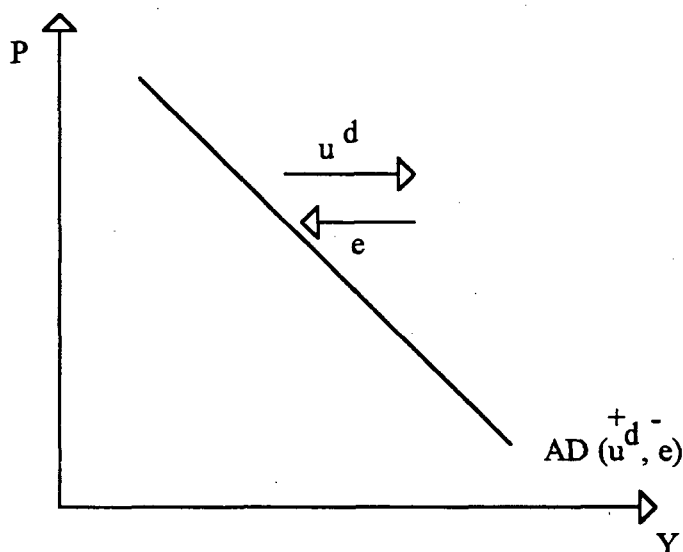
The symmetry assumptions are unpalatably strong. They rule out important effects due to size differences and behavioral differences. Some of the most interesting reactions in the European Monetary System are due to asymmetries across member countries. These effects easily swamp the effects generated by the symmetric LS-model. Most importantly, the likelihood of a negative transmission of shocks within the exchange rate union depends on the relative size of the two union members and on the difference in elasticities, especially the interest elasticity of money demand in the two countries. Hence, we are interested in converting the LS-results into quantitative policy effects; if we need to know whether the negative transmission effects are actually taking place between Germany and France, say, we must extend the LS-model to permit size and elasticity differences.

However, the symmetry assumptions make the model very transparent -- so transparent that we can reduce the model to three equations:

- Aggregate demand
- Aggregate supply (with an indexation rule)
- Money market equilibrium (with an interest parity and exchange rate expectation mechanism).

Aggregate demand is quite conventional and depicted in figure 1.

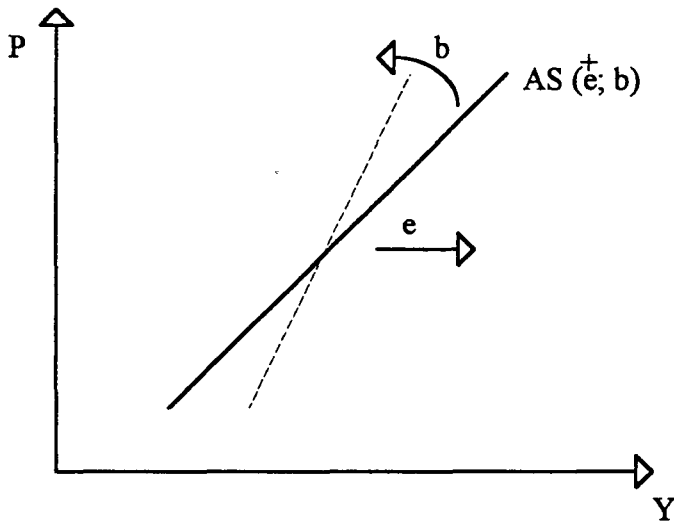
Figure 1: Aggregate Demand



An aggregate demand shock (denoted by u^d) shifts the demand curve outwards. This, however, leads to an appreciation of the union currency (its exchange rate with respect to the rest of the world is denoted by e), worsens the trade balance and thus reduces the outward shift of the demand curve. In a Mundell/Fleming-world, this effect leads to a complete crowding out of the demand shift. We will see that this is not the case in the LS-model.

Aggregate supply is more interesting, see figure 2:

Figure 2: Aggregate Supply

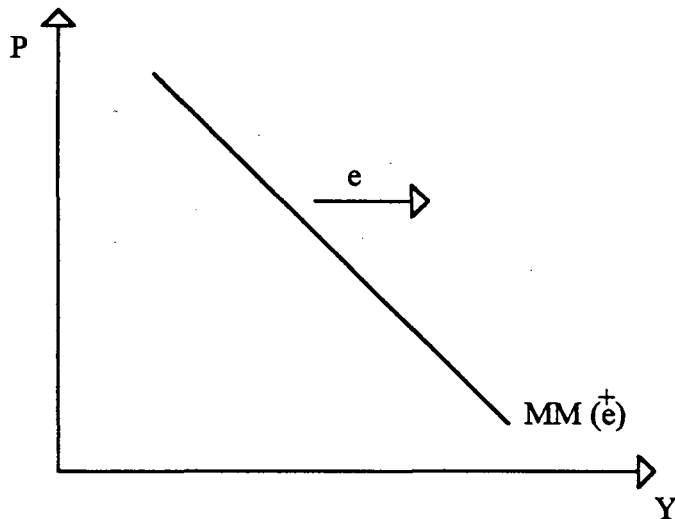


Aggregate supply is positively sloped. This is due to sticky wages which are in turn generated by a staggered wage mechanism not explicitly described in the paper. Implicit is also the assumption of a very elastic labor supply which permits the expansion of commodity supply. Indexation of wages to the CPI links the supply schedule to the exchange rate e . A higher degree of indexation (the parameter b of the LS-model) creates a more inelastic supply function (dashed schedule).

The dependency of aggregate supply on the exchange rate is essential for the LS-model. The appreciation of the union currency makes aggregate supply more profitable because it increases the ratio of product prices to the CPI. This "terms-off-trade-effect" creates an expansion of supply that prevents the complete crowding out of a fiscal expansion known from the Mundell/Fleming flexible exchange rate model.

The third building block is a money market equilibrium schedule that is more or less conventional.

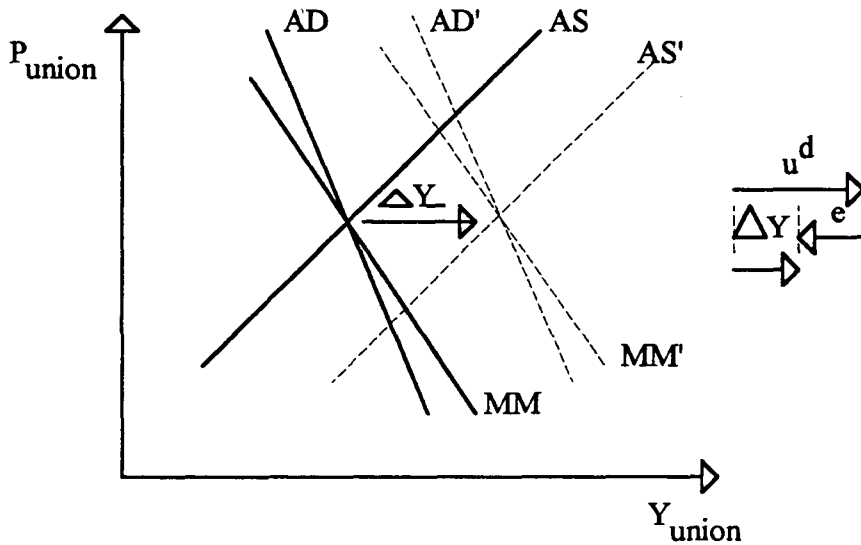
Figure 3: Money Market



Again, the main point is to observe that an appreciation of the union currency induces expectations of a depreciation in the future and thus reduces money demand (as indicated in the above figure). This effect amplifies the shift of the supply schedule, further reducing the crowding-out effect known from the Mundell/Fleming model. With strict interest parity, this effect, of course, vanishes. We then obtain the results of the first four sections in Feuerstein and Siebke (1990).

The combination of the three schedules easily provides the first result of the paper, see figure 4, when we interpret P and Y in figures 1-3 as union aggregates:

Figure 4: Union Effects



A new equilibrium must feature higher output as the joint intersection of the three schedules is to the right of the old equilibrium. Nothing can be said about price effects.

The most interesting result of the paper concerns the intra-union differences. They too can be derived from figures 1-4. The exchange rate appreciation and its implied increase in the interest rate reduce the income of the union in a symmetric fashion. Hence, these two effects generate no intra-union effects. The demand shock, however, is asymmetric. It increases income stronger in the originating country (say, Germany) than in the other country (say, France). While we know from figure 4 that the demand effect dominates the exchange rate and interest effects for the entire union and for Germany, the sign for the second country (France) remains undetermined. This is an important difference to Levin (1983) who always postulates negative transmissions. The Läufer/Sundararajan analysis therefore weakens the results of earlier studies. They are further weakened by a fourth effect, namely a substitution effect due to a faster increase or at least a slower decrease in producer prices in Germany relative to France.

Let me summarize:

1. What is unambiguous in a two-country world -- such as the Mundell/Fleming world -- becomes ambiguous in a multicountry world.

2. Ambiguity increases if supply is positively sloped, for example, due to wage stickiness or because of exchange rate expectation mechanisms. This positively sloped supply schedule is the crucial assumption which makes real effects possible at all. The LS-model increases ambiguity relative to its predecessor papers mentioned above. It thus provides more support for an exchange rate union than the earlier papers.

3. Symmetry makes the model tractable and transparent. However, it rules out that we can use the LS-model in order to derive realistic policy implications. Because the effects of asymmetry easily swamp the effects generated by the LS-model, an extension allowing for country differences would be a worthwhile enterprise for policy applications.

Discussion of the paper 'The International Transmission of Economic Shocks in a Three-Country World Under Mixed Exchange Rates' by N. Läufer and S. Sundararajan

This paper deals with an important and interesting issue. The transmission of economic disturbances between two countries may be influenced by indirect repercussion effects originating in a third country, and in some cases these indirect effects may be dominant, i. e., they may reverse the direction in which disturbances are transmitted in a two-country world. This aspect has not been given enough consideration in the literature so far. Unfortunately, many of the comparative statics results derived by the authors have ambiguous signs because the traditional transmission effects are compounded (sometimes in a rather impenetrable way) with what the authors call 'the third country effect'.

My comments center mainly on the theoretical framework in which the analysis is cast. First of all, the transmission and adjustment mechanisms studied in this work are dynamic in nature, so they would ideally be analyzed in an intertemporal setting. Yet, although the notation and some formulations in the paper produce the impression of a dynamic economic environment, there is no question that the model is basically static because all adjustment processes take place within one single period.

The authors remain rather silent about how expectations are formed on the part of the economic agents. They argue that expectations follow long-run equilibrium values. It is unclear, however, what long-run equilibrium values are in this context and how, precisely, the expectations formation mechanism works.

The internal structure of the model could be made more transparent by linking the 13 equations more directly to the existing markets. In particular, I have been wondering what the driving force for the adjustment process of the exchange rate against the third country, c , looks like. Since the behavior of this country is not modelled explicitly and the trade between country c and the rest of the world need not be equilibrated, it is unclear which mechanism determines country c 's exchange rate.

As a final remark, I have been puzzled by the fact that the comparative statics results do not depend on the distribution of the real and monetary shocks. Since this distribution will, in general, influence the agents' expectations and the rate of money growth, we should expect the distributional parameters to show up in the multipliers. Quite obviously some assumptions on the distribution of the shocks and on the agents' attitudes towards risk are implicitly made. If, for example, the shocks were perfectly correlated then it would not be legitimate to study the effects of the disturbances in isolation, as is done in this work. Thus, some form of stochastic independence seems to be necessary in order to justify the analysis.

In summary, this paper addresses interesting and important questions. It contributes to our knowledge by pointing out the impact of a third country on the repercussion effects between two internationally integrated countries. I feel, however, that the abundance of comparative statics results sometimes tends to obscure (rather than to clarify) the basic mechanisms which are at work. A simpler model in which we can isolate and intuitively understand these mechanisms might be a more promising approach.