EUROPEAN UNIVERSITY INSTITUTE, FLORENCE

DEPARTMENT OF ECONOMICS

EUI WORKING PAPER No. 8 9 / 3 7 4

SMALL COUNTRIES
AND EXOGENOUS POLICY SHOCKS

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preliminary

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Abstract

In a flexible exchange rate regime, the interaction of large countries might cause *per se* a bias in the world economy which can be seen as an external policy shock for any small country.

It is argued, especially as far as the experience of recent years is concerned, that the lack of coordinated policies has generated an excessively deflationary situation. This is especially true, in the context of the model presented here, when the monetary authorities do not face any exogenous uncertainty.

A three-country asymmetric model is developed to show that a small country in a monetary union may have to adjust more than the other follower country to any external policy shocks to which the leader responds.

The usual argument for "tying the hands" of the monetary authorities in exchange for internal credibility has, therefore, to be more carefully examined in the case of a small country joining a fixed exchange rate regime with leadership.

February 1989

1. Introduction

Small countries have advantages and disadvantages by not influencing the other countries: they may well benefit from a demand coordinated expansion without incurring higher public deficits; at the same time the externalities stemming from the interaction of large countries might severely limit policy stabilization in the small economies — small may no longer be beautiful.

Most of the recent literature on strategic behaviour focuses its attention on the strategic interaction of significantly large countries and between their policy makers and the domestic private agents. Although small countries may face the same inconsistency problem of big countries due to the lack of reputation of their monetary authorities vis-à-vis the private sector, they do not enter the game among countries but rather take it as given. This paper discusses the way a two-large-country policy game acts upon the stability of an open economy.

In choosing the appropriate exchange rate regime, policy makers in small countries may be tempted to join an area of monetary stability where the tone of the monetary stance is given by a credible (anti-inflation) leader; the authorities "tie their hands" in search of a solution for the internal consistency problem — too high a level of inflation resulting from the non-cooperative game between monetary authorities and private agents. The price they have to pay to purchase credibility is the competitiveness punishment of an overvalued currency (see Giavazzi and Pagano, 1988b) which domestically enforces the rules of the game.[1]

In a fixed exchange rate regime with leadership, where not all countries are sufficiently large to influence the other members of the system, this penalty might be further aggravated by asymmetric policy shocks. This asymmetry

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[1] We do not discuss here whether a fixed exchange rate regime is compatible with the Treasury financial requirements. This fact deserves more attention since it may undermine the stabilization program from the outset or generate speculative attacks on the exchange rate — see Giavazzi and Pagano (1988a).

may come from a given external shock to which the leader is responding. In this case, small countries have to adjust more than the other big countries in the union. This double asymmetry (that is being a small follower), if not taken into account, may then underestimate the flexibility costs of adhering to such a union.

In the section below we discuss the deflationary (inflationary) bias that may arise for the world economy from a two-country policy game in a flexible exchange rate regime; the analysis is carried both in a deterministic and a stochastic environment. In section 3 we develop a three-country Mundell-Fleming asymmetric model to emulate the functioning of a flexible and a fixed exchange rate regime with leadership. Section 4 summarizes the main conclusions.

2. Effects of Strategic Interaction between Large Countries

A classical example of strategic behaviour of two interdependent economies is their attempt to rapidly deflate (or inflate) the economy as the only way to overcome some upward (or downward) price rigidity. This is especially true in a flexible exchange rate regime with a high degree of capital mobility, where a contractionary monetary policy may produce an appreciation of the currency and, consequently, lower inflation (measured by some consumer price index). In other words, these countries may have an incentive to export inflation by running beggar-thy-neighbour policies (producing a significative reduction in inflation at the cost of a small increase in unemployment).

By following the same strategy, however, none of these countries will experience a significative appreciation of its currency: they will incur in a higher rate of unemployment without the benefits of stabilizing inflation. Moreover, they will difficultly stepback due to the risk of accelerating inflation for a given deflationary environment.

The outcome of this non-cooperative game among large countries can then produce a deflationary bias for the world economy. The relative importance of this bias is reduced when the monetary authorities act in a stochastic framework.

The two-country model here developed (see Macedo, 1985 and Torres and Teles, 1986) is of the static linear quadratic type; each country pursues two objectives through the manipulation of one sole instrument; there is interdependence because the two instruments jointly determine the four objectives; these are conflictual in the sense that it is not possible to simultaneously atain their optimal values in both countries.

In these conditions, the cooperative solution is a Pareto Optimium, all the others being innefficient; the former is typically compared with the Cournot-Nash equilibria (deflationary and inflationary biases).

2.1 The Two-Country Deterministic Model

This simple model considers two interdependent countries, symmetric in both the goods market and the asset market. The structure of the two economies is given, in the steady state, by an IS curve, an LM curve, a price weighted average of domestic and imported goods and the interest rate arbitrage condition and may be represented by the following equations:

$$q_1 = \gamma(e + p_2 - p_1) - \lambda i_1 \tag{2.1}$$

$$m_1 - p_1 = \alpha q_1 - \beta i_1 \tag{2.2}$$

$$P_c = \mu(p_2 + e) + (1 - \mu)p_1 \tag{2.3}$$

$$i_1 = i_2 \tag{2.4}$$

The equations for the other country are easy to obtain by symmetry. Variables are expressed in logarithmic deviations from the optimal stationary equilibrium: $q_1(q_2)$ is the real income (GDP) in country 1 (2); e the nominal exchange rate (units of country 1's currency per unit of country 2's currency); $p_1(p_2)$ the price of the good produced in country 1 (2); $i_1(i_2)$ the nominal interest rate in country 1 (2); $P_{c_1}(P_{c_2})$ the consumer price index (CPI) in country 1 (2); and $m_1(m_2)$ the money supply in country 1 (2).

All parameters are assumed to be positive.

With regard to the arbitrage condition, perfect asset substitution is assumed and all portfolio and risk considerations are neglected. In the stationary state $\dot{e}$ is always equal to zero.[2]

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[2] E_{t_1} being the actual equilibrium exchange rate and E_{t_0} the reference (optimal) exchange rate – both stationary equilibria – $\dot{e}$ is, by definition, equal to zero, even if $E_{t_1} \neq E_{t_0}$ (with $e \neq 0$ and $m_1 \neq m_2$).

As a trick to introduce policy conflict, some price rigidity is assumed:

$$p_1 = p_2 = \bar{p} \neq 0$$

The model can then be solved in order to obtain the reduced form of the system in terms of the two policy instruments (m_1 and m_2) and the price rigidity.

$$q_1 = am_1 - bm_2 + cp_1$$
$$e = \frac{m_1 - m_2}{2a}$$
$$P_{c_1} = \mu e + \bar{p}$$

where $a > b > 0$ and $c = b - a < 0$.[3]

Let us assume now that the two countries choose m_1 and m_2 in order to minimize a quadratic function of GDP and CPI deviations with respect to the optimal stationary state:

$$L = q^2 + w\,P_c^2$$

Minimizing $W = \theta L_1 + (1 - \theta)L_2$ (with $0 \leq \theta \leq 1$) it is possible to assure an efficient set of policies in the Paretian sense, that is a point on the contract curve.[4]

Except for the cases where policy symmetry is imposed or it is possible to transfer utility among countries — cases where $\theta = 1 - \theta$ (point of minimum

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[3] $a = \dfrac{\beta + 2\alpha\lambda}{2\alpha(\beta + \alpha\lambda)}$, $b = \dfrac{\beta}{2\alpha(\beta + \alpha\lambda)}$ e $c = -\dfrac{\lambda}{\beta + \alpha\lambda}$

[4] $\dfrac{\frac{\partial L_1}{\partial m_1}}{\frac{\partial L_1}{\partial m_2}} = \dfrac{\frac{\partial L_2}{\partial m_1}}{\frac{\partial L_2}{\partial m_2}}$

joint disutility) — the cooperative solution may be located at any point on the contract curve, θ and $(1 - \theta)$ being the bargaining capacity of each country. For this construction of the model (symmetric in all other respects) however, it is reasonable to admit the same bargaining power ($\theta = 0.5$) for each of the two countries.

Given the exogenous price rigidity, the minimization of W is thus equivalent to the minimization of the GDP deviations relative to the optimal solution. The cooperative solution (point C in figures 1, 2 and 3) then becomes necessarily symmetric in terms of the two policy instruments:

$$m_1 = m_2 = \bar{p}$$

The reaction functions of the two countries are given by R_1 and R_2.

$$R_1 : \frac{\partial L_1}{\partial m_1} = 0 \Rightarrow m_1 = Am_2 - B\bar{p} \Leftrightarrow m_2 = \frac{1}{A}m_1 + \frac{B}{A}\bar{p}$$

$$R_2 : \frac{\partial L_2}{\partial m_2} = 0 \Rightarrow m_2 = Am_1 - B\bar{p}$$

where $0 < A < 1$ and $B \gtrless 0$ according to $c \gtrless -\frac{wk}{2a}$.[5]

The deflationary (in the case of $\bar{p} > 0$) or inflationary (in the case of $\bar{p} < 0$) non-cooperative solution is the Cournot-Nash equilibrium (point N in figures 1, 2 and 3), which ignores conjectural variations.

$$N : m_1 = m_2 = -\frac{B}{1 - A}\bar{p} = \psi\bar{p}, \quad \psi < 1.$$

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[5] $A = \dfrac{2ab + \frac{wk^2}{2}}{2a^2 + \frac{wk^2}{2}}$, $B = \dfrac{2ac + wk}{2a^2 + \frac{wk^2}{2}}$, $k = \dfrac{\mu}{\alpha\gamma}$

The loss function can be represented by a family of elypses in the plane $m_1 - m_2$, given that q_i and P_{c_i} are linear in m_1 and m_2.
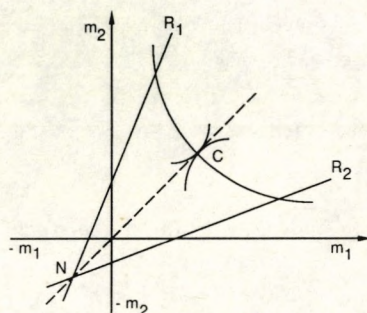

Figure 1: Deflationary non-cooperative solution ($\bar{p} > 0$ and $B > 0$)
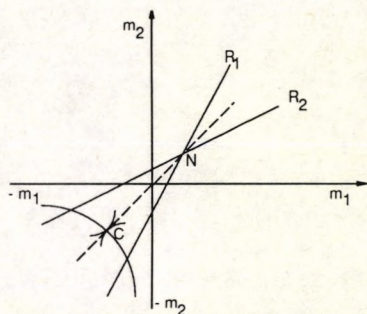

Figure 2: Inflationary non-cooperative solution ($\bar{p} < 0$ and $B > 0$)

The direction of the monetary policy bias depends on the type of price rigidity considered: $\bar{p} \gtrless 0$. It should be stressed, however, that the deflationary or inflationary bias of the non-cooperative solution depends on how the game is constructed. When the model allows for a high or low degree of wage indexation, monetary policy may be "locomotive" ($a > 0$ and $b > 0$) or "beggarthy-neighbour" ($a > 0$ and $b < 0$), generating, in this way, a different bias.[6]

In the case of $\bar{p} > 0$ we have, in the context of our model, a deflationary bias for the world economy.

2.2 Coordination under uncertainty: the stochastic model

In this section we analyze the influence of a real shock on the cooperative and non-cooperative solutions of the model developed above. It is possible to show that the potential gains resulting from the cooperative process are, in this case, substantially reduced. Perfect control of money supply is assumed [7] and the value of the monetary instrument is defined before the shock has ocurred. Representing the optimal steady state by the subscript t_0 and the actual steady state by the subscript t_1, and ε being a random variable on average equal to zero (a bar over a variable indicating its expected value) it is possible to write:

$$q_{t_0} = x_{t_0} + \varepsilon \bar{q}_{t_0}, \; where \;\; \mathrm{E}(x_{t_0}) = \bar{q}_{t_0} \qquad (2.5)$$

$$q_{t_1} = x_{t_1} + \varepsilon \bar{q}_{t_1}, \; where \;\; \mathrm{E}(x_{t_1}) = \bar{q}_{t_1} \qquad (2.6)$$

Introducing this randomness expressed in (2.5) and (2.6) in the model presented above we obtain equations (2.7) to (2.14).

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[6] See van der Ploeg (1987) on the influence of wage indexation on the nature of interdependence in a two-country Mundell-Fleming model.

[7] A nominal money shock introduced in a similar way would produce the same conclusions.

$$q_1 = \gamma(e + p_2 - p_1) - \lambda i_1 + \bar{q}_1 \varepsilon_1 \qquad (2.7)$$

$$m_1 - p_1 = \alpha q_1 - \beta i_1 \qquad (2.8)$$

$$q_2 = \gamma(p_1 - e - p_2) - \lambda i_2 + \bar{q}_2 \varepsilon_2 \qquad (2.9)$$

$$m_2 - p_2 = \alpha q_2 - \beta i_2 \qquad (2.10)$$

$$P_{c1} = \mu(p_2 + e) + (1 - \mu)p_1 \qquad (2.11)$$

$$P_{c2} = \mu(p_1 - e) + (1 - \mu)p_2 \qquad (2.12)$$

$$i_1 = i_2 \qquad (2.13)$$

$$p_1 = p_2 = \bar{p} \qquad (2.14)$$

The reduced form of the model is given by the following system:

$$q_1 = am_1 - bm_2 + c\bar{p} + \alpha b(\bar{q}_2 \varepsilon_2 + \bar{q}_1 \varepsilon_1)$$

$$q_2 = am_2 - bm_1 + c\bar{p} + \alpha b(\bar{q}_1 \varepsilon_1 + \bar{q}_2 \varepsilon_2)$$

$$P_{c1} = \mu e + \bar{p}$$

$$P_{c2} = -\mu e + \bar{p}$$

$$e = \frac{1}{2\gamma}\left(\frac{m_1 - m_2}{\alpha} + \bar{q}_2 \varepsilon_2 - \bar{q}_1 \varepsilon_1\right)$$

The expected value of the loss function is given by the following expression:

$$E(L_i) = (am_i - bm_j + c\bar{p})^2 + w\left[\frac{\mu}{2\alpha\gamma}(m_i - m_j) + \bar{p}\right]^2$$

$$+ 2(\alpha^2 b^2 + w\frac{\mu^2}{4\gamma^2})(\bar{q}_i \sigma_{\varepsilon_i}^2 + \bar{q}_j \sigma_{\varepsilon_j}^2) \qquad (2.15)$$

The cooperative solution maintains $m_1^A = m_2^A = \bar{p}$, towards which the non-cooperative solution aproximates. In fact the result for this solution can be given by expression (2.16) when, by the symmetry condition, $\sigma_{\varepsilon_1}^2 = \sigma_{\varepsilon_2}^2 = \sigma_\varepsilon^2$.[8]

$$m_1^A = \left[\frac{2ac + \dfrac{w\mu}{\alpha\gamma} - 2c^2(\alpha^2 b^2 + w\dfrac{\mu^2}{4\gamma^2})\sigma_\varepsilon^2}{2ac - 2c^2(\alpha^2 b^2 + w\dfrac{\mu^2}{4\gamma^2})\sigma_\varepsilon^2} \right] \bar{p} \qquad (2.16)$$

Superscript A applies to the stochastic case. Comparing the expression for m_1^A (2.16) with $m_1 = \dfrac{2ac + \dfrac{w\mu}{\alpha\gamma}}{2ac}\bar{p}$ in the deterministic case we get $m_1^A > m_1$. In fact it is possible to write:

$$\frac{dm_1^A}{d\sigma_\varepsilon^2} = \frac{(m_1^A - \bar{p})\left[c(\alpha^2 b^2 + w\dfrac{\mu^2}{4\gamma^2}) + \sigma_\varepsilon^2 \right]}{a} > 0$$

With the objective of minimizing the fluctuations arround q, monetary authorities will try to get closer to situations where $q = 0$ or, in other words, where $m_1 = m_2 = \bar{p}$. At this point the effect of the random shock on the difference between the actual and the optimal stationary equilibria disapears.

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[8] The reaction function for country 1 is the following:

$$m_2^A = \frac{2a^2 + \dfrac{w\mu^2}{2\alpha^2\gamma^2} + 2(a^2 + b^2)(\alpha^2 b^2 + w\dfrac{\mu^2}{4\gamma^2})\sigma_\varepsilon^2}{2ab + \dfrac{w\mu^2}{2\alpha^2\gamma^2} + 4ab(\alpha^2 b^2 + w\dfrac{\mu^2}{4\gamma^2})\sigma_\varepsilon^2} m_1^A +$$

$$+ \frac{2ac + \dfrac{w\mu}{\alpha\gamma} - 2c^2(\alpha^2 b^2 + w\dfrac{\mu^2}{4\gamma^2})\sigma_\varepsilon^2}{2ab + \dfrac{w\mu^2}{2\alpha^2\gamma^2} + 4ab(\alpha^2 b^2 + w\dfrac{\mu^2}{4\gamma^2})\sigma_\varepsilon^2} \bar{p}$$

where $\dfrac{\partial m_2}{\partial m_1} > 1$ and $\dfrac{\partial}{\partial \sigma_\varepsilon^2}\left(\dfrac{\partial m_2}{\partial m_1} \right) \gtrless 0$.

Figure 3 presents the cooperative and non-cooperative solutions in both the deterministic and the stochastic cases when the slope rises with σ_ε^2 and $\bar{p} > 0$ (the analysis for $\bar{p} < 0$ being perfectly symmetric).
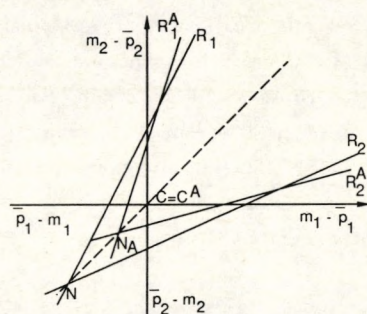
Figure 3: Deterministic and stochastic non-cooperative solutions

We can then conclude that in the model discussed above, where the lack of policy coordination may generate a deflationary bias in the world economy, the introduction of a real random shock reduces the gap between the cooperative and non-cooperative equilibria. This result is due to the fact that monetary authorities minimize not only the expected value of the deviation with respect to the optimal long run solution but also the variance of that random variable. At the limit, when the variance of the random shock is too high, the two solutions coincide and there is no case for cooperation.

3. A three-country asymmetric model

This section presents a simple example of a stylized analysis of policy interdependence in a monetary area like Europe. Other large countries are left out of the analysis but taken into account as far as external policy shocks are concerned. Two different exchange rate regimes are considered: flexible exchange rates and fixed exchange rates with leadership. An asymmetric functioning of the fixed exchange regime is presumed mirroring the case of the European Monetary System (EMS).[9] However, attention will be focused on the comparative adjustment to exogenous policy shocks of a small country vis-à-vis the other (larger) follower country.

3.1 Flexible exchange rates:

This is a simple version of the Mundell-Fleming three country model for the world economy.[10] The model is asymmetric in the sense that one of the economies depends upon the other two (symmetric and interdependent) and does not influence them (small country assumption). Each country produces a good which is an imperfect substitute in the rest of the world's demand; the aggregate demand equation defines the goods market equilibrium for each country, the price of the good produced in each country being fixed. The equilibrium in the money market is given by the standard money demand equation. As far as the arbitrage condition is concerned, perfect asset substitutability and perfect capital mobility ($i_1 = i_2 = i$) are assumed. While variables for the two big countries are denoted by subscripts 1 and 2, there are no subscripts in the case

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[9] See Giavazzi and Giovannini (1988) for a thorough discussion of this issue.

[10] Roubini (1987) presents a very similar model for different exchange rate regimes. His model, however, assumes four identical countries and does not take into account any type of structural asymmetry.

of the small country.

The equations of the model are the following:

$$m_1 - p_1 = \varphi q_1 - \beta i \qquad (3.1)$$

$$m_2 - p_2 = \varphi q_2 - \beta i \qquad (3.2)$$

$$m - p = \varphi q - \beta i \qquad (3.3)$$

$$q_1 = \delta(e_{1,2} + p_2 - p_1) + \gamma q_2 + g_1 - \sigma i \qquad (3.4)$$

$$q_2 = -\delta(e_{1,2} + p_2 - p_1) + \gamma q_1 + g_2 - \sigma i \qquad (3.5)$$

$$q = -\delta(e_1 + p - p_1) - \delta(e_1 - e_{1,2} + p - p_2) + \gamma(q_1 + q_2) + g - \sigma i \qquad (3.6)$$

where: m stands for nominal money balances; p for the price of each country's produced good; q for real output; i for the nominal interest rate; $e_{1,2}$ for nominal exchange rate between the two big countries (country 1's units of currency for each unit of country 2's currency); e_i for the number of units of country i's currency for each unit of the small country's currency; and g is a measure of fiscal policy. All variables (except i and g) are in logs.

The parameters are all assumed to be positive and $\gamma < 1$.

In a system of flexible exchange rates the control variables are fiscal and monetary policy, while real output, the interest rate and the exchange rate are endogenous variables. Solving the system (3.1) to (3.6) we get:[11]

$$q_1 = \Omega(m_1 - p_1) + \Psi(m_2 - p_2) + \Phi(g_1 + g_2)$$

$$q_2 = \Omega(m_2 - p_2) + \Psi(m_1 - p_1) + \Phi(g_1 + g_2)$$

$$q = \frac{1}{\gamma}(m - p) + \Psi\left[(m_1 - p_1) + (m_2 - p_2)\right] + \Phi(g_1 + g_2)$$

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[11] The expressions for the interest rate i and for the two exchange rates $e_{1,2}$ and e_1 are derived in the appendix.

where:

$$\Omega = \frac{1 - \gamma + \dfrac{2\varphi\sigma}{\beta}}{2\varphi\left(1 - \gamma + \dfrac{\sigma\varphi}{\beta}\right)} > 0$$

$$\Psi = \frac{\gamma - 1}{2\varphi\left(1 - \gamma + \dfrac{\sigma\varphi}{\beta}\right)} < 0$$

$$\Phi = \frac{1}{2(1 - \gamma) + \dfrac{\sigma\varphi}{\beta}} > 0$$

From the reduced form derived above we can then make the following comments (implicit in the hypotheses of the model):

An expansionary fiscal policy in any one of the two big countries increases output at home and abroad. For the small country, however, an expansionary fiscal policy has no real effects at home — it is completely offset by an increase in the demand for foreign goods relative to domestic goods, due to the appreciation of its currency; by definition, the policies of small countries have no effects abroad.

In country 1 and country 2 monetary policy is expansionary at home but causes contraction abroad; this is because of the negative exchange rate effect on external output (equivalent, in the case of an expansionary monetary policy, to a depreciation of the country's currency with a consequent shift away from foreign goods, reducing the output of the rest of the world) which more than compensates for the positive output effect due to the fall in world interest rates. Monetary policy in the small country only affects its own output by the reciprocal of γ — the less open the small economy is the greater its monetary policy effectivenessis.

The exchange rate between the two big countries depends on the relative stance of monetary and fiscal policies: the country implementing a fiscal

expansion experiences a currency appreciation while the easy-money country experiences a depreciation of its currency. The bilateral exchange rate between the small country and any of the large countries depends (negatively) on the money supply and (positively) on the fiscal policy of the other big country as well.

3.2 Fixed rates with leadership:

Let us suppose now that the three countries described above decide to peg their bilateral exchange rates within a monetary union. Moreover we assume as well that country 1 is the leader of the union (the N-th country), in the sense that it maintains its monetary autonomy; this means that the two other economies have to endogenously adjust their money supplies. This model can then be seen as the present functioning of the EMS as a Deutsche Mark zone: country 1 may be Germany, country 2 France or Italy (the United Kingdom if it joins the EMS) and the small country any other small member (Greece, Portugal or Spain in the case that they join the EMS). This simple version of reality leaves out the rest of the world (namely the United States and/or Japan) and therefore should be examined with caution.

Country 2 and the small country lose money supply as their control variable, being left only with domestic credit (d) as a policy instrument; as a result the quantity of foreign exchange reserves (r) is endogenously determined. This fact translates into the following equations:

$$m_2 = r_2/2 + d_2/2$$
$$m = r/2 + d/2$$

At the initial linearization point base money is composed of domestic credit

and foreign reserves in equal shares.[12]　Solving the system with these new constraints it is possible to obtain:

$$q_1 = \frac{\sigma\vartheta}{\varphi}m_1 + \frac{\beta\vartheta}{\varphi(1+\gamma)}g_1 + \frac{\beta\vartheta\gamma}{\varphi(1+\gamma)}g_2 + \Gamma_1 p_1 + \Gamma_2 p_2$$

$$q_2 = \frac{\sigma\vartheta}{\varphi}m_1 + \Lambda g_1 + \frac{\varphi+\gamma\vartheta}{\varphi(1+\gamma)}g_2 + \Gamma_1' p_1 + \Gamma_2' p_2$$

$$q = (1+\gamma)\frac{\sigma\vartheta}{\varphi}m_1 + \Lambda' g_1 + \frac{\beta\vartheta\gamma}{\varphi(1+\gamma)}g_2 + g + \frac{p}{\varphi} + \Gamma_1'' p_1 + \Gamma_2'' p_2$$

where:

$$\Lambda = \frac{\vartheta-\varphi}{1+\gamma} \gtrless 0$$

$$\Lambda' = \frac{\beta\vartheta}{\varphi(1+\gamma)} - 1 \gtrless 0$$

$$\vartheta = \frac{(1-\gamma)\beta}{\varphi} - \sigma > 0$$

$\Gamma_1 < 0, \Gamma_2 > 0, \Gamma_1' \gtrless 0, \Gamma_2' < 0$ e $\Gamma_i'' \gtrless 0$.[13]

In this new regime of fixed rates and leadership, the monetary policy ("beggar-thy-neighbour" in the flexible exchange rate regime) has become "locomotive" — its expansionary stance now has a positive effect on the output of the two follower countries. In fact, to maintain the intra-union nominal parities, country 2 has to adjust its money stock to any change in m_1 by the same amount, while the small country has to adjust by a larger amount; this leads necessarily to a positive ("locomotive") transmission of country 1's monetary policy to the followers.

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[12]　Also in this hypothesis we follow Roubini (1987) who considers other alternatives as well (the possibility of sterilization policies, symmetric intervention rules, etc.).

[13]　See appendix for the other endogenous variables and Γ_i, Γ_i' and Γ_i''.

Monetary policy in these countries is completly dependent on the policy pursued by the leader: a monetary expansion leads to an increase in output [14] and a monetary contraction leads to a recession.

Fiscal policy of country 1 has a positive effect on its own output; the effect on the output of the two other countries depends on the intensity of each of the following opposite effects: on the one hand, a fiscal expansion by the leader is directely and positively transmitted (via increase in the demand for imports from the two other countries) to the output of the followers; on the other hand, that expansion has a negative effect on their output via the contraction of their money supplies, given the tendency of country 1's currency to appreciate.

The fiscal policy of either of the two followers now has a cumulative effect on their own output because it is reinforced by a change in the money stock necessary to avoid any departures from intra-union fixed exchange rates.

Fiscal policy in country 2 is now "locomotive" with respect to the other countries: an increase in g_2 has, besides its usual stimulating consequences on the output of the other two countries, an additional positive effect due to the necessary monetary expansion, which acts positively upon the nominal interest rate without the negative effect, for the other economies, of the competitive exchange rate depreciation.

The fact that country 1 assumes the role of leader may be justified by the types of reasons used to describe the EMS case (the competitiveness versus discipline argument), or because it performs a more important role in international payments.[15] It is then natural that external shocks, for instance changes in the monetary or fiscal stance of a third country (like the US in respect to

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[14] This simple example assumes the aggregate supply is always equal to the aggregate demand. Of course in a more realistic model where the supply side is explicitly taken into account the result is not necessarily the same.

[15] See Wyplosz (1988) for a formal justification of this type of asymmetry in portfolio preferences.

the EMS), have a direct effect on the leader's monetary policy.[16] In this case
the burden of the adjustment is not shared equally by the different members of
the union. In fact, these types of shocks, even if initially symmetric, lead not
only to a change in the exchange rate between the union and the rest of the
world but also to a change in the relative intra-union money supply (foreign ex-
change reserves). This situation is depicted in the equations below (remember
that $\gamma > 0$).[17]

$$r_2 = 2m_1 + \frac{2\varphi}{1+\gamma}(g_2 - g_1) + 2\left(\frac{2\varphi\delta}{1+\gamma} - 1\right)(p_1 - p_2) - d_2$$

$$r = 2(1+\gamma)m_1 + 2\varphi(g_2 - g_1) + 2(2\varphi\delta - 1 - \gamma)p_1 + 2(1 - 2\varphi\delta)p_2 - d$$

Domestic credit creation is totally reflected in the change in foreign ex-
change reserves.

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[16] This argument is often used by the *Bundesbank* as a justification for a reluctant
leadership of the EMS.

[17] This situation is parallel to Mundell's argument (1968) on the optimal division
of the burden of adjustment: in order to minimize the welfare costs derived from an
external disturbance (which requires a change in relative prices) the large country
price level should be kept constant while the small countries should bear the burden
of the adjustment.

4. Conclusion

Small countries face exogenous policy shocks that should be taken into account in any stabilization programme they might undertake.

In a flexible exchange rate regime, the interaction of large countries might cause *per se* a bias in the world economy which can be seen as an external policy shock for any small country. It is argued (especially as far as the experience of recent years is concerned) that the lack of coordinated policies has generated an excessively deflationary situation. This is especially true, in the context of the model presented above, when the authorities of both countries do not face any exogenous uncertainty.

A three-country asymmetric model was developed to illustrate the need for relatively higher adjustments that may have to be undertaken by a small country in a monetary union. The deflationary bias stemming from the non-cooperative game between two large economies (the leader of a monetary union and a third large country, say Germany and the US for the EMS case) will affect the small country more than any other big country in the union. Therefore, the small country has to adjust more than any other economy in the union, as it is compelled to stick to the leader's monetary stance and to the maintainance of the intra-union parities. This fact is determined only by the country's size. In this case, the argument for "tying the hands" of the domestic monetary authorities in search of credibility at the cost of a lower degree of flexibility has to be more carefully examined.

Appendix

1. Endogenous monetary variables in a flexible exchange rate regime.

$$e_{1,2} = \frac{1+\gamma}{2\varphi\delta}(m_1 - m_2) + \frac{1}{2\delta}(g_2 - g_1) + (1 - \frac{1+\gamma}{2\varphi\delta})(p_1 - p_2)$$

$$e_1 = \frac{\beta\left[2 - \gamma(1+\gamma)\right] + 4\sigma\varphi}{4\delta\left[(1-\gamma)\beta\varphi + \sigma\varphi^2\right]}m_1 - \frac{(1-\gamma)\beta\gamma}{2\left[(1-\gamma)\beta\varphi + \sigma\varphi^2\right]}m_2 - \frac{1}{2\varphi\delta}m -$$

$$-\frac{(2-3\gamma)\beta + 2\sigma\varphi}{4\delta\left[(1-\gamma)\beta + \sigma\varphi\right]}g_1 + \frac{\gamma\beta}{4\delta\left[(1-\gamma)\beta\varphi + \sigma\varphi\right]}g_2 + \frac{1}{2\delta}g +$$

$$+\frac{\beta\delta(4 - 5\delta + \gamma\varphi) + \beta\delta\dfrac{1-\gamma}{\varphi} + \sigma(4\delta\varphi - 2\gamma)}{4\delta\left[(1-\gamma)\beta + \sigma\varphi\right]}p_1 +$$

$$+\frac{\dfrac{\gamma^2\beta}{\varphi} + 2\gamma\sigma + (1+\gamma-\gamma\varphi)}{4\delta\left[(1-\gamma)\beta + \sigma\varphi\right]}p_2$$

$$i = \frac{\gamma-1}{2\left[(1-\gamma)\beta + \sigma\varphi\right]}(m_1 + m_2) + \frac{\varphi}{2\left[(1-\gamma)\beta + \sigma\varphi\right]}(g_1 + g_2) +$$

$$\frac{1-\gamma}{2\left[(1-\gamma)\beta + \sigma\varphi\right]}(p_1 + p_2)$$

2. Endogenous monetary variables in a fixed exchange rate regime.

$$m_2 = m_1 + \frac{\varphi}{1+\gamma}(g_2 - g_1) + (\frac{2\varphi\delta}{1+\gamma} - 1)(p_1 - p_2)$$

$$m = (1+\gamma)m_1 + \varphi(g_2 - g_1) + [2\varphi\delta - (1+\gamma)]p_1 + (1 - 2\varphi\delta)p_2$$

$$i = \frac{\gamma - 1}{[(1-\gamma)\beta + \sigma\varphi]}m_1 + \frac{1}{\left[\frac{(1-\gamma)\beta}{\varphi} + \sigma\right](1+\gamma)}(g_1 + \gamma g_2) +$$

$$+ \frac{\frac{(1-\gamma^2)}{\varphi} + (\gamma-1)\delta}{\left[\frac{(1-\gamma)\beta}{\varphi} + \sigma\right](1+\gamma)}p_1 + \frac{(1-\gamma)\delta}{\left[\frac{(1-\gamma)\beta}{\varphi} + \sigma\right](1+\gamma)}p_2$$

3. Parameters not defined in the text ($\Gamma = \frac{\partial q}{\partial p}$).

$$\Gamma_1 = \frac{\beta\delta(\gamma-1) - \sigma(\gamma+1)}{[(1-\gamma)\beta + \sigma\varphi](\gamma+1)} < 0$$

$$\Gamma_2 = \frac{\beta\delta(1-\gamma)}{(1-\gamma)\beta + \sigma\varphi} > 0$$

$$\Gamma_1' = \frac{\beta\delta(1-3\gamma) - \sigma[\varphi(1+\gamma) + 1]}{[(1-\gamma)\beta + \sigma\varphi](\gamma+1)} \gtrless 0$$

$$\Gamma_2' = \frac{\beta\delta(\gamma-1) - 2\sigma\varphi}{(1-\gamma)\beta + \sigma\varphi} < 0$$

$$\Gamma_1'' = 2\delta - \frac{1+\gamma}{\varphi} + \frac{\beta\left[\frac{1}{\varphi}(1-\gamma^2) + \delta(\gamma-1)\right]}{\left[\frac{(1-\gamma)\beta}{\varphi} + \sigma\right](\gamma+1)} \gtrless 0$$

$$\Gamma_2'' = \frac{1 - 2\varphi\delta}{\varphi} + \frac{\beta\delta(1-\gamma)}{[(1-\gamma)\beta + \sigma\varphi](1+\gamma)} \gtrless 0$$

Note that when $\frac{2}{3} > \gamma > \frac{1}{3}$: $\quad \frac{\partial e_1}{\partial g_1} > 0 \quad$ e $\quad \Gamma_1' < 0$.

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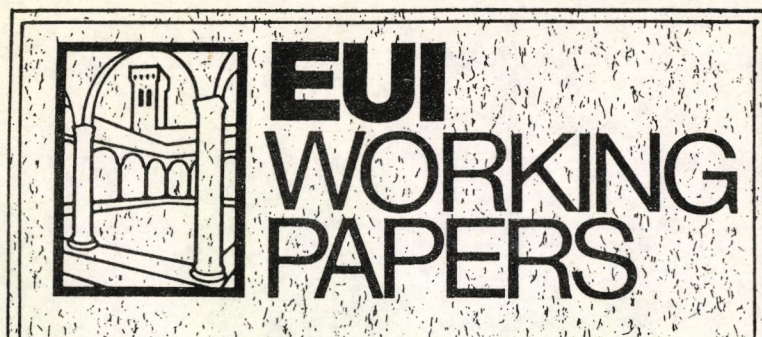
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