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On the Desirability of Coordinated Supply-side Intervention: Does a Monetary Union Matter?

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1. Introduction

When deciding the convenience of forming a monetary union, a question broadly discussed is that, due to the disappearance of domestic monetary policies and an independent exchange rate, national governments would have to deal with shocks mainly using fiscal policy. However, the disciplinary effects of a monetary union may require some discipline on fiscal policies; we can mention, as an example, the limitations imposed by the Pact for Stability and Growth in the European monetary union. As a consequence, it would be desirable to have other alternative policies available, and, among them, the possibility of using supply-side policies has been discussed – see (Viñals – Jimeno, 1998), (De Miguel – Sosvilla, 2001), (Hughes Hallet – Viegi, 2001) among others.

In this paper we examine the desirability of coordinated supply side intervention and the extent to which the formation of a monetary union could change the desirability of coordination. To this end, we first analyze the topic in a two-country model. Secondly, we modify the model so that the two countries form a monetary union, where an independent central bank controls monetary policy within the monetary union, but supply policies are still determined by the authorities at a national level.

The paper is structured as follows. In section 2, we develop the theoretical framework; in section 3, we study the desirability of supply-side policy coordination between countries; and section 4 concludes.

2. The Theoretical Framework

2.1 A Two-country Model

The starting point will be the standard two-country Mundell-Fleming model, extended to incorporate the supply side. The model developed in this

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paper is an extension of Díaz-Roldán (2003), and consists of two symmetric economies, country 1 and country 2, with flexible exchange rates and perfect capital mobility between them, along the lines of the classical literature on coordination – see (Oudiz – Sachs, 1984), (Cooper, 1985), (Canzoneri – Gray, 1985), (De Bonis, 1994), among others.

The set of equations for country 1 is as follows, and a similar setup is used for country 2:

$$y_1 = -\alpha r + \beta(e + p_2 - p_1) + \delta y_2 + f_1 \tag{1}$$

$$m_1 - p_1 = \theta y_1 - \psi r \tag{2}$$

$$p_{c1} = (1 - \mu)p_1 + \mu(p_2 + e) \tag{3}$$

$$w_1 - \varepsilon p_{c1} = \phi prod_1 - \eta u_1 + z_1 - v_1 - t_1 \tag{4}$$

$$p_1 - w_1 = -\phi prod_1 - \varphi u_1 \tag{5}$$

$$y_1 = n_1 + prod_1 \tag{6}$$

$$u_1 = l_1 - n_1 \tag{7}$$

All the variables are defined as rates of change, except r and u that capture the instantaneous changes in the interest rate, and in the unemployment rate, respectively.[1] All parameters, denoted by Greek letters, are non-negative.

Equation (1) represents the goods market equilibrium condition. Output, y, depends on the world's interest rate r, the real exchange rate $e + p_2 - p_1$ (derived from the nominal exchange rate and the domestic prices of the two countries), the other country's output, and a positive real shock f.

Equation (2) shows the money market equilibrium condition, where m denotes the money supply, and money demand depends on domestic output, and the world interest rate.

Equations (3) to (7) represent the aggregate supply of the economy, built along the lines of Layard, Nickell and Jackman (1991). Equation (3) defines the consumer price index p_c, as a weighted average of the domestic goods' and the imported goods' prices in terms of the domestic currency.

Equation (4) shows that nominal wages, w, are determined by the degree of indexation with respect to the consumer price index, depending on parameter ε; labour productivity, $prod$; the unemployment rate, u; wage pressure factors, z; the error in expectations, captured by the variable v; and the use, as a policy instrument, of a supply-side variable t, which could be used as a direct way of policy intervention in the labour market. Notice that the parameter ε denotes the degree of wage rigidity, with $0 \leq \varepsilon \leq 1$.

In equation (5), prices are set by adding a margin to wages, which depends on productivity, and the unemployment rate. We also assume that the parameter ϕ is the same as in the wage-setting equation (4), as in (Layard – Nickell – Jackman, 1991).

[1] Notice that, as usual in the literature on coordination, we assume that the change in the expected inflation rate and the change in the expected rate of change of the exchange rate, are both zero. This imply that the nominal interest rate equals the real interest rate, and that the domestic interest rate equals the world's interest rate.

To close the model, equation (6) defines changes in output as the sum of changes in employment, n, and productivity; and equation (7) defines changes in the unemployment rate, in terms of labour force, l, and employment.

2.1.1 Transmission of the Shocks

Solving the model given by equations (1) to (7) and their counterparts for country 2, and assuming equilibrium in the goods market, we can obtain the reduced forms for the two countries[2] – see (Díaz-Roldán, 2002) for further details. Therefore, the interaction of the variables shows interdependence between the two countries.

We find that a negative supply shock, always leads to a fall in output and a rise in prices in both countries.

In turn, positive demand shocks lead to positive effects on the output and prices of the country of origin of the shock. But when the shock is transmitted between the two countries, the sign of the coefficients depends on which channel of transmission prevails. In our model, the channels of transmission of the demand shocks are the aggregate demand, the interest rate, the nominal exchange rate, and the countries' relative prices. When aggregate demand prevails, the result is the "*locomotive effect*": we find an aggregate demand expansion coupled with an output expansion and a rise in prices in all the involved economies. But when changes in the interest rate and the real exchange rate prevail, the result is the "*beggar-thy-neighbour effect*": the effects on the output and prices of the country of origin of the shock are transmitted to the other country with the opposite sign.

2.2 The Model for a Monetary Union

In order to describe a monetary union, the two sets of equations for countries 1 and 2 are modified as follows: the nominal exchange rate is made equal to zero; and both countries replace each individual money market equilibrium condition (equation (2) for country 1, and the symmetric one for country 2) by a common equilibrium condition:

$$m - \frac{1}{2} p_1 - \frac{1}{2} p_2 = \frac{\theta}{2} y_1 + \frac{\theta}{2} y_2 - \psi r \qquad (8)$$

where m denotes now the union's money supply.

Notice that, since all the variables are in rates of change, the variables of the monetary union are equal to the weighted sum of the member countries' variables, so that for any variable x: $x = \frac{Y_1}{Y} x_1 + \frac{Y_2}{Y} x_2$, where x, x_1, x_2

[2] Equations (1) to (7) together with the set for country 2, would make a system of 14 equations with 14 endogenous variables: y_1, y_2, p_1, p_2, r, e, pc_1, pc_2, w_1, w_2, u_1, u_2, n_1 and n_2. The exogenous variables would be the policy instruments t_1 and t_2, as well as the monetary (m_1, m_2), real (f_1, f_2) and supply ($prod_1$, $prod_2$, z_1, z_2, v_1, v_2, l_1 and l_2) shocks.

are the rates of change of each variable for the union, country 1, and country 2 respectively; Y, Y_1, Y_2 are their levels of output, and $Y_1 + Y_2 = Y$. For simplicity, we will assume: $\frac{Y_1}{Y} = \frac{Y_2}{Y} = \frac{1}{2}$.

2.2.1 Transmission of the Shocks

In a similar way as the two-country model, we can obtain the reduced forms for the monetary union's member countries – see (Díaz-Roldán, 2002) for details.

For a negative supply shock, we also find an output fall and a rise in prices in both countries.

Regarding demand shocks, a real shock may lead again to both the "*locomotive effect*" or the "*beggar-thy-neighbour effect*", when transmitted to the other country. However, in contrast to the two-country model, a monetary union does not allow for country-specific monetary shocks.

3. Supply Policies Coordination

3.1 The Optimization Problem

We assume that countries 1 and 2 are represented by their authorities, which face the problem of minimizing their loss functions. In the two country model, they are:

$$L_1 = y_1^2 + \pi_1 p_1^2 \tag{9}$$

$$L_2 = y_2^2 + \pi_2 p_2^2 \tag{10}$$

where the target variables are the rates of change in both output (y_1, y_2), and prices (p_1, p_2). The authorities use as their policy instrument the supply side variable (t_1, t_2), and we assume $\pi_1 \neq \pi_2$ (i.e., we consider asymmetric preferences). Given the quadratic form of the loss functions, they will be minimized when the target variables are equal to zero.

As for the monetary union, the loss functions are now:

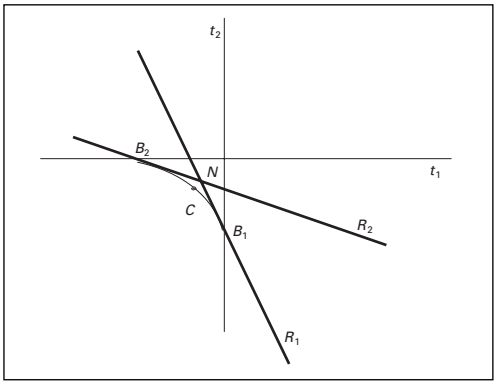
$$L_1 = y_1^2 + \sigma_1 g_1^2 + \pi_1 p_1^2 \tag{11}$$

$$L_2 = y_2^2 + \sigma_2 g_2^2 + \pi_2 p_2^2 \tag{12}$$

where assuming that the disciplinary effects of a monetary union imply some restrictions on fiscal policy, we include the budget deficit (g_1, g_2) as a target variable, with $\sigma_1 \neq \sigma_2$. An example of this situation is the European monetary union, where each member country has to fulfill the budget deficit requirements of the Pact for Stability and Growth. On the other hand, although in a monetary union an independent central bank controls monetary policy, prices are included as a target variable again, so that we try to capture the cost of the authorities' intervention in terms of inflation.

In both cases (the two-country model and the monetary union), the countries' authorities will choose the optimal rate of change of the supply side

FIGURE 1 Expansionary Shock in Both Countries. Cooperation Undesirable



variable, subject to the restrictions imposed by the international economic framework (i.e., the reduced form equations for each country). By solving the minimization problem of each country, we obtain the policy reaction functions of the authorities; and the competitive or Nash solution will be the intersection of these functions. However if the authorities decide to cooperate they will minimize the weighted sum of their individual loss functions, so obtaining the cooperative solution.

In order to avoid the spillover effects of their policies, the countries' authorities will identify stabilization with avoiding changes in the policy instrument. So, the authorities will choose the solution (competitive or cooperative) that requires the lowest change in the policy instrument.

3.2 Graphical Analysis

In this section, we will compare the competitive solution and the cooperative solution in graphical terms. In absence of shocks, the reaction functions, R_1 and R_2, of the two countries cross through the origin of the figures. But, after suffering a disturbance, the reaction functions shift to the left or to the right depending on the kind of shock. In these cases, the *bliss points* are denoted by B_1 and B_2.

3.2.1 Desirability of Supply Policy Coordination in a Two-country Model

Figure 1 shows the reaction functions after an expansionary (demand or supply) shock in both countries. The Nash solution is at point N, where the reaction functions intersect. There are infinite cooperative solutions, along the line linking the intercepts of the reaction functions, but we focus on the case in which both countries react in the same way, $t_1 = t_2$. In that case, the solution is given by point C in Figure 1; and, according to the criteria stated above, cooperation would be undesirable because it requires a greater change of the policy instrument.

In a similar way, as in the case of a contractionary (demand or supply)

FIGURE 2 Contractionary Shock in Both Countries. Cooperation Undesirable

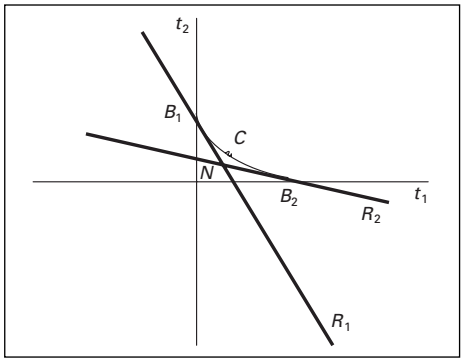
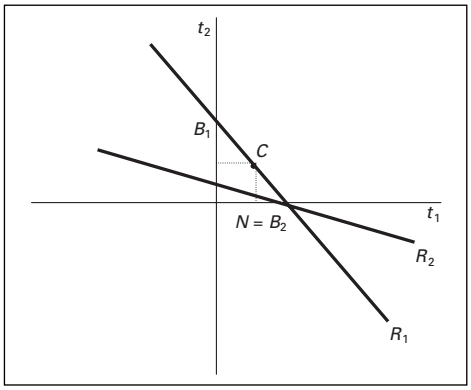


FIGURE 3 Contractionary Supply Shock in Country 1:
Cooperation Desirable for Country 1 and Undesirable for Country 2



shock leading to a recession in both countries, cooperation would be again undesirable (see *Figure 2*).

In *Figure 3* we depict the case of a contractionary supply shock in country 1. In this situation, cooperation would be desirable for country 1 but undesirable for country 2, which has not suffered the shock.

The above cases correspond to the "*locomotive effect*", so that the shocks would require the same policy response in the countries involved. Therefore, it would be preferable not to coordinate.

In contrast, different results would appear when expansionary (contractionary) demand shocks in a country of the union translate into a contraction (expansion) to the other country. In these cases, when the "*beggar-thy--neighbour effect*" prevails as in *Figures 4* and *5*, the shocks would require a different policy response in the countries involved. In other words, cooperation would prove to be desirable.

The results are summarized in *Table 1*. For supply shocks, cooperation always proves to be undesirable, but for demand shocks, the channel of transmission would be determinant.

FIGURE 4 Expansionary Demand Shock in Country 1, Contractionary in Country 2: Cooperation Desirable

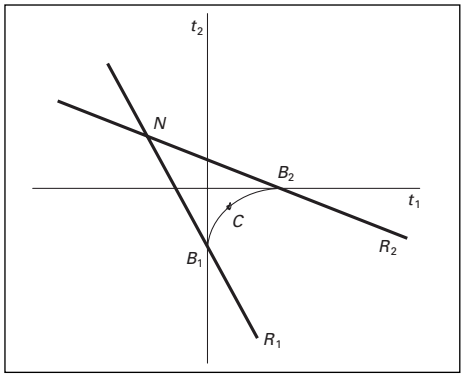


FIGURE 5 Expansionary Demand Shock in Country 2, Contractionary in Country 1: Cooperation Desirable

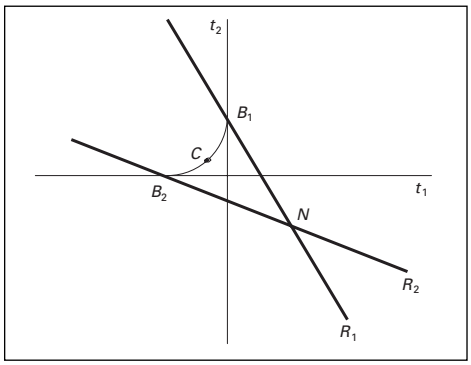


TABLE 1 Desirability of Supply Policy Coordination in a Two-country Model

SHOCK	COOPERATION
Monetary	"Locomotive effect": ***undesirable*** "Beggar-thy-neighbour effect": ***desirable***
Real	"Locomotive effect": ***undesirable*** "Beggar-thy-neighbour effect": ***desirable***
Supply	***Undesirable***

3.2.2 Desirability of Supply Policy Coordination in a Monetary Union

The results for a monetary union coincide with those of the two-country model in the cases of real and supply shocks. However, for monetary shocks, since a monetary union does not allow for country-specific monetary shocks, these would be transmitted in the same way leading to the "*locomotive effect*". In other words, coordination would be always undesirable against monetary shocks. Therefore, Figures 1, 2 and 3 will still apply for a monetary union, but Figures 4 and 5 would only apply for real shocks.

TABLE 2 Desirability of Supply Policy Coordination in a Monetary Union

SHOCK	COOPERATION
Monetary	***Undesirable***
Real	"Locomotive effect": ***undesirable*** "Beggar-thy-neighbour effect": ***desirable***
Supply	***Undesirable***

Table 2 summarizes the results. For monetary and supply shocks, cooperation always proves to be undesirable; but for real shocks, the channel of transmission would be again determinant.

4. Conclusions

In this paper we have analyzed the desirability of coordinated supply-side intervention within a monetary union against shocks, provided that the countries suffer some restrictions in the use of fiscal policy. In particular, we compared it with the case in which countries run independent monetary policies.

From our analysis we concluded that a monetary union with some restrictions on fiscal policy would require less coordinated supply-side intervention than a two-country model, since this would be desirable only for real shocks transmitted through the "*beggar-thy-neighbour effect*". On the contrary, when monetary policy is conducted at the national level (i.e., the no monetary union case), we find that country-specific monetary shocks can lead to ambiguous effects across the two economies, depending on the transmission mechanism, so that when they lead to the "*beggar-thy-neighbour effect*", there would appear an additional case for coordination.

In other words, coordinated supply-side intervention would be advised in a monetary union only against real shocks transmitted through the "*beggar-thy-neighbour effect*". Therefore, in the rest of the cases supply-side policies should be performed at the national level.

To summarize, coordination of supply-side policies would be useful only against shocks requiring a different policy response in each economy involved. For this reason, it would be crucial to know which would be the channel of transmission and the kind of disturbances actually prevailing in a particular monetary union.

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SUMMARY

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This paper examines the desirability of coordinated supply-side intervention within a monetary union, given the constraints on monetary and fiscal policy. The author considers an economic framework featuring independent monetary policy. In general, coordinated intervention is most useful against shocks that require distinct policy responses in each separate economy.