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## MACROECONOMIC ANALYSIS OF FINANCIAL CRISIS: DO MONETARY UNIONS MATTER?<sup>1</sup>

*Недавній аналіз фінансової кризи призвів до деяких дискусій про роль економічної політики, зокрема, про наслідки різних режимів грошової політики. Тим не менш, на рівні теоретичного аналізу моделі відкритої економіки досліджують тільки два полярних випадки гнучкого та фіксованого обмінного курсу, тоді як валютні союзи ще не достатньо досліджені. У цій статті ми проаналізуємо, як економічна політика сприяла компенсації зниження темпів зростання ВВП після фінансової кризи. Наш основний внесок полягає у розширенні стандартного підходу, що дозволяє отримати макроекономічну модель, яка описує діяльність валютного союзу.*

*Ключові слова: фінансова криза, економічна політика, валютні союзи.*

*Недавний анализ финансового кризиса привел к некоторым дискуссиям о роли экономической политики, в частности, о последствиях различных режимов денежной политики. Тем не менее, при теоретическом анализе модели открытой экономики исследуют только два полярных случая гибкого и фиксированного обменного курса, тогда как валютные союзы недостаточно исследованы. В этой статье мы проанализируем, как экономическая политика способствовала компенсации снижения темпов роста ВВП после финансового кризиса. Наш основной вклад заключается в расширении стандартного подхода, что позволяет получить макроекономическую модель, которая описывает деятельность валютного союза.*

*Ключевые слова: финансовый кризис, экономическая политика, валютные союзы.*

*The recent experience after the financial crisis has led to some debate on the role of economic policies; in particular, the implications of monetary policy regimes. However, at a theoretic analysis level, open-economy models only show the two polar cases of flexible and fixed exchange rates, while monetary unions are not properly described. In this paper, we will analyze how economic policies responses have contributed to offset the decline of GDP growth after a financial shock. Our main contribution will be to extend the standard approach providing a macroeconomic model that describes a monetary union.*

*Keywords: financial crisis, economic policies, monetary unions.*

The recent experience with the problems generated by the economic and financial crisis has led to some debate on the role of economic policies. In particular, to which extent a particular monetary policy regime would impose a restriction to policymakers. The greater is the degree of openness and economic integration, the greater are the effects of the interaction among the involved economies. Those effects depend on the international linkages or channels of transmission, being structural interdependence one of the main implications of integration with partner countries. Finally, the interdependence derived from the economic interaction among economies produces externalities which can turn to be counterproductive when having domestic policy decisions.

The recent financial crisis is considered to be the worst crisis since the Great Depression of the 1930s. After the collapse of financial institutions there has been a decline in economic activity and an increase of unemployment that have contributed to a global economic recession. There are several explanations for such a big crisis (see Reinhart and Rogoff (2009) for a survey of financial crises, and Carmona-González and Díaz-Roldán (2012) for an historical perspective of economic crises), but there is no consensus about how it could be avoided.

Macroeconomic models do not seem to capture specifically the role of financial markets. As far as we know a financial crisis is generally modelled as a monetary negative shock. Therefore, the main goal of this paper is to study the consequences of monetary (financial) shocks under alternative monetary agreements (and/or different exchange rate regimes). We will study two simple and alternative cases: a flexible exchange rate regime, and a fixed ex-

change rate that we will characterize as a monetary union. In this way, and through a simple two-country model, we will analyse the effects of monetary shocks on the involved economies when there are no restrictions in using the exchange rate and monetary policy as instruments. Next, we will examine the consequences of such kind of shocks when there is neither an independent monetary policy, nor an exchange rate policy, and the domestic authorities are constrained by the fiscal discipline imposed by the monetary agreements of a monetary union.

Establishing a monetary union has been suggested as an alternative to a system of fixed exchange rates. As is well known, recent experiences (such as the speculative attacks on currencies in the European Monetary System in 1992-1993, the default on Mexican debt in 1994, the devaluations and the banking crises across Asia in 1997-1998, the Argentine crises in 2001 and the recent financial crisis of 2007 followed by a global recession) have shown the increasing difficulty for a country to build the reputation needed to sustain a fixed exchange rate system. The ultimate reason is the spectacular growth of world capital markets, following the continuous liberalization and deregulation of capital movements that occurred in last years. So, if a government's compromise of maintaining a certain exchange rate is not believed as credible by financial markets, huge speculative attacks at such a massive scale would occur. All this has led to some authors (e.g., Obstfeld and Rogoff, 1995) to suggest that, in the near future, the choice faced by a country would be either maintaining a flexible exchange rate or adopting a common currency, rather than a fixed exchange rate, with other related countries. Moreover, from a macroeconomic point of view it

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is clear that a system of fixed exchange rates (and full capital mobility) implies that there is only one system-wide monetary policy. National currencies would become perfect substitutes through the irrevocable fixing of exchange rates if they became equally appropriate for the three classical functions of money, namely: unit of account, store of value and medium of exchange.

The Economic and Monetary Union (EMU) that started in Europe in 1999, displays a novel economic policy framework. A single monetary policy is the sole competence of an independent and supranational central bank, the European Central Bank (ECB), whilst other economic policies (budgetary and structural policies, as well as wage determination) generally remain the responsibility of the member states. The ECB formulates its policy in the light of developments in the euro area as a whole. Monetary policy is therefore well placed to respond, if necessary, to any symmetric shocks that might affect the currency area. By contrast, and in line with the subsidiarity principle, national governments are in a position (subject to certain common rules) to deal with their respective economies, e.g., in the case of country-specific shocks. However, the 2007 financial crisis spread into a global economic shock and it was transmitted to the EMU. In 2009 the Eurozone growth became negative.

The macroeconomic policy responses have focusing mainly in short-term actions such as expanding money supplies and implementing large fiscal stimulus packages. Both the U.S. Federal Reserve and the European Central Bank have done the largest monetary policy action in world history. Regarding the long-term responses, none significant measure has been implemented. Particularly, the lack of fundamental changes in banking and financial markets is one of the main concerns of some contributions to the International Monetary Fund publications (see Blanchard and Milesi-Ferreti (2009) and Merrouche and Nier (2010), among others).

In the EMU, the degree and the mechanism for coordination differ according to how convincing the economic rationale for coordination is in the particular policy area. The large risk posed by fiscal imbalances to any monetary

area stability justifies close rules-based coordination in budgetary policies. For those reasons, we first develop a simple two-country model in order to analyse in strategic terms how the authorities can deal with monetary shocks, and, second we compare the results with the case of a monetary union. When modelling the monetary union we will consider a common money market equilibrium condition, and alternatively a common monetary policy rule; as well as the fiscal limitations imposed by the monetary agreements.

The paper is structured as follows: the two alternative macroeconomic models are presented in section 2; the possibility of policy coordination is studied in section 3; section 4 shows the results; and, finally, section 5 concludes.

## 1. The macroeconomic models

### 1.1. The model of flexible exchange rates

The starting point will be the standard two-country Mundell-Fleming model, extended to incorporate the supply-side. The countries are symmetric; we assume flexible exchange rates and perfect capital mobility. The variables are defined as rates of change.

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

$$y_1 = -a r + b(e + p_2 - p_1) + d y_2 + f_1 \tag{1}$$

$$m_1 + q_1 - p_1 = -q y_1 - y r \tag{2}$$

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

$$w_1 - e p_{c1} = f prod_1 - h u_1 + z_1 - v_1 - t_1 \tag{4}$$

$$p_1 - w_1 = f prod_1 - j u_1 \tag{5}$$

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

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

(1) and (2) are the goods market and the money market equilibrium condition respectively, (3) to (7) describe the aggregate supply of the economy, following Layard, R., Nickell, S. and Jackman, R. (1991)

Solving the model given by equations (1) to (7) and their counterparts for country 2 (see Díaz-Roldán (2004) for details), we obtain the reduced form:

$$y_1 = M_y m_1 \pm M'_y m_2 + M_y q_1 \pm M'_y q_2 + F_y f_1 \pm F'_y f_2 - S_y s_1 - S'_y s_2 - S_y t_1 - S'_y t_2 \tag{8}$$

$$y_2 = M_y m_2 \pm M'_y m_1 + M_y q_2 \pm M'_y q_1 + F_y f_2 \pm F'_y f_1 - S_y s_2 - S'_y s_1 - S_y t_2 - S'_y t_1 \tag{9}$$

$$p_1 = M_p m_1 \pm M'_p m_2 + M_p q_1 \pm M'_p q_2 + F_p f_1 \pm F'_p f_2 + S_p s_1 + S'_p s_2 + S_p t_1 + S'_p t_2 \tag{10}$$

$$p_2 = M_p m_2 \pm M'_p m_1 + M_p q_2 \pm M'_p q_1 + F_p f_2 \pm F'_p f_1 + S_p s_2 + S'_p s_1 + S_p t_2 + S'_p t_1 \tag{11}$$

Where  $s$  captures the supply-side shocks:  $s = z - v - (1/\lambda) prod$ , with  $\lambda = 1/(\eta + \phi)$ . Notice that a negative supply shock ( $s > 0$ ), leads to a fall in output and a rise in prices in both countries. And a positive demand shocks ( $q, f > 0$ ) lead to positive effects on the output and prices of the country of origin of the shock, but when transmitted to the other country the effects depend on the channel of transmission.

When a country's aggregate demand increases, also increases foreign goods' imports, and the result is the called "locomotive" effect, i.e., the effects on the output and prices of the country of origin of the shock are transmitted to the other country with the same sign.

When changes in the real exchange rate prevail, the result is the "beggar-thy-neighbor" effect, i.e., the effects on the output and prices of one country are transmitted abroad with the opposite sign. The reason is that a real

exchange rate depreciation (appreciation) in an economy means an appreciation (depreciation) in the other, which leads to an aggregate demand expansion (recession) in that economy, and to a recession (expansion) in the other.

### 1.2. The model of fixed exchange rates: a monetary union

Establishing a monetary union has been suggested as an alternative to a system of fixed exchange rates (e.g., Obstfeld and Rogoff, 1995). As mentioned in the introduction, recent experiences have shown the increasing difficulty for a country to build the reputation needed to sustain a fixed exchange rate system.

From a macroeconomic point of view, a system of fixed exchange rates (and full capital mobility) implies that national currencies would become perfect substitutes through the irrevocable fixing of exchange rates, so there would be

only one monetary policy, and therefore, a monetary union would guarantee the credibility of the system

Next, in order to characterize a fixed exchange rate, we will develop the extreme case of a monetary union. For simplicity, we will develop a model for a small mone-

tary union. The set 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 by a common equilibrium condition:

$$m + q - (1/2) p_1 - (1/2) p_2 = (\theta/2) y_1 + (\theta/2) y_2 - \psi r \tag{12}$$

where  $m$  denotes the union's money supply, and  $q$  a common monetary (or financial) shock.

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  $x$ :  $x = (Y_1/Y)x_1 + (Y_2/Y)x_2$ , where  $x$ ,  $x_1$ ,  $x_2$  are the rates of change of a particular variable for the union.  $Y$ ,  $Y_1$ ,  $Y_2$  are their levels of output, and  $Y_1 + Y_2 = Y$ .

For simplicity, we will assume the symmetric case  $(Y_1/Y) = (Y_2/Y) = 1/2$ .

In a similar way to the two-country model, (see Díaz-Roldán (2004) for details), we obtain the reduced form for the monetary union's member countries:

$$y_1 = M_y m + M_y q + F_y f_1 \pm F_y f_2 - S_y s_1 - S_y s_2 - S_y t_1 - S_y t_2 \tag{13}$$

$$y_2 = M_y m + M_y q + F_y f_2 \pm F_y f_1 - S_y s_2 - S_y s_1 - S_y t_2 - S_y t_1 \tag{14}$$

$$p_1 = M_p m + M_p q + F_p f_1 \pm F_p f_2 + S_p s_1 + S_p s_2 + S_p t_1 + S_p t_2 \tag{15}$$

$$p_2 = M_p m + M_p q + F_p f_2 \pm F_p f_1 + S_p s_2 + S_p s_1 + S_p t_2 + S_p t_1 \tag{16}$$

For a negative supply shock, we also find an output fall and a rise in prices in both countries. Regarding demand shocks, a shock that affect the goods market may lead again to the "locomotive" effect or the "beggar-thy-neighbour" effect, when transmitted to the other country. However, in contrast with the two-country model, a monetary union does not allow for country-specific monetary shocks.

## 2. Macroeconomic policy coordination

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

$$L_1 = y_1^2 + \pi_1 p_1^2 \tag{17}$$

$$L_2 = y_2^2 + \pi_2 p_2^2 \tag{18}$$

The target variables are: the rates of change in both output ( $y_1$ ,  $y_2$ ) and prices ( $p_1$ ,  $p_2$ ), and we assume  $\pi_1 \neq \pi_2$  (i.e., we consider asymmetric preferences). The authorities could use as their policy instrument: the money supply ( $m_1$ ,  $m_2$ ), the budget deficit ( $g_1$ ,  $g_2$ ), or a supply-side variable ( $t_1$ ,  $t_2$ ). Given the quadratic form of the loss functions, they will be minimized when the target variables are equal to zero.

In the monetary union, the loss functions are now:

$$L_1 = y_1^2 + \sigma_1 g_1^2 + \pi_1 p_1^2 \tag{19}$$

$$L_2 = y_2^2 + \sigma_2 g_2^2 + \pi_2 p_2^2 \tag{20}$$

Where assuming that the disciplining effects of a monetary union imply some restrictions on fiscal policy, we include the budget deficit ( $g_1$ ,  $g_2$ ) as a target variable, and we consider asymmetric preferences ( $\sigma_1 \neq \sigma_2$ ) again. An example of this situation is the EMU, where each member country has to fulfil the budget deficit requirements of the Pact for Stability and Growth.

In both cases (the two-country model and the monetary union) the countries' authorities are subject to the restrictions imposed by the international economic framework, which is given by the reduced form of the model.

By solving the optimization 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. A well known example of international policy conflict arise from currency depreciating policies under flexible exchange rates, just as they emerge from the use of devaluation under fixed exchange rates. However if the

authorities decide to cooperate they will minimize the weighted sum of their individual loss functions, 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. When solving the optimization problems (playing Nash or the cooperative solution) from the first-order conditions of the social planner problem, we find that the cooperative solution internalizes the externalities. When the externality has the same sign than the shock, the cooperative solution reinforces the effect of the shock. In those cases, the cooperative solution requires a greater change of the policy instrument than the Nash solution; therefore, cooperation became counterproductive or non desirable. Given that, the desirability of coordination can be determined by comparing the effect of the shock in the reduced form equation (given by its mathematical sign), with the externality derived from the policy instrument when the authorities try to offset the shock in a coordinated way (cooperative solution). The cases where cooperation would be undesirable are those in which the externality derived from the change of the policy instrument reinforces the effect of the shock. On the contrary, the cases where cooperation proves to be desirable are those in which the externality from the policy instrument offsets the effect of the shock, so that the coordinated solution implies a lower change in the policy instrument.

## 3. Results

Solving the optimization problems we would be able to derive the conditions under which macroeconomic policy coordination could be desirable (see Díaz-Roldán (2004) for further details). Table 1 shows the main findings. When using monetary policy to deal with financial shocks in a flexible exchange rate regime, it does not matter to coordinate or not. Regarding fiscal policies, coordination would be desirable only for financial shocks transmitted through the real exchange rate and leading to the "beggar-thy-neighbour" effect.

The effectiveness of demand policies, depends on the money supply process under the particular exchange rate regime (Recall that in a two-country model, the relative effectiveness of demand policies under flexible exchange

rates is the opposite to that obtained under fixed exchange rates). In a two-country model, flexible exchange rates insulate the economy from isolated foreign autonomous spending disturbances but not from a general coordinated disturbance by a group of foreign countries.

When using the budget deficit as policy instrument, fiscal policy coordination proves to be useful only when shocks are transmitted leading to "beggar-thy-neighbour" effect. If a negative financial shock leads to an decrease in output in both countries simultaneously, cooperation would result desirable since it requires a lower change in budget deficit in both countries. On the contrary, it can be proved that for the "locomotive" effect, externalities have the same sign than the shock. Because of that, cooperation is undesirable since it reinforces the effects of the shock and requires a greater change in the budget deficit.

If we look at the case of supply-side intervention, it would be desirable only to deal with financial shocks transmitted through the real exchange rate and leading to the "beggar-thy-neighbour" effect. When using a supply-

side variable as a policy instrument, for the case of a negative financial shock leading to an output reduction in both countries, cooperation would be undesirable because requires a greater change of the policy instrument. That case corresponds 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 a negative financial shock in a country translates into a expansion in the other country. In this case, when the "beggar-thy-neighbour" effect prevails, the shock would require a different policy response in the countries involved. In other words, cooperation would prove to be desirable.

Finally, under a fixed exchange regime (the model for a monetary union), since the countries have lost their independence in the use of the exchange rate and monetary policy, we only consider the use of fiscal and supply-side policies. Solving the optimization problems, we have found that the best solution is not coordinate.

**Table 1. Desirability of macroeconomic policies coordination when dealing with financial shocks**

Policy	Two-country model	Monetary union
Monetary	Indifferent	
Fiscal	- Locomotive ND - Beggar-thy-neighbour D	- Locomotive ND - Beggar-thy-neighbour ND
Supply-side	- Locomotive ND - Beggar-thy-neighbour D	- Locomotive ND - Beggar-thy-neighbour ND

Note: Results show that macroeconomic policies coordination may be "desirable" (D) or "non desirable" (ND). Those results depend on the way of transmission of the shocks: the *locomotive* effect or the *beggar-thy-neighbour* effect.

#### 4. Conclusions

In this paper we have analysed how economic policies responses could contribute to offset monetary (financial) shocks under alternative exchange rate regimes. In particular, to which extent a specific monetary policy regime would impose a restriction to policymakers.

We have studied two simple and alternative cases: first, a flexible exchange rate regime within a two-country model; and second, a fixed exchange rate characterized as a small monetary union. In this monetary union, the domestic authorities are constrained by the fiscal discipline imposed by the monetary agreements of a monetary union. Finally, we have shown the desirability of macroeconomic policy coordination within the monetary union (provided that the countries suffer some restrictions also in the use of fiscal policy), and we have compared it with the case in which countries have a flexible exchange rate regime, and run independent monetary policies.

Particularly, when using monetary policy to deal with monetary shocks in a flexible exchange rate regime (the two country model), coordination proves to be indifferent. Regarding fiscal and supply-side policies in the two-country model, coordination would be desirable only for monetary

shocks leading to the "beggar-thy-neighbour" effect, being this result independent of the exchange rate regime. Finally, the coordination of fiscal and supply-side policies in a monetary union would not be advised. Notice that the results for fiscal and supply-side policies are identical.

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