European Research Studies,
Volume XII, Issue (3), 2009

Economic Governance in an Asymmetric Monetary Union: A Fiscal Policy Game Analysis

Cornel Oros[♣]

Abstract:

Given a Monetary Union which is heterogeneous at the level of labour market flexibility, this paper studies the relative effectiveness of two fiscal policy games, i.e. Nash equilibrium and fiscal coordination in terms of macroeconomic stabilization.

We will use a static Keynesian model within a closed Monetary Union and prove that the stabilization effectiveness depends mainly on the type and origin of the economic shocks affecting the Union members.

Our results also point out that neither of the fiscal configurations succeeds in optimizing the macroeconomic stabilization of both the demand and supply shocks simultaneously for all the Union members.

Keywords*: Economic policy, Macroeconomic Stabilization, Economic Shocks, Structural Heterogeneity.*

JEL*: E 52, E 58, E 61, E 62, E 63.*

[♣]University of Poitiers, Faculty of Economics, CRIEF-MOFIB. 93 avenue du Recteur Pineau – 86022 Poitiers, France. Tel.: (33) 05 49 45 48 45. E-mail : cornel.oros@univ-poitiers.fr

1. Introduction

The adoption of the euro has brought about a complete change of perspective on the coordination of economic policies within the Economic and Monetary Union. On the one hand, the two instruments acting against the country-specific shocks that may affect the Union members, that is the interest rate and the exchange rate, have lost their autonomy. On the other hand, the game of economic policies will take place henceforth in a particular context: the single and centralized monetary policy, which is set up by an independent monetary authority (the European Central Bank), will interfere with several decentralized fiscal policies, and set up by the national governments. Within this original framework, a new debate arises: what is the impact of the fiscal policy coordination on the efficiency of the macroeconomic stabilization?

The answers provided by the literature on the subject are rather contradictory because of the different theoretical frameworks used. Uhlig (2002) underlines the existence of a very clear specialization between the Central bank and the national governments: the Central bank stabilizes symmetrical supply shocks, whereas the governments deal with national demand shocks. As a result of this specialization, the conflict between public authorities will increase, having negative consequences on the macroeconomic equilibria. According to Uhlig, the solution relies on the enforcement of the Stability and Growth Pact which sets up a form of coordination between governments. This solution allows a limitation of the public deficits of the Union members and avoids the implementation of an extremely binding monetary policy.

Mundschenk and von Hagen (2003), while making the same assumption as Uhlig regarding the specialization between authorities, claim however that the fiscal policies are inefficient being limited exclusively to the use of automatic stabilizers, and that the Stability Pact can't guarantee an efficient macroeconomic stabilization. They support the idea of an active coordination of the fiscal policies that can improve the efficiency of the macroeconomic stabilization compared to a non cooperative equilibrium. Lambertini and Rovelli (2003) defend the same idea and show that the informational power plays an essential part in the mechanisms of shock stabilization. Thus, the governments' leadership improves the efficiency of macroeconomic stabilization.

At the same time, the effects of the fiscal policy coordination may differ according to the types of the shock affecting the economy. As shown by Beetsma, Debrun & Klaassen (2001), even if the fiscal policy coordination has a positive effect on asymmetric shocks' stabilization, it may nevertheless prove to be counterproductive as regards symmetric shocks' stabilization. This analysis is confirmed by Laskar (2003) who identifies an optimum degree of shock asymmetry at the level of which the fiscal coordination in a Monetary Union begins to be more efficient than in a flexible exchange rate system. However, Villieu (2000) states that on the contrary, with the enlargement of the Monetary Union, the fiscal coordination becomes less efficient if the degree of shock asymmetry grows.

These studies, like most of the literature dealing with the subject, are limited by the fact that they only take into consideration the countries which are homogeneous from a structural point of view. In reality, the EMU members display various and important structural heterogeneities (different sector structures, heterogeneities in terms of financial structures and at the level of the national labour market organization[1]). With the gradual enlargement of the Euro zone, these heterogeneities will become even more significant and will therefore influence the mechanisms of macroeconomic stabilization.

Under these circumstances, we consider that the structural heterogeneity of the Union affects the labour market flexibility and we will study the efficiency in terms of macroeconomic stabilization of two fiscal policy games liable to take place between governments, i.e. Nash equilibrium and fiscal coordination. More precisely, we will make a distinction between shocks according to their type and origin and will analyse whether the fiscal coordination can improve the national welfare of each country member in comparison with a non cooperative game between governments.

The first section of the paper presents the model that we have used and the reaction functions of public authorities (Central bank and national governments). The second section assesses, by means of numerical simulations, the relative efficiency of the fiscal coordination compared to a non cooperative game between national governments in terms of stabilization of the different economic shocks. The final section concludes.

2. The Model

We use a static Keynesian model within a closed Monetary Union with two countries (i, j). The macroeconomic equilibria are described by demand and supply functions and we consider that the heterogeneity of the Union concerns the labour market flexibility. All the variables (except the interest rate) are expressed in logarithms. Thus the demand function is represented by a standard IS function, often used in the literature:

$$y_i^d = ag_i + bg_j - \delta r + \varepsilon_i^d \qquad 0 < a < 1; \quad |b| < 1 \; ; \; \delta > 0 \qquad (1)$$

where y_i^d and g_i are the output (as deviation from the natural output) and the budget deficit respectively of country i; g_j represents the budget deficit of the

[1] See Cadiou *et al.* (1999), Kaiser (2005), Mojon and Peersman (2001), Penot *et al.* (2000), Van Els *et al.* (2001) for a review of the literature.

country j; r – the short-term interest rate; ε_i^d the demand shock specific to the country i with zero mean and finite variance $\sigma^2_{\varepsilon_i^d}$.

The national demand of the country i depends positively on the national budget deficit according to a sensitivity bellow the unit ($a<1$) because of the crowding out effect, and depends negatively on the interest rate according to sensitivity δ. At the same time, the national output of the country i is influenced by the budget deficit of the other Union member in a proportion b. The sign of the parameter b can be positive or negative according to whether it is the output channel or the common exchange rate channel respectively that plays the major part in the transmission of the fiscal spillovers. Finally, the national output is influenced by a specific demand shock.

As regards the supply equation, the production (y_i^s) is described by a "Lucas supply" function augmented by the imported inflation. We consider that the expected inflation is zero as we are only investigating the issue of the macroeconomic stabilization and therefore leave aside any question of credibility.

$$y_i^s = \mu_i \pi_i - \mu_i s(\pi - \pi_i) + \varepsilon_i^s \qquad \mu_i > 0,\ s > 0 \tag{2}$$

where π and π_i are the average inflation of the Union and the inflation of the country i respectively; ε_i^s – a supply shock specific to the country i with zero mean and finite variance ($\sigma^2_{\varepsilon_i^s}$).

The coefficient μ measures the degree of labour market flexibility (Beetsma, Debrun and Klaassen, 2001 and Buti, Roeger and In't Veld, 2001). If we represent the degree of heterogeneity between countries by a coefficient k ($0<k<1$), then $\mu_i = (1+k)\mu$ and $\mu_j = (1-k)\mu$, where μ stands for the average sensitivity of production to the price evolution. Therefore, if $k=0$, the countries will be perfectly homogeneous in terms of labour market flexibility ($\mu_i = \mu_j$), whereas, if $k=1$, the heterogeneity between the two countries reaches its maximum degree, as the price dynamics influences exclusively and with a maximum impact the national production of the country i ($\mu_i = 2\mu$ and $\mu_j = 0$).

For any variable x, we have defined the aggregate component $x = (x_i + x_j)/2$ (which represents the symmetric component of the variable x) and the difference component $\bar{x} = (x_i - x_j)/2$ (which represents the asymmetric component of the variable x). Regarding shocks, we consider ε^θ et $\bar{\varepsilon}^\theta$ which stands for symmetric and asymmetric shocks respectively, where $\theta = d,\ s$.

Having described the macroeconomic equilibria we will now analyse the behaviour of the policymakers. The Central bank decides on the single monetary policy using its interest rate as a policy instrument to achieve its objectives. The Central bank is mainly interested in price stabilization (with a weight β_0), but also in output stabilization (with a weight β_1) and in interest rate smoothing (with a weight β_2).[2]

$$L^M = \frac{1}{2}\left[\beta_0 \pi^2 + \beta_1 y^2 + \beta_2 r^2\right] \text{ where } \quad \beta_0,\ \beta_1,\ \beta_2 \in (0;1) \tag{3}$$

The governments are in charge with the implementation of the fiscal policies using the budget deficit as a policy instrument. Their aim is to minimize a loss function (L_i^G) which depends on the evolution of national economic activity and national budget deficit (the relative weight of these objectives are α_0, α_1). We consider that the governments are not interested in price stabilization. Indeed, within the Euro zone, the governments' reaction in order to stabilize the activity and prices is considerably restricted by the measures of the Stability and Growth Pact, whereas the ECB's main objective is the stabilization of inflation. Consequently, we can infer that the fiscal authorities will take a greater interest in stabilizing the output than in stabilizing the prices. Moreover, we have considered that the imported inflation influences the national prices' evolution (see equation 2) and thus weakens ever more the governments' capacity to maintain the price stabilization.

$$L_i^G = \frac{1}{2}\left[\alpha_0 y_i^2 + \alpha_1 g_i^2\right] \qquad \alpha_0,\ \alpha_1 \in (0;1) \tag{4}$$

Besides the Central bank's and the governments' loss functions, we also build a social loss function defined at the national level for each country of the Union. It depends on the national variables of the output and inflation (their relative weights being α_0^S and α_1^S respectively). This function will allow us to compare the effectiveness in terms of macroeconomic stabilization of the Nash equilibrium relative to the fiscal coordination game.

$$L_i^S = \frac{1}{2}\left[\alpha_0^S y_i^2 + \alpha_1^S \pi_i^2\right] \quad \alpha_0^S,\ \alpha_1^S \in (0;1) \tag{5}$$

[2] The target values of the macroeconomic variables in the policymakers' loss functions are normalized to zero.

3. The Analysis of the Model

We consider Nash equilibrium between national governments and the Central Bank. The first stage in solving the model is to identify the optimal decisions of public authorities, which can minimize their loss functions. The interest rate writes as:

$$r = \frac{1}{\delta}\left[z\left((a+b)g + \varepsilon^d\right) - \theta\left[k\left((a-b)\bar{g} + \bar{\varepsilon}^d - \bar{\varepsilon}^s\right) + \varepsilon^s\right]\right] \quad (6)$$

where $z = \dfrac{\beta_0\eta^2 + \beta_1}{\beta_0\eta^2 + \beta_1 + \dfrac{\beta_2}{\delta^2}}$ $\theta = \dfrac{\beta_0\eta^2}{\beta_0\eta^2 + \beta_1 + \dfrac{\beta_2}{\delta^2}}$ and $\eta = \dfrac{1}{\mu(1-k^2)}$

The reaction function of the governments depends on the type of game developed between them.

3.1 Nash Equilibrium

In this case, there is an utter lack of coordination between governments, each of them aiming at minimizing its own loss function. The aggregate and difference component of public deficit are:

$$\left.\begin{aligned} g^N &= \frac{a\alpha_0(\delta r - \varepsilon^d)}{\alpha_1 + a\alpha_0(a+b)} \\ \bar{g}^N &= -\frac{a\alpha_0}{\alpha_1 + a\alpha_0(a-b)}\bar{\varepsilon}^d \end{aligned}\right\} \quad (7)$$

Using the equations (6) and (7), the equilibrium values of the public deficit and the interest rate become:

$$\left.\begin{aligned} g^N &= -\frac{a\alpha_0}{D^N}\left[(1-z)\varepsilon^d + \theta(\varepsilon^s - k\bar{\varepsilon}^s) + \frac{\theta\alpha_1 k}{'D^N}\bar{\varepsilon}^d\right] \\ r^N &= \frac{1}{\delta D^N}\left[\alpha_1 z\varepsilon^d - D\left(\theta(\varepsilon^s - k\bar{\varepsilon}^s) + \frac{\theta\alpha_1 k}{'D^N}\bar{\varepsilon}^d\right)\right] \end{aligned}\right\} \quad (8)$$

Where $D^N = \alpha_1 + a\alpha_0(a+b)(1-z)$; $'D^N = \alpha_1 + a\alpha_0(a-b)$ and $D = \alpha_1 + a\alpha_0(a+b)$

The equations (8) allow us to seize the difference between the public authorities' responses according to the type of economic shocks. Thus, the efforts made by the governments and the Central Bank in order to stabilize the symmetric demand shocks converge. For instance, in the case of a negative demand shock, the authorities will adopt an expansionary policy; the public deficit will rise while the interest rate will go down in order to encourage the demand and to boost the activity. On the contrary, when it comes to the supply shocks, the authorities' reactions diverge. Indeed, these shocks hit directly only the inflation, causing the Central Bank to react as it is the only one interested in this objective. As a consequence of this reaction which affects the output, the governments will respond because they are concerned with bringing the economic activity at the equilibrium level again.

The aggregate and difference components of the output and the inflation are:

$$\left.\begin{aligned} y^N &= \frac{\alpha_1}{D^N}\left[(1-z)\varepsilon^d + \theta(\varepsilon^s - k\bar{\varepsilon}^s) + \frac{\theta\alpha_1 k}{D^N}\bar{\varepsilon}^d\right] \quad ; \qquad \bar{y}^N = \frac{\alpha_1}{D^N}\bar{\varepsilon}^d \\ \pi^N &= \frac{\eta}{D^N}\left[\alpha_1(1-z)\varepsilon^d - (D^N - \theta\alpha_1)\left((\varepsilon^s - k\bar{\varepsilon}^s) + \frac{\alpha_1 k}{D^N}\bar{\varepsilon}^d\right)\right] \\ \bar{\pi}^N &= \frac{\eta}{(1+s)D^N}\left[-\alpha_1 k(1-z)\varepsilon^d + k(D^N - \theta\alpha_1)\varepsilon^s - (D^N - \theta\alpha_1 k^2)\left(\bar{\varepsilon}^s - \frac{\alpha_1}{D^N}\bar{\varepsilon}^d\right)\right] \end{aligned}\right\} \quad (9)$$

3.2 Fiscal Coordination

In this configuration the governments cooperate and the collective loss function will correspond to the sum of all the national loss functions:

$$L^C = L_i^G + L_j^G = \frac{1}{2}\left[\alpha_0(y_i^2 + y_j^2) + \alpha_1(g_i^2 + g_j^2)\right] \quad (10)$$

The aggregate and difference components of the output and the inflation are :

$$\left.\begin{aligned} y^C &= \frac{\alpha_1}{D^C}\left[(1-z)\varepsilon^d + \theta(\varepsilon^s - k\bar{\varepsilon}^s) + \frac{\theta\alpha_1 k}{D^C}\bar{\varepsilon}^d\right] \quad ; \qquad \bar{y}^C = \frac{\alpha_1}{D^C}\bar{\varepsilon}^d \\ \pi^C &= \frac{\eta}{D^C}\left[\alpha_1(1-z)\varepsilon^d - (D^C - \theta\alpha_1)\left((\varepsilon^s - k\bar{\varepsilon}^s) + \frac{\alpha_1 k}{D^C}\bar{\varepsilon}^d\right)\right] \\ \bar{\pi}^C &= \frac{\eta}{(1+s)D^C}\left[-\alpha_1 k(1-z)\varepsilon^d + k(D^C - \theta\alpha_1)\varepsilon^s - (D^C - \theta\alpha_1 k^2)\left(\bar{\varepsilon}^s - \frac{\alpha_1}{D^C}\bar{\varepsilon}^d\right)\right] \end{aligned}\right\} \quad (11)$$

where $D^C = \alpha_1 + \alpha_0 (a+b)^2 (1-z)$; $'D^C = \alpha_1 + \alpha_0 (a-b)^2$

Taking into account the aggregate and difference components of the output and inflation, we can identify the equilibrium values of these macroeconomic variables at the national level according to the type of fiscal game configuration. If we consider $\phi = \mathrm{N}, \mathrm{C}$ as the two games liable to take place between the governments, i.e. the Nash equilibrium and the fiscal coordination, any national variable x_i will be written according to the demand and supply shocks specific to the two Union members i and j: $X_i^{\phi} = f^{\phi}(\varepsilon_i^d, \varepsilon_j^d, \varepsilon_i^s, \varepsilon_j^s)$. By means of these national equations, we will be able to conceive the social loss functions for each country and to compare the relative efficiency of the two fiscal games in terms of macroeconomic stabilization[3].

In order to study analytically the impact the Union's heterogeneity degree has on the national stabilization mechanisms, we will make a double distinction between the stabilization of output and inflation, on the one hand, and between the type and origin of the shocks on the other hand. In the case of output stabilization, we point out firstly that the effectiveness of output stabilization for the country j against its own demand shocks improves if the Union's heterogeneity rises ($\left[\frac{\partial y_j^{\phi}}{\partial k}\right]_{\varepsilon_j^d} < 0$).

Secondly, in the case of supply shocks specific to the country j, if k increases (rise of the structural heterogeneity between the Union members) the impact of this kind of shocks on the national output of all the Union members will also rises ($\left[\frac{\partial y_{i,j}^{\phi}}{\partial k}\right]_{\varepsilon_j^o} > 0$).

These evolutions are the direct consequence of the different influences of the two countries on the aggregate inflation at the Union level. Indeed, if k rises, the labour market of the country i becomes more flexible than the labour market of its partner j and the latter's weight is thus more important in fixing the aggregate inflation at the Union level (see equation 2). Under these circumstances, the Central bank will develop a relatively more reactive monetary policy in order to stabilize the shocks specific to the country j to the detriment of the shocks specific to the country i. Thus, for the country j's specific shocks, a reinforced monetary policy action will have different effects on the output stabilization according to the type of shocks: it will improve the output stabilization in the case of the demand shocks (due to the convergent efforts of stabilization developed by the Central bank and the

[3] The full expressions of the social loss functions at the national level are presented in Appendix 1.

governments of the countries affected by these shocks), it will worsen the output stabilization for the supply shocks (this kind of shocks are transmitted to the output by the monetary policy channel).

On the contrary, in the case of shocks specific to the country i, the impact of the Union's heterogeneity evolution degree on the national output is not clear-cut because the national governments can make up in some measure for the lack of monetary policy reaction generated by the increase of k. Indeed, a variation of k causes a re-adjustment in the monetary policy decision process which generates a response from the national governments. Nevertheless, if the Central bank is mainly interested in price stabilization (β_0 high), the governments' responses aren't able to overweigh the effects of a particularly active monetary policy (β_0 being high, β_2 will be weak which implies that the Central bank has very large autonomy in using its interest rate). Thus, following a rise in k, the country i specific shocks bring about the opposite effects relatively to country j specific shocks: a worsening of the national output stabilization against the demand shocks ($\left[\frac{\partial y_i^{\phi}}{\partial k}\right]_{\varepsilon_i^d} > 0$), a improvement of output stabilization for all the Union members against the supply shocks ($\left[\frac{\partial y_{i,j}^{\phi}}{\partial k}\right]_{\varepsilon_i^o} < 0$).

There is some ambiguity as to the way in which the evolution of the degree of the Union's heterogeneity may influence the stabilization of output against the non specific demand shocks. The reason is that the mechanisms involved here may have contradictory effects: the foreign fiscal policies (the fiscal policies adopted in the countries where the shocks appear) together with the single monetary policy can neutralize the impact of the national fiscal policies.

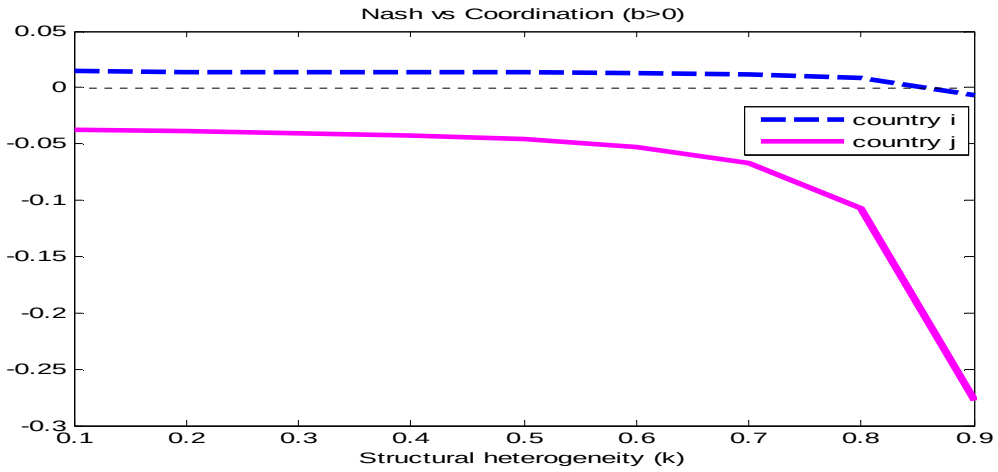
The analysis of the way in which the degree of structural heterogeneity influences the efficiency of shock neutralization is again hindered when dealing with the inflation stabilization. The reason is that the heterogeneity of the market flexibility generates a divergence between the inflation and output stabilization mechanisms. For instance, in the case of the demand shocks specific to the country j, a rise of k ensures a better national output stabilization but it also triggers a growing influence of economic activity on national inflation. Under these circumstances, this more fluid transmission of the economic activity on national inflation can overweight, at the level of inflation stabilisation, the better results obtained in terms of output stabilization.

Since no analytical solution is available to account for all the mechanisms of macroeconomic stabilization against the different types of shocks at the national

level, we need to make use of numerical simulation[4] techniques. They will mainly enable us to analyse the relative efficiency of the fiscal coordination game relative to the Nash equilibrium by comparing the values of the national social loss functions resulting from these two fiscal game configurations.

In order to compare the macroeconomic efficiency at the national level, we have distinguished between the economic shocks according to their type – demand and supply shocks – and to their origin – shocks specific to the country i or j. The Figures bellow describes the evolution of the differences between the national social losses obtained in the Nash equilibrium relatively to the fiscal coordination game. The evolution of the national social loss's differences[5] takes into account the evolution of the structural heterogeneity degree between the countries (k) and the sign of the fiscal spillovers ($b > 0$ or $b < 0$).

Figure 1: Demand shocks specific to the country i – relative impact on the national welfare



[4] The simulations were developed using a numerical calibration that is presented in Appendix 2.

[5] The national social losses are developed according to the hypothesis of the independence between the different types of economic shocks.

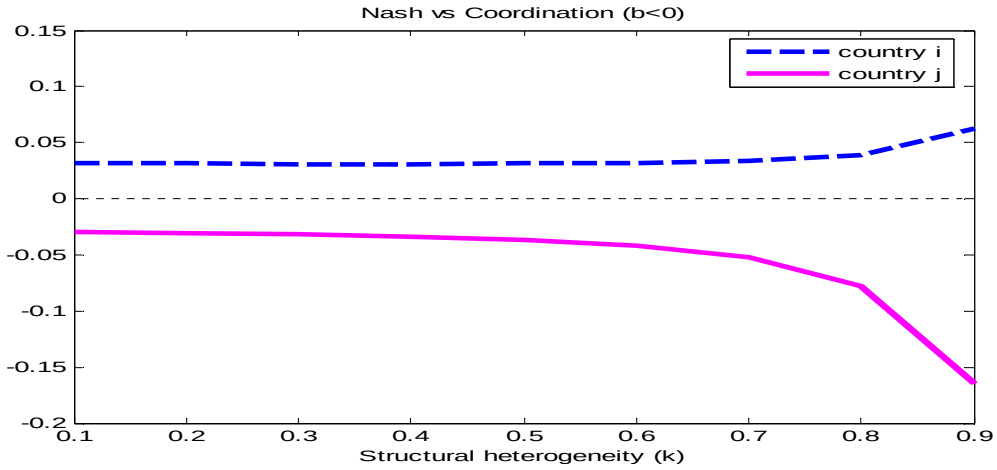
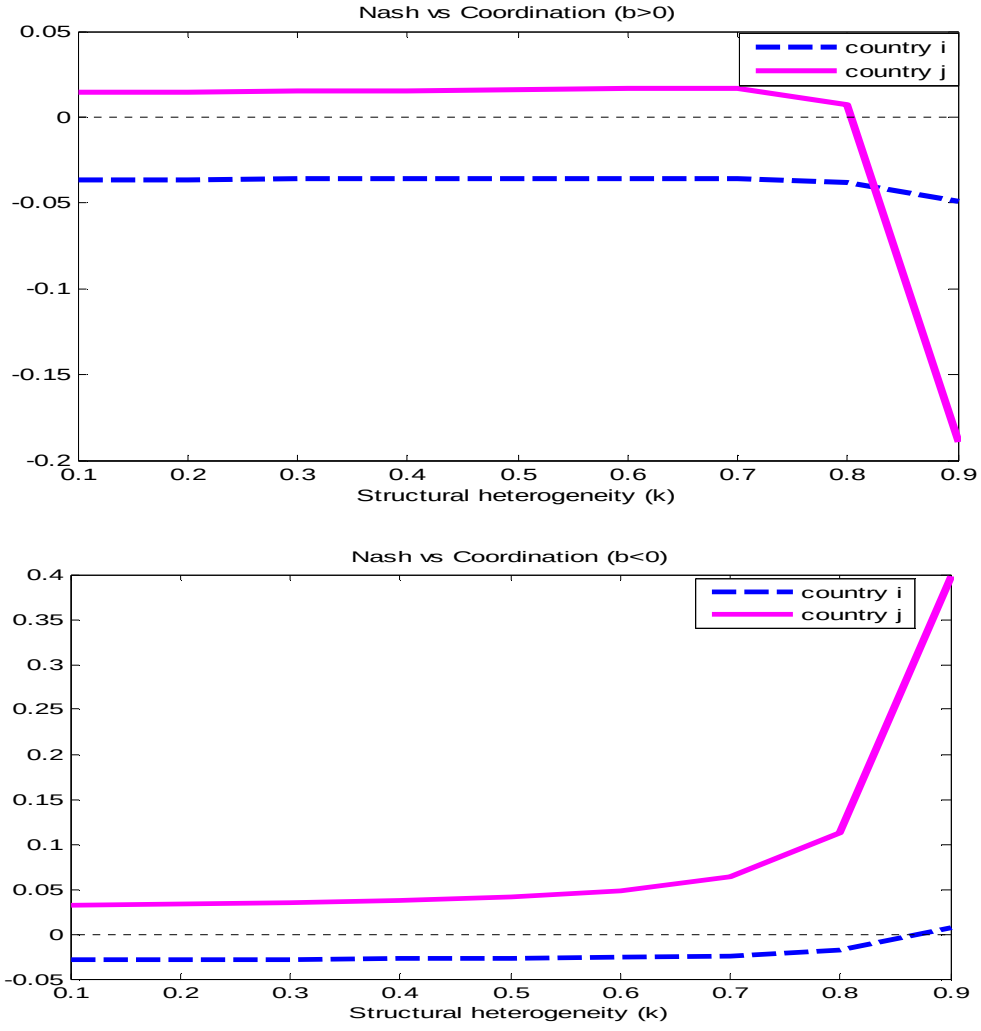


Figure 2: Demand shocks specific to the country j – relative impact on the national welfare



In the case of the demand shocks specific to the country i, in order to achieve the best stabilization, the two countries need in general two different game configurations: fiscal coordination for the country i ($E^C(L^S_{i(\sigma_i^d)}) < E^N(L^S_{i(\sigma_i^d)})$ and lack of coordination for its partner j ($E^N(L^S_{j(\sigma_i^d)}) < E^C(L^S_{j(\sigma_i^d)})$, irrespectively of the sign of the fiscal spillovers ($b > 0$ or $b < 0$). There is only one exception concerning these stabilization mechanisms in the case where high structural heterogeneity ($k = 0{,}9$) is associated with positive fiscal spillovers ($b > 0$). The Nash equilibrium will then succeed in maximizing the quality of stabilization for the country i as well, thus becoming the common optimum solution to both Union members.

In the case of the demand shocks specific to the country j, the same general conditions of stabilization apply: the fiscal coordination provides the best stabilization for this country ($E^C(L^S_{j(\sigma_j^d)}) < E^N(L^S_{j(\sigma_j^d)})$, whereas the country i prefers a Nash equilibrium ($E^N(L^S_{i(\sigma_j^d)}) < E^C(L^S_{i(\sigma_j^d)})$). Identifying the optimum solution common to both countries is dependent on a very high level of the structural heterogeneity between the countries ($k = 0{,}9$), just as in the previous case. This solution will have to take into account the sign of the fiscal spillovers and may be either the Nash equilibrium between governments if $b > 0$ or fiscal coordination if $b < 0$.

In general, except the case of a strong structural heterogeneity between countries, the specific demand shocks require a fiscal coordination game, while the non specific shocks are better stabilized by a Nash equilibrium between governments. In other words, in the case of the demand shocks if the Union's level of structural heterogeneity is not excessively high, the two countries have different needs in terms of fiscal policy games that can converge only if the Union members display a very high level of structural heterogeneity. In this case, the Nash equilibrium provides the best stabilization for both countries if the fiscal spillovers are positive ($b > 0$), whereas if the fiscal spillovers are negative ($b < 0$), the fiscal coordination game becomes the best common solution for stabilizing the demand shocks specific only to the country j.

We need to underline the robustness of these results which are not qualitatively changed by the use of different degrees of sensitivity of the public authorities to the evolution of the macroeconomic variables[6]. We can therefore

[6] For instance, when the monetary policy is at the same time more flexible and more sensitive to the Union's aggregate price evolution ($\beta_0 = 0{,}7;\ \beta_1 = 0{,}3;\ \beta_2 = 0{,}1$) or when the fiscal policies are less flexible and thus less apt to neutralize the demand and supply shocks ($\alpha_0 = 0{,}5;\ \alpha_1 = 0{,}5$).

conclude that except the case of a very high degree of structural heterogeneity between the Union members, the stabilization of the demand shocks generates a system blockage at the national level because there isn't a single common solution which could ensure an optimum welfare for both Union members simultaneously.

Figure 3: Supply shocks specific to the country i – relative impact on the national welfare

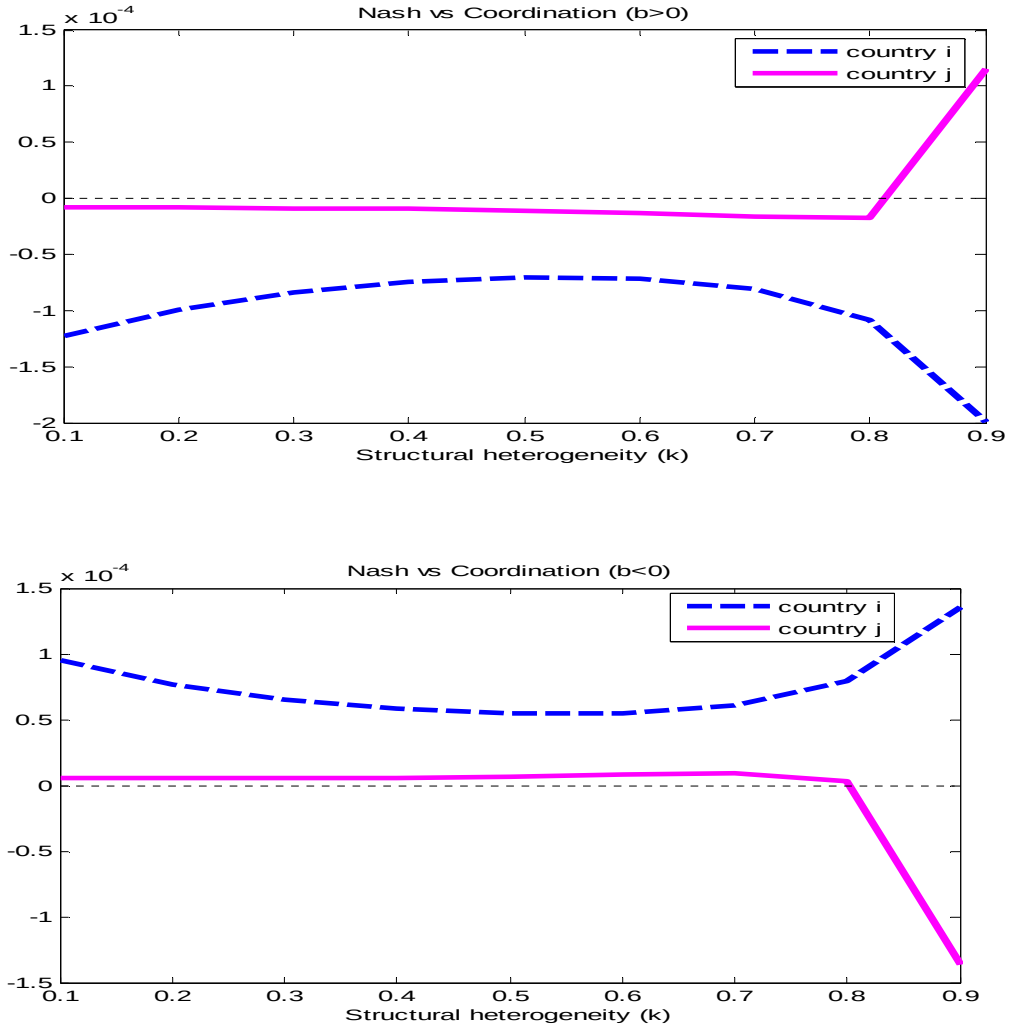
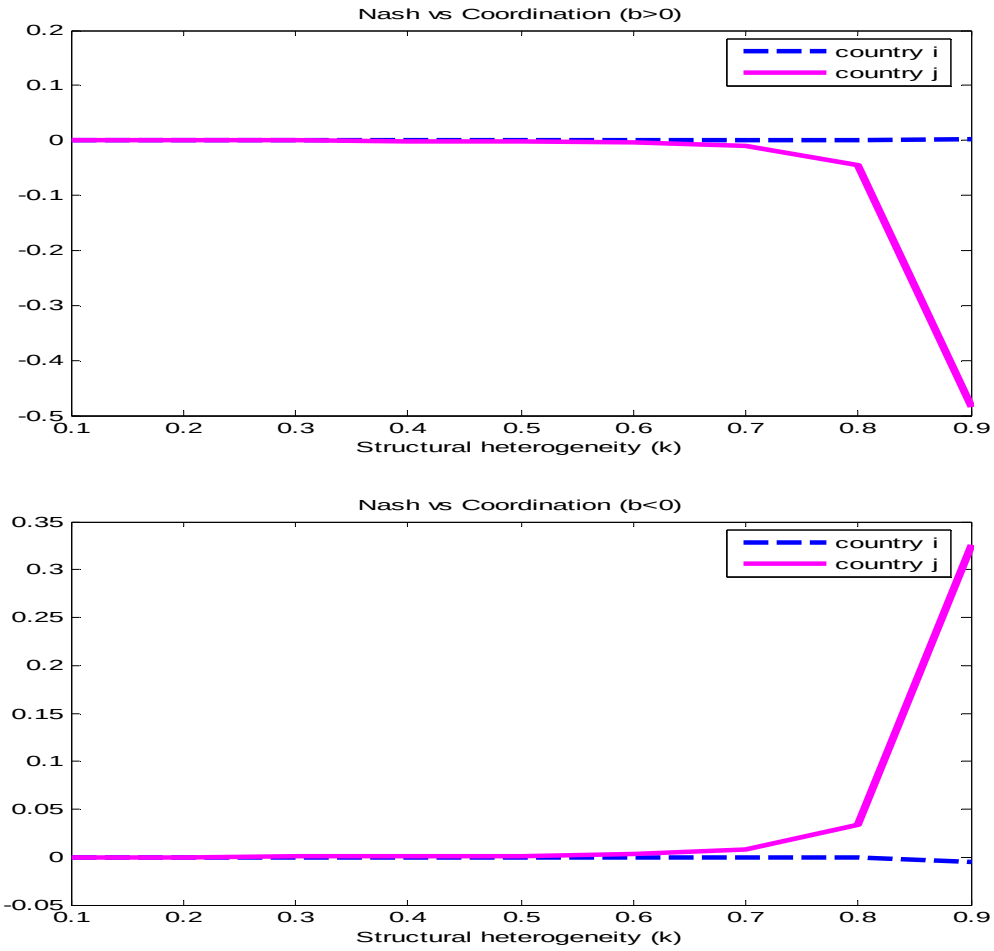


Figure 4: Supply shocks specific to the country j – relative impact on the national welfare



In the case of the supply shocks, the sign of the fiscal spillovers becomes more important as a criterion of differentiating the quality of stabilization than in the case of the demand shocks. Thus, if $b > 0$ the Nash equilibrium between governments is the best solution for both countries irrespectively of the origin of the supply shocks (specific to the country i or j)[7] on condition that the structural heterogeneity is not very high ($k < 0{,}7$): $E^N(L^S_{i,j(\sigma^s_{i(j)})}) < E^C(L^S_{i,j(\sigma^s_{i(j)})})$. On the contrary, if the structural heterogeneity is high ($k > 0{,}7$), the system blocks because while the specific supply shocks are better stabilized by the Nash equilibrium

[7] For the supply shocks, the differences between the values of the social national losses in a Nash equilibrium in comparison with the fiscal coordination game are very low especially if $k < 0{,}7$, and whatever the sign of the fiscal spillovers ($b > 0$ or $b < 0$). To put it differently, for $k < 0{,}7$, the relative efficiency of either of the fiscal configurations is considerably low in comparison with the other.

($E^N(L^S_{i(j)(\sigma^s_{i(j)})}) < E^C(L^S_{i(j)(\sigma^s_{i(j)})})$), the non specific shocks are more successfully stabilized by the fiscal coordination between governments ($E^C(L^S_{j(i)(\sigma^s_{i(j)})}) < E^N(L^S_{j(i)(\sigma^s_{i(j)})})$).

If the fiscal spillovers are negative ($b < 0$), the same principles of stabilization apply except that the optimum solutions are reversed in comparison with the previous case. To put it clearly, the fiscal coordination is the optimum solution for both countries in stabilizing the supply shocks, whatever their origin, if the structural heterogeneity is situated bellow a threshold value ($k < 0{,}7$): $E^C(L^S_{i,j(\sigma^s_{i(j)})}) < E^N(L^S_{i,j(\sigma^s_{i(j)})})$. If the structural heterogeneity is higher than this threshold value ($k > 0{,}7$), the optimal common solution no longer works: the fiscal coordination optimizes the specific shocks stabilization ($E^C(L^S_{i(j)(\sigma^s_{i(j)})}) < E^N(L^S_{i(j)(\sigma^s_{i(j)})})$), but it is the Nash equilibrium which is the best solution to neutralize the impact of the non specific shocks ($E^N(L^S_{j(i)(\sigma^s_{i(j)})}) < E^C(L^S_{j(i)(\sigma^s_{i(j)})})$).

We should also notice that just as in the case of the demand shocks, these results are stable and remain unaffected by the different choices of parameters reflecting the public authorities' preferences in building their specific loss functions. At the same time, we need to underline that the relative differences between national losses in the case of the supply shocks (the differences concern the loss functions between the Nash and fiscal coordination games) are less strong compared to the relative differences in the case of the demand shocks. This is explained by the discrepancy in the reactions of the public authorities (Central bank and national governments) concerning the stabilization of the supply shocks. Consequently, except the case of a very high degree of structural heterogeneity between the two Unions members, it is more likely to have a system blockage in the case of the demand shocks than to identify an optimum common solution (Nash equilibrium or fiscal coordination) for all the Union members in the case of the supply shocks.

If we sum up the results, we notice a strong opposition between the mechanisms of stabilization of the demand and supply shocks, which doesn't allow for an optimum solution common to both Union members and to both types of shocks (demand and supply shocks) simultaneously. Indeed, in the case of the demand shocks the optimum solution available for both countries simultaneously can be identified only if the Union displays a high structural heterogeneity ($k > 0{,}8$). But for such a level of structural heterogeneity there is no optimum common solution available for the stabilization of the supply shocks. Given the incompatibility between the national stabilization mechanisms for the demand and supply shocks, and the lack of an optimum fiscal configuration for all the country

members, it may be necessary that the current system of economic governance be reformed.

Table 1: Synthesis of results at national level

Type of shocks	Optimum solution in welfare terms			
	Specific shocks		*Non Specific shocks*	
	$b > 0$	$b < 0$	$b > 0$	$b < 0$
Demand	Fiscal coordination Nash equilibrium ($k = 0,9$)	Fiscal coordination	Nash equilibrium	Nash equilibrium Fiscal coordination ($k = 0,9$)
Supply	Nash equilibrium	Fiscal coordination	Nash equilibrium Fiscal coordination ($k > 0,7$)	Fiscal coordination Nash equilibrium ($k > 0,7$)

4. Conclusion

In this paper, we have aimed at investigating the relative advantages of two fiscal policy games, i.e. the Nash equilibrium and the fiscal coordination, as institutional instruments providing the neutralization of the economic shocks in a heterogeneous Monetary Union. Considering the heterogeneity of the Union with respect to the national labour market flexibility, we have distinguished between shocks according to their type and origin, and raised the question whether the fiscal coordination can improve the national welfare of each Union country member in comparison to a non cooperative fiscal game between national governments.

To sum up our results, we can underline the key elements that influence the mechanisms of macroeconomic stabilization. The main element is the type of shocks affecting the Union members. But the stabilisation mechanisms are also influenced by the sign of fiscal spillovers and by the extent of structural heterogeneity between Union's members. In the case of the demand shocks, there is no single optimal solution for the two countries of the Union, irrespectively of the sign of the fiscal spillovers or of the various relative preferences of the public authorities. The specific shocks are better neutralized by a fiscal coordination game while the optimal absorption of the non specific shocks requires the absence of coordination between governments. On the contrary, if the structural heterogeneity of the Union is very strong, these results change: according to the origin of the demand shocks and to the sign of fiscal spillovers, the Nash equilibrium or secondarily the fiscal coordination become able to optimise the stabilization of the demand shocks simultaneously for the two Union members.

The analysis of the supply shocks yields opposite results in comparison with the case of the demand shocks. Thus, a high degree of structural heterogeneity triggers a robust blockage of the system at the national level, whereas for a weaker heterogeneity, the system can provide an optimum solution for both countries, whose nature is determined by the sign of the fiscal spillovers.

To conclude, we may say that the optimum solution to the economic shocks affecting the countries of a heterogeneous Monetary Union requires different game configurations between the demand and supply shocks. As shown by our study, neither the Nash equilibrium between governments nor the fiscal coordination are capable of providing an overall efficient solution for all the Union members and for all the shocks whatever their type and origin. At the institutional level, this situation is critical because it causes an impass in terms of economical governance which may become problematic and undermine the coherence and credibility of the whole Euro zone. Consequently, the Euro zone needs to think about reforming its system of economic governance. We can suggest possible lines of reflection, as the idea of a more active coordination between the national fiscal policies on the one hand and the unique monetary policy, more sensitive to the national economic evolutions, on the other hand; or the idea of variable geometry fiscal coordination or of fiscal federalism.

APPENDIX 1

The national social loss functions for the Union's countries

We consider $\phi = \mathrm{N},\ \mathrm{C}$ as the two fiscal policy games liable to take place between governments i.e. Nash equilibrium and fiscal coordination. The social loss functions for the two countries of the Union which allow us to develop the numerical simulations are :

$$E^{\phi}(L_i^S) = \left[\alpha_0^S \left({}^{i}A_{yi}^{\phi}\right)^2 + \alpha_1^S \left({}^{i}A_{\pi i}^{\phi}\right)^2\right]\sigma_{\varepsilon_i^d}^2 + \left[\alpha_0^S \left({}^{i}A_{yj}^{\phi}\right)^2 + \alpha_1^S \left({}^{i}A_{\pi j}^{\phi}\right)^2\right]\sigma_{\varepsilon_j^d}^2 + \left[\alpha_0^S \left(\frac{\theta\alpha_1(1-k)}{D^{\phi}}\right)^2 + \alpha_1^S \left({}^{i}B_{\pi i}^{\phi}\right)^2\right]\sigma_{\varepsilon_i^o}^2 + \left[\alpha_0^S \left(\frac{\theta\alpha_1(1+k)}{D^{\phi}}\right)^2 + \alpha_1^S \left({}^{i}B_{\pi j}^{\phi}\right)^2\right]\sigma_{\varepsilon_j^o}^2$$

$$E^{\phi}(L_j^S) = \left[\alpha_0^S \left({}^{j}A_{yj}^{\phi}\right)^2 + \alpha_1^S \left({}^{j}A_{\pi j}^{\phi}\right)^2\right]\sigma_{\varepsilon_j^d}^2 + \left[\alpha_0^S \left({}^{j}A_{yi}^{\phi}\right)^2 + \alpha_1^S \left({}^{j}A_{\pi i}^{\phi}\right)^2\right]\sigma_{\varepsilon_i^d}^2 + \left[\alpha_0^S \left(\frac{\theta\alpha_1(1+k)}{D^{\phi}}\right)^2 + \alpha_1^S \left({}^{j}B_{\pi j}^{\phi}\right)^2\right]\sigma_{\varepsilon_j^o}^2 + \left[\alpha_0^S \left(\frac{\theta\alpha_1(1-k)}{D^{\phi}}\right)^2 + \alpha_1^S \left({}^{j}B_{\pi i}^{\phi}\right)^2\right]\sigma_{\varepsilon_i^o}^2$$

where, for the country i :

$${}^{i}A_{yi}^{\phi} = \frac{\alpha_1(1-z)}{D^{\phi}} + \frac{\theta\alpha_1^2 k}{{}'D^{\phi}D^{\phi}} + \frac{\alpha_1}{{}'D^{\phi}} \qquad {}^{i}A_{yj}^{\phi} = \frac{\alpha_1(1-z)}{D^{\phi}} - \frac{\theta\alpha_1^2 k}{{}'D^{\phi}D^{\phi}} - \frac{\alpha_1}{{}'D^{\phi}}$$

$${}^{i}A_{\pi i}^{\phi} = \frac{\alpha_1\eta(1-z)}{D^{\phi}} - \frac{\alpha_1\eta k}{{}'D^{\phi}}\left(1 - \frac{\theta\alpha_1}{D^{\phi}}\right) + \frac{1}{1+s}\left[-\frac{\alpha_1\eta k(1-z)}{D^{\phi}} + \frac{\alpha_1\eta}{{}'D^{\phi}}\left(1 - \frac{\theta\alpha_1 k^2}{D^{\phi}}\right)\right]$$

$${}^{i}A_{\pi j}^{\phi} = \frac{\alpha_1\eta(1-z)}{D^{\phi}} + \frac{\alpha_1\eta k}{{}'D^{\phi}}\left(1 - \frac{\theta\alpha_1}{D^{\phi}}\right) + \frac{1}{1+s}\left[-\frac{\alpha_1\eta k(1-z)}{D^{\phi}} - \frac{\alpha_1\eta}{{}'D^{\phi}}\left(1 - \frac{\theta\alpha_1 k^2}{D^{\phi}}\right)\right]$$

$${}^{i}B_{\pi i}^{\phi} = -\eta(1-k)\left(1 - \frac{\theta\alpha_1}{D^{\phi}}\right) + \frac{1}{1+s}\left[\eta k\left(1 - \frac{\theta\alpha_1}{D^{\phi}}\right) - \eta\left(1 - \frac{\theta\alpha_1 k^2}{D^{\phi}}\right)\right]$$

$${}^{i}B_{\pi j}^{\phi} = -\eta(1+k)\left(1 - \frac{\theta\alpha_1}{D^{\phi}}\right) + \frac{1}{1+s}\left[\eta k\left(1 - \frac{\theta\alpha_1}{D^{\phi}}\right) + \eta\left(1 - \frac{\theta\alpha_1 k^2}{D^{\phi}}\right)\right]$$

- for the country j :

$${}^{j}A_{yj}^{\phi} = \frac{\alpha_1(1-z)}{D^{\phi}} - \frac{\theta\alpha_1^2 k}{{}'D^{\phi}D^{\phi}} + \frac{\alpha_1}{{}'D^{\phi}} \qquad {}^{j}A_{yi}^{\phi} = \frac{\alpha_1(1-z)}{D^{\phi}} + \frac{\theta\alpha_1^2 k}{{}'D^{\phi}D^{\phi}} - \frac{\alpha_1}{{}'D^{\phi}}$$

$$^{j}A^{\phi}_{\pi j} = \frac{\alpha_1\eta(1-z)}{D^{\phi}} + \frac{\alpha_1\eta k}{^{'}D^{\phi}}\left(1-\frac{\theta\alpha_1}{D^{\phi}}\right) - \frac{1}{1+s}\left[-\frac{\alpha_1\eta k(1-z)}{D^{\phi}} - \frac{\alpha_1\eta}{^{'}D^{\phi}}\left(1-\frac{\theta\alpha_1 k^2}{D^{\phi}}\right)\right]$$

$$^{j}A^{\phi}_{\pi i} = \frac{\alpha_1\eta(1-z)}{D^{\phi}} - \frac{\alpha_1\eta k}{^{'}D^{\phi}}\left(1-\frac{\theta\alpha_1}{D^{\phi}}\right) - \frac{1}{1+s}\left[-\frac{\alpha_1\eta k(1-z)}{D^{\phi}} + \frac{\alpha_1\eta}{^{'}D^{\phi}}\left(1-\frac{\theta\alpha_1 k^2}{D^{\phi}}\right)\right]$$

$$^{j}B^{\phi}_{\pi j} = -\eta(1+k)\left(1-\frac{\theta\alpha_1}{D^{\phi}}\right) - \frac{1}{1+s}\left[\eta k\left(1-\frac{\theta\alpha_1}{D^{\phi}}\right) + \eta\left(1-\frac{\theta\alpha_1 k^2}{D^{\phi}}\right)\right]$$

$$^{j}B^{\phi}_{\pi i} = -\eta(1-k)\left(1-\frac{\theta\alpha_1}{D^{\phi}}\right) - \frac{1}{1+s}\left[\eta k\left(1-\frac{\theta\alpha_1}{D^{\phi}}\right) - \eta\left(1-\frac{\theta\alpha_1 k^2}{D^{\phi}}\right)\right]$$

$$D^{N} = \alpha_1 + a\alpha_0(a+b)(1-z) \qquad ^{'}D^{N} = \alpha_1 + a\alpha_0(a-b)$$

$$D^{C} = \alpha_1 + \alpha_0(a+b)^2(1-z) \qquad ^{'}D^{C} = \alpha_1 + a\alpha_0(a-b)^2$$

APPENDIX 2

The numerical simulations have been obtained using the Matlab language. In order to analyse the quality of the national macroeconomic stabilization, we have studied the differences between the national losses resulting from the two game configurations in which the governments are involved (Nash equilibrium and fiscal coordination game). The relative differences have been calculated according to the evolution of the degree of structural heterogeneity between the countries (k). For the rest of the parameters, we have used a rich empirical and theoretical literature in order to choose the values that reflect the average of the Euro zone countries.

For the sensitivity of the demand to the national deficit, we consider an average coefficient of 0,5 ($a = 0{,}5$), (Beetsma *et al.* (2001), Menguy (2005)). The value of fiscal spillovers has been established at 0,2 in absolute value ($b = |0{,}2|$); we consider that the spillovers can't be superior, in absolute value, to the sensitivity of the demand to the national public deficit ($a > |b|$).

We use the sensitivity of the demand to interest rate as identified by Mojon and Peersman (2001) and by Van Els *et al.* (2001) with an average value of 0,2 for the Euro zone ($\delta = 0{,}2$). Concerning the sensitivity of the production to the evolution of inflation, the coefficients used in the literature are generally situated around 3 et 4 (Van Aarle *et al.* (2002), Engwerda *et al.* (2002), Rogers (2001)); we

have thus chosen the value 3 for this coefficient ($\mu = 3$). The sensitivity of the national inflation to foreign inflation is 0,2 ($s = 0,2$) as in Creel (2002).

When identifying the relative preferences of the Central bank, we took into account the ECB's main objective that is price stabilization. Consequently, the relative importance of this objective ($\beta_0 = 0,5$) is higher than the weight of the output stabilization ($\beta_1 = 0,3$) and of the interest rate smoothing ($\beta_2 = 0,2$). As to the national governments, they slightly favour the output stabilization $\alpha_0 = 0,6$ relative to the public deficit stabilization ($\alpha_1 = 0,4$). As for the national social preferences, we consider a perfect equilibrium between the objectives of output and inflation stabilization ($\alpha_0^S = \alpha_1^S = 0,5$).

The values of the model's parameters are summed up in the Table bellow:

Table 2: Calibration of the model's parameters

a	b	δ	μ	s	β_0	β_1	β_2	α_0	α_1	α_0^S	α_1^S
0,5	+/-0,2	0,2	3	0,2	0,5	0,3	0,2	0,6	0,4	0,5	0,5

Bibliography

1. Beetsma, R., X. Debrun and F. Klaassen, 2001, "Is Fiscal Policy Coordination in EMU Desirable?" *CEPR Discussion paper*, 3035.
2. Buti, M., W. Roeger and, J. In't Veld, 2001, "Stabilising Output and Inflation in EMU: Policy Conflicts and Co-operation under a Stability Pact", *Journal of Common Market Studies* 39, 801-828.
3. Cadiou, L. and S. Guichard, 1999, "La diversité des marchés du travail en Europe: quelles conséquences pour l'Union Monétaire (first part)", *CEPII, Document de travail,* 10.
4. Cadiou, L., S. Guichard and M. Maurel, 1999, "La diversité des marchés du travail en Europe: quelles conséquences pour l'Union Monétaire (second part)", *CEPII Document de travail*, 11.
5. Creel, J. 2002, "Asymétries budgétaires dan la zone euro, un essai de modélisation du Pacte de stabilité", *Revue française d'économie* 16(3), 91-127.
6. Cristea, M., Dracea, R., Ionascu, C. and Irtes, M., 2009, "Are there any Correlations between Fiscality Rate, GDP and Tax Incomes Flux? Case Study Romania and Turkey", European Research Studies Journal, Vol. XII, Issue 2, 77-98.
7. Engwerda, J., J. Plasmans and B. Van Aarle, 2002, "Cooperative and non-cooperative fiscal stabilization policies in the EMU", *Journal of Economic Dynamics and Control* 26(3), 451-481.
8. Kaiser, M. 2005, "Zone euro: la convergence inachevée", *Conjoncture, BNP Paribas,* Septembre.
9. Lambertini, L. and R. Rovelli, 2003, "Monetary and Fiscal Policy Coordination and Macroeconomic Stabilization: A Theoretical Analysis", *Università di Bologna Working Paper*, 464.
10. Laskar, D. 2003, "Policy-mix: le besoin de coordination des politiques budgétaires entre pays est-il accru en Union monétaire", *Recherches Economiques de Louvain* 69(3), 267-291.
11. Léonard, J. and C. Oros, 2007, "Gouvernance économique et élargissement de la zone euro. Les avantages d'une coordination budgétaire à géométrie variable", *Revue du Marché commun et de l'Union européenne* 513, 621-627.
12. Menguy, S. 2005, "Hétérogénéité structurelle des pays membres et conflit d'objectifs entre les autorités économiques dans l'UEM", *Economie et Prévision* 3(169-171), 41-58.

13. Mojon, B. and G. Peersman, 2001, "A VAR Description of the Effects of Monetary Policy in the Individual Countries of the Euro Area", *ECB Working Paper*, 92.

14. Mundschenk, S. and J. Von Hagen, 2003, "Fiscal and Monetary Policy Coordination in EMU", *International Journal of Finance and Economics* 4, 279-295.

15. Penot, A. 2002, "Appréciations et conséquences possibles de l'hétérogénéité structurelle dans la zone euro", *Revue d'économie financière* 65, 153-175.

16. Penot, A., J.-P. Pollin and V. Seltz, 2000, "Hétérogénéité de la zone euro et politique monétaire unique", *XVII*^{èmes} *Journées Internationales d'Economie Monétaire et Bancaire*, Lisbonne, 7-9 juin.

17. Oros, C. 2008, "Coordination budgétaire à géométrie variable et stabilisation conjoncturelle dans une Union monétaire hétérogène", *Economie Appliquée* 3, 99-132.

18. Oros, C. 2008 "Macroeconomic stabilization in a heterogeneous monetary union: some insights into the effects of fiscal policy coordination", *Economics Bulletin*, 34, 1-12.

19. Rogers, J. H. 2001, "Price Level Convergence Relative Prices, and Inflation in Europe", *The Board of Governors of the Federal Reserve System, International Finance Discussion Papers*, 699.

20. Thalassinos, E., 2008, "Trends and Developments in the European Financial Sector", *European Financial and Accounting Journal*, vol. 3, no. 3, pp. 51-68.

21. Thalassinos, E., Thalassinos, P., 2006, "Stock Markets' Integration Analysis", *European Research Studies Journal*, Vol. IX, Issue 3-4, pp. 3-14.

22. Uhlig, H. 2002, "One Money but Many Fiscal Policies in Europe: What Are the Consequences?" *CEPR Discussion Papers*, 3296.

23. Van Aarle, B., J. C. Engwerda and J. E. J. Plasmans, 2002, "Monetary and Fiscal Policy Interaction in the EMU: A Dynamic Game Approach", *Annals of Operations Research* 109, 229-264.

24. Van Els, P., Locarno, A., Morgan, J. and J.-P. Villetelle, 2001, "Monetary Policy Transmission in the Euro Area: What do aggregate and National Structural Models Tell Us?" *ECB Working Paper*, 94.

25. Villieu, P. 2000, "Élargissement de l'Union monétaire et coordination des politiques budgétaires : un point de vue", *Annales d'Économie et de Statistique* 59, 137-63.