Macroeconomic Stabilization in a Heterogeneous Monetary Union: Are governments tempted to distort their private information about national economic shocks?

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Abstract

The subsidiarity principle governing the collection of statistical data in the EMU may cause asymmetrical information. The national governments may be tempted to distort their economic and financial data communicated to ECB in order to influence its monetary policy decisions. We base our analysis on a static Keynesian model in a closed monetary Union and we prove that the governments' incentives to modify their private information depend mainly on the nature of the economic shocks affecting the Union members, on the degree of monetary activism and on the extent of the Union's structural heterogeneity. We will analyze the institutional mechanisms that could be used to discipline the governments and encourage them to communicate real information. An incentive contract of the "principal-agent" type or a variable geometry fiscal coordination represent two institutional solutions that could help creating a revealing equilibrium within the Euro zone.

Keywords : Economic policy, Asymmetrical Information, Economic Shocks, Structural Heterogeneity

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

Introduction

Since the creation of the Euro zone, the question of the policy-mix has been dealt with according to two main issues. The first one is an issue of credibility concerning the combination of the economic policies and involves possible discrepancies relative to macroeconomic objectives between the national governments and the single Central Bank[1]. The second issue is concerned with the macroeconomic stabilization against the different types of shocks that can affect the economies of the member countries in a specific institutional context, which is that of the independence of the ECB and of the fiscal constraints imposed on the governments by the Stability and Growth Pact[2].

These two major issues trigger another problematic aspect specific to the EMU, which is the asymmetrical information that may appear between the policymakers and thus influence the organization of the policy-mix. A type of asymmetrical information specific to the EMU relies on the fact that the governments have private information about their economic shocks which they may choose either to hide or to transmit in a deformed manner to the other governments and to the Central Bank in order to enhance their individual welfare. This asymmetrical information can be accounted for by two major aspects of the current organization of the EMU. Firstly, the governments have a certain influence on the national statistical information. Indeed, despite the measures of control and harmonisation, the statistical data are essentially collected by the national institutes[3]. Secondly, when deciding on the single monetary policy, the ECB takes into account the aggregate values of macroeconomic variables at the level of the entire Euro zone, which can encourage even more the countries to distort their information to the ECB so that its policy could be oriented according to their specific objectives. For instance, by overestimating the extent of its demand shock, a country can avoid the compensation of shocks' effects at the aggregate level of the Union. This is indeed the

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[1] See Dixit and Lambertini (2001), Beetsma and Bovenberg (1998, 1999), Beetsma and Uhlig (1999), Chari and Kehoe (1998), Dornbusch (1997), Villieu (2003).

[2] See Uhlig (2002), Mundschenk and Von Hagen (2003), Beetsma et al. (2001), Engwerda et al. (2002).

[3] This issue is currently put forward by the accusations against Greece which has been suspected of having falsified its statistics relative to its public deficit and its public debt for 2009. In fact, in the last few years, in addition to the Greek case, the European Commission has also questioned the quality of Italy's and Portugal's economic and financial statistics. Because of such irregularities, in February 2010 the Commission proposed a reform of the system controlling the reliability of the economic statistics provided by the European countries.

only means for a country to generate a stabilization effort from the Central Bank in order to stabilize its national variables[4].

So far, very few studies have discussed the European policy-mix in a case of asymmetrical information. Their main conclusion points out the lack of effectiveness of a decentralized system collecting economic and financial information on account of the Union countries' being inclined to modify their information in order to influence the ECB's decisions. This lack of effectiveness is however linked with heterogeneities existing within the EMU either at the level of the policymakers objectives (Crettez (1998)) or at the level of economic shocks (Bottazzi and Manasse (2005), Duchassaing and Koessler (2004)). Inexact information provided by the governments may generate an inflation and public deficit bias as well as an excessively restrictive monetary policy and a recession bias (Bottazzi and Manasse (1998, 2005)). Yet, Duchassaing and Koessler (2004) show that the governments could be prevented from changing their private information by a fiscal leadership configuration in which the transmission of information is expensive. But when the information about the national shocks is correct, there is a loss in terms of welfare at the national level compared to a simultaneous policy game, which dissuades the fiscal authorities from adopting such a policy-mix configuration.

Based on the literature on the subject, this paper aims at further exploring this issue by analysing the impact of asymmetrical information on the effectiveness of the economic policies within a heterogeneous monetary Union. As the country members have private information on their specific shocks, we want to point out that the governments have an interest in changing this private information that will then be provided to the Central Bank. Several questions will thus be addressed: which are the mechanisms accounting for the governments' changing their statistical data? Is this behaviour systematic? Which are the institutional means allowing to discipline the governments and prevent them from providing modified data? In other words, we will analyse the reliability of the subsidiarity principle, currently used in the EMU, in collecting statistical data and the adjustment possibilities of this principle in order to avoid the governments' being tempted to modify their national statistical data.

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[4] In a monetary Union, the single monetary policy doesn't take into account the national asymmetric shocks since their effects are compensated at the aggregate level.

In the first section of the paper, we will present the model which accounts for the macroeconomic equilibrium and the reaction functions of the policymakers (the national governments and the Central Bank). In the second part, we will look into the reasons why the governments are tempted to distort their private information. In the last section, we will analyse some of the mechanisms that could allow to discipline the fiscal authorities and avoid altering information.

1. The model

We use a static Keynesian model within a closed monetary Union with two countries (i, j). We have deliberately chosen a very simple model in order to be able to focus on the analysis of the mechanisms used by the governments in transmitting their private information about national economic shocks in the case of asymmetric information among the policymakers within the Union. The macroeconomic equilibriums are described by demand and supply functions and we consider that the heterogeneity of the Union involves both the mechanisms of monetary policy transmission and the economic shocks affecting the Union members (Oros (2008a)). 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:

(1) $y_i = a g_i + b g_j - \delta_i \, r + \varepsilon_i$ where $0 < a < 1$; $|b| < 1$; $\delta > 0$

y_i and g_i stand for the output (as deviation from the natural output) and the budget deficit of the country i; g_j represents the budget deficit of the country j; r represents the short-term interest rate; ε_i the demand shock specific to the country i with zero mean and finite variance $\sigma_{\varepsilon_i}^2$. The demand shocks (ε_i, ε_j) are independent random variables whose density functions are expressed by normal distributions with zero mean.

The national demand of the country i depends positively on its 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 interest rate

channel respectively that play the major part in the transmission of the fiscal spillovers. Finally, the national output is influenced by a specific demand shock.

Since the heterogeneity of the Union concerns the mechanisms of monetary policy transmission, the parameter δ is specific to each country. If we represent the degree of heterogeneity between countries by a coefficient h ($0 < h < 1$), then $\delta_i = (1+h)\delta$ and $\delta_j = (1-h)\delta$, where δ stands for the average impact of the monetary policy on the economic activity of the countries i and j. Therefore, if $h = 0$, the countries will be perfectly homogeneous in terms of monetary policy transmission mechanisms ($\delta_i = \delta_j$), whereas, if $h = 1$, the heterogeneity between the two countries attains its maximum degree, as the monetary policy influences exclusively and with a maximum impact the national demand of the country i ($\delta_i = 2\delta$ et $\delta_j = 0$).

Regarding the supply equation, we use a Lucas function. We consider that the expected inflation is zero as we are only investigating the issue of the macroeconomic stabilization and therefore leave aside any issue of credibility.

(2) $\qquad \pi_i = \mu\, y_i \qquad$ where $\mu > 0$

π_i represents the inflation of the country i. For any variable x, we define the aggregate component, $x = (x_i + x_j)/2$ and the difference component, $\overline{x} = (x_i - x_j)/2$. Regarding shocks, we consider ε and $\overline{\varepsilon}$ which stand for symmetric and asymmetric shocks respectively.

Having described the macroeconomic equilibrium, we will now analyse the behaviour of the policy-makers. The Central Bank decides on the single monetary policy independently, using its interest rate as a policy instrument in order to minimize its loss function (L^M). The Central Bank is mainly interested in price stabilization at the aggregate level of the Union (with a weight β_0), but also in the interest rate smoothing (with a weight β_2).[5]

(3) $\qquad L^M = \dfrac{1}{2}\left[\beta_0 \pi^2 + \beta_2 r^2\right] \qquad\qquad$ where $\qquad \beta_0, \beta_2 > 0$

The governments are in charge of 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)

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[5] The target values of the macroeconomic variables in the policy-makers' loss functions are normalized to zero.

which depends on the evolution of national output and budget deficit (the relative weight of these objectives is α_1 et de α_2 respectively).

(4) $L_i^G = \dfrac{1}{2}\left[\alpha_1 y_i^2 + \alpha_2 g_i^2\right]$ where α_1 , $\alpha_2 > 0$

We will first present the values of the policy instruments in a complete information game; we will then use these values to identify the macroeconomic equilibrium in a case of asymmetrical information. The players are aware of the shocks affecting the member countries before the beginning of the simultaneous and non cooperative game (Nash equilibrium). In this configuration, the interest rate, the aggregate and the difference component of budget deficit write as follows:

(5)
$$
\begin{cases}
r = \dfrac{z\left[(a+b)g+\varepsilon\right]}{\delta} \\[4mm]
g = \dfrac{a\alpha_1(\delta r - \varepsilon)}{A} \\[4mm]
\overline{g} = \dfrac{a\alpha_1(\delta h r - \overline{\varepsilon})}{\alpha_2 + a\alpha_1(a-b)} \quad\text{with}\quad z = \dfrac{\beta_0\mu^2}{\beta_0\mu^2 + \dfrac{\beta_2}{\delta^2}} \;,\quad A = \alpha_2 + a\alpha_1(a+b)
\end{cases}
$$

Using the equations (5) the equilibrium values of the budget deficit and the interest rate become:

(6)
$$
\begin{cases}
g = -\dfrac{a\alpha_1(1-z)}{D}\varepsilon \\[4mm]
\overline{g} = \dfrac{a\alpha_1\alpha_2 z h}{DC}\varepsilon - \dfrac{a\alpha_1}{C}\overline{\varepsilon} \\[4mm]
r = \dfrac{z\alpha_2}{\delta D}\varepsilon \quad\text{with}\quad D = \alpha_2 + a\alpha_1(a+b)(1-z) \;,\quad C = \alpha_2 + a\alpha_1(a-b)
\end{cases}
$$

The equations (6) show that for a specific demand shock, the stabilization efforts made by the governments affected by this shock and by the Central Bank converge. For instance, in the case of a negative demand shock affecting the country i, its government and the Central Bank will adopt an expansionary policy; the budget deficit will rise

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while the interest rate will go down in order to encourage the demand and to boost the activity.[6]

Moreover, it can be noticed that the Central Bank's reaction is determined by the average demand shock of the Union. Consequently, if the demand shocks are asymmetric, every government may be inclined to overestimate their shocks so that the Central Bank should adapt its monetary policy in favour of each government's specific objective.

We can intuitively posit that the convergence of the stabilisation efforts made by the governments and the Central Bank can account for the temptation for the fiscal authorities to modify their messages to the Central Bank. Indeed, as the fiscal reaction is expensive (the evolution of the budget deficit is a part of loss functions for the governments), the fact of giving false information could strengthen monetary activism and thus allow the governments to loosen their efforts in the stabilisation process with a positive effect in terms of welfare.

2. The governments' strategies of communicating private information

We examine the case of an incomplete information game, which means that there is an information gap between the players. The asymmetrical information hypothesis corresponds to the current institutional context of the EMU where the governments are in possession of private information about their own economic shocks. The game configuration will therefore be a Bayesian game in which each player knows the density function of the shocks. The governments' and the Central Bank's decisions are taken simultaneously and non-cooperatively.

In order to better take into consideration the institutional framework of the Euro zone, we consider that each government accepts ex-ante to inform the Central Bank about the exact nature and extent of its national shock. Formally, the commitment of the government i writes : $\theta_i = \varepsilon_i$, where θ_i represents the message transmitted by the government i to the Central Bank when the shock ε_i occurs. After this stage, the simultaneous game will be put into place and each player's optimal decisions will be identified. We consider also that, contrary to the Central Bank, the governments have

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[6] In the case of symmetric shocks, the convergence of stabilization efforts concerns all the public authorities (the governments and the Central Bank). Moreover, when $z = 1$, the Central Bank can use its policy instrument freely and it manages to perfectly absorb the impact of the symmetric shocks.

exact information about the specific shocks affecting the Union's country members and we examine the unilateral incentive of the governments to fail to their commitments and to transmit a distorted message ($\underline{\theta}_i$ where $\underline{\theta}_i \neq \varepsilon_i$) to the Central Bank.

The hypothesis that the Union countries have mutual knowledge of their specific shocks is based on the specificity of the Euro zone's economic and institutional context.

Firstly, the Euro zone is characterised by a high degree of economic and financial integration that makes the countries' business cycles extremely dependent on each other. It is therefore very likely that each country can obtain exact information about the shocks affecting the other members of the Union and that, at the same time, it would be particularly difficult for a country to conceal or distort the state of its economy faced with the other countries.

Secondly, what justifies the hypothesis that every country is aware of the situation of their economic partners is the institutional features of the EMU and its economic governance. As pointed out, two major elements determine the organization of the policy-mix in the Euro zone: the ECB's independence and the fiscal constraints on the governments imposed by the Stability and Growth Pact. Under these specific circumstances, there is a clear de facto hierarchy for the macroeconomic objectives within the Union: the price stabilization at the aggregate level is put forward in order to protect the stability of the single currency to the detriment of the objectives of growth and employment nevertheless essential to the welfare of the member countries. To put it differently, the economic governance of the Euro zone is based on the one hand on a rather restrictive monetary policy which is focused almost exclusively on fighting inflation at the aggregate level of the EMU without taking into account the national macroeconomic indicators of the member countries, and on the other hand on the fiscal policies highly weakened by the constraints of the Stability and Growth Pact. The major inconvenient for the governments is that, within such an institutional context, they have very few possibilities to fight against the specific shocks affecting their economies. Therefore, modifying information data may be a way for the governments to find a further means to fight against the economic shocks and thus stabilize their national macroeconomic variables. Indeed, by modifying their message to the ECB, the fiscal authorities gear the monetary policy towards their specific objectives of macroeconomic stabilization.

Moreover, the hypothesis that the informational discrepancy can only occur between the governments and the Central Bank is reinforced by the results of a complete informational model, which we have previously introduced. Indeed, as we have already pointed out, as the governments and the Central Bank's efforts for stabilization converge, the governments may well be temped to distort their messages to the monetary authority.

Based on the hypothesis that the member countries are aware of the shocks affecting the Union and assuming that the country i tries to deviate from its commitment of conveying true information to the Central Bank, we can identify the new game equilibrium. Thus, the Central Bank establishes its optimum interest rate based on the information about the economic shocks provided by the governments ($\underline{\theta}_i$ and ε_j):

(7) $\quad r = \dfrac{z}{\delta}\left[(a+b)g + \underline{\theta}_i + \varepsilon_j\right]$

In this game configuration, the aggregate and the difference components of public deficit are[7] :

(8) $\begin{cases} g = \dfrac{a\alpha_1}{A}\left[\dfrac{\alpha_2 z}{D}\left(\underline{\theta}_i + \varepsilon_j\right) - \left(\varepsilon_i + \varepsilon_j\right)\right] \\[3mm] \overline{g} = \dfrac{a\alpha_1}{C}\left[\dfrac{\alpha_2 zh}{D}\left(\underline{\theta}_i + \varepsilon_j\right) - \left(\varepsilon_i - \varepsilon_j\right)\right] \\[3mm] y = -\dfrac{\alpha_2}{A}\left[\dfrac{\alpha_2 z}{D}\left(\underline{\theta}_i + \varepsilon_j\right) - \left(\varepsilon_i + \varepsilon_j\right)\right] \\[3mm] \overline{y} = -\dfrac{\alpha_2}{C}\left[\dfrac{\alpha_2 zh}{D}\left(\underline{\theta}_i + \varepsilon_j\right) - \left(\varepsilon_i - \varepsilon_j\right)\right] \end{cases}$

The equilibrium values of the macroeconomic variables will be introduced in the government i's loss function (L_i^G). If we minimize this loss function relative to $\underline{\theta}_i$, we obtain the optimum message provided by the country i:

(9) $\quad \underline{\theta}_i = \varepsilon_i + \dfrac{A\left[C(1-z) - \alpha_2 zh\right]}{\alpha_2 z\left[C + hA\right]}\left[\varepsilon_i + \varepsilon_j\right] + \dfrac{AD}{\alpha_2 z\left[C + hA\right]}\left[\varepsilon_i - \varepsilon_j\right]$

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[7] The complete equations are available upon request.

According to the same principle, we obtain the optimum message provided to the Central Bank by the country j:

$$(10) \quad \underline{\theta}_j = \varepsilon_j + \frac{A[C(1-z)+\alpha_2 zh)]}{\alpha_2 z[C-hA]}\left[\varepsilon_i + \varepsilon_j\right] + \frac{AD}{\alpha_2 z[C-hA]}\left[\varepsilon_j - \varepsilon_i\right]$$

The first general observation that we can make regarding the optimal messages transmitted by the governments is that the temptation to distort information is not systematic. Thus, the revealing equilibrium (when the two governments announce their true shocks to the Central Bank) occurs if the Central Bank is not constrained in using its interest rate ($z = 1$) and if the Union is homogeneous both structurally ($h = 0$) and in terms of economic shocks affecting the country members ($\varepsilon_i = \varepsilon_j$). Indeed, a maximum degree of monetary activism means that the Central Bank has no leeway left to stabilize the shocks. Consequently, the governments have no reason to distort the information about their national shocks if the shocks are symmetrical and if the efforts of stabilization made by the Central Bank are equally profitable to the governments. On the contrary, any asymmetry at the level of the national shocks causes every government to distort its private information in order to influence the Central Bank's decisions of monetary policy in favour of its specific objectives.

There is a second general element that influences the strategy of the governments in revealing their private information: it concerns the way in which the Central Bank organizes its macroeconomic objectives. The governments will be all the more inclined to lie if the Central Bank focuses on the interest rate smoothing (β_2 rises) rather than on the stabilization of the inflation (β_0 goes down). In other words and taking into account the fact that both the governments and the Central Bank have an interest in stabilizing the demand shocks, we can state that the less active the Central Bank is, the more involved the governments become in making up for the Central Bank's lack of activism by overestimating the extent of their shocks.

The differences between the specific national communication strategies depend on the existence of a structural heterogeneity among the Union countries ($h \neq 0$) and concern both the symmetric and asymmetric shocks.

Regarding the symmetric shocks ($\varepsilon_i = \varepsilon_j$), in the case of the government i, we identify a degree of structural heterogeneity h^* for which the revealing equilibrium is

optimal in terms of national welfare ($h^* = \dfrac{C(1-z)}{\alpha_2 z}$). We can notice that the degree of structural heterogeneity that leads to a revealing equilibrium decreases as z and α_2 (the government's preference for a stable budget deficit) go up. When z goes up – which is justified either by a reinforced monetary policy activism (β_2 decreases and β_0 increases) or by a national demand highly sensitive to the single monetary policy (δ increases) - the stabilization effects of the monetary policy are more efficiently transmitted and the effects of this increase of z on the country i are similar to those of a reinforced structural heterogeneity (h increases))[8]. Therefore, the two coefficients (z and h) can be substituted for one another. At the same time, if α_2 increases, the governments will be less interested in stabilizing their national output and the country i will be in less demand for a high structural heterogeneity as a means of stabilizing its output provided by the monetary policy.

The threshold value of the structural heterogeneity (h^*)[9] allows a distinction between two deceitful behaviours triggered by different reasons. When the degree of heterogeneity is inferior to the threshold value it is only the extent of the shock that may be the object of a distorted message. The inclination to do so diminishes when the structural heterogeneity is reinforced, whereas when $h > \dfrac{C(1-z)}{\alpha_2 z}$, the country i will be inclined to communicate a shock of a different type and whose extent is all the more distorted as the structural heterogeneity is high (Figure 1).

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[8] Indeed, the rise of h represents an increased sensitivity of the country i's national demand to the effects of the single monetary policy.

[9] Since the degree of heterogeneity (h) is below the unit, the threshold value has to meet another condition ($\dfrac{C(1-z)}{\alpha_2 z} < 1$). We can identify a threshold value of the monetary activism which allows to have the above condition: $\beta_2 < \dfrac{\beta_0 \mu^2 \alpha_2 \delta^2}{C}$.

Figure 1: Country i's informational bias in the case of symmetrical shocks
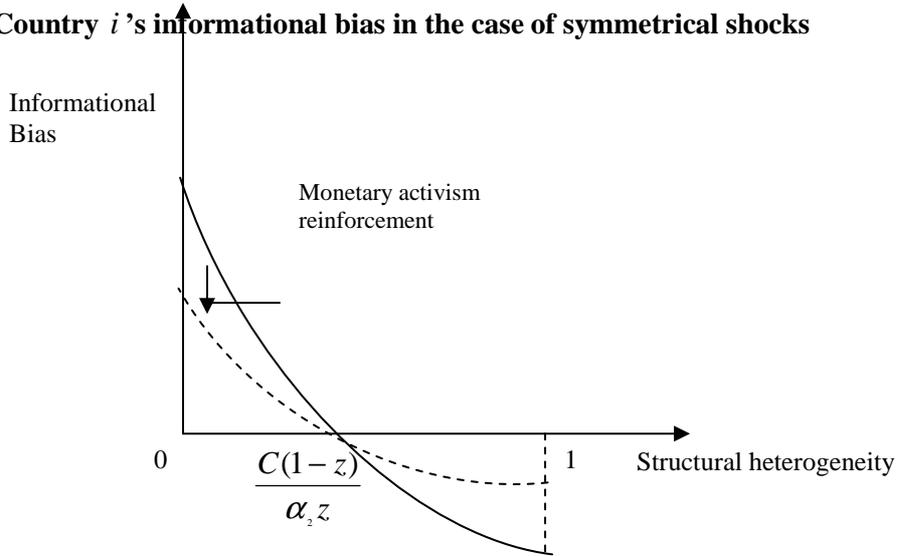

We can assume that the government i will act in this way according to the principle we have already put forward: given the fact that the Central Bank and the governments work together in stabilizing the demand shocks, the governments tamper with their information in order to make up for the Central Bank's possible loss of activism in taking stabilization measures. Indeed, if the Union's heterogeneity increases at the level of the mechanisms of the single monetary policy transmission (h increases), then the single monetary policy has a growing (decreasing) influence on the country i (j) and consequently the Central Bank's efforts for stabilization are transmitted more fluently to the country i to the detriment of the country j. Thus, when $h < \dfrac{C(1-z)}{\alpha_2 z}$, the country i benefits largely from the stabilization undertaken by the Central Bank, which gives it less reasons to distort its information when h rises. On the contrary, if the structural heterogeneity becomes more important, the country i is inclined to lie about the type and the extent of its shock so that it could limit the variations of the Union's aggregate values and avoid the detrimental effects of a monetary policy which is too active for this country.

Regarding the country j, its communication strategy starts to differ from the country i's with h going up as the country j is trying to make up for a slow-down of the single monetary policy's stabilization effects by gradually overestimating its shock. Exceptionally, there is a case in which the above mechanism doesn't apply and that is when positive spillovers ($b > 0$) occur at the same time as the level of heterogeneity is above a threshold value $\bar{h}$ ($\bar{h} = \dfrac{C}{A}$). In this case, the government j modifies the nature

of its shock by introducing a distortion that decreases as h rises (Figure 2). Indeed, in the case of symmetric shocks and positive spillovers, the country j can count on its neighbour's efforts of stabilization whose intensity is all the more important as the Central Bank's activism is low. The country j will modify the information about the nature of its shock in order to make up for the effects of the shocks at the aggregate level and limit the Central Bank's intervention. To put it differently, if h rises beyond the threshold value $\bar{h}$, the country j will benefit less and less from the stabilizing effects of the monetary policy and it will try to neutralize the Central Bank's action in order to take advantage of the neighbouring country's reinforced fiscal activism. This exception doesn't occur if the fiscal spillovers are negative irrespective of the degree of structural heterogeneity within the Union.

Figure 2: Country j 's informational bias in the case of symmetrical shocks
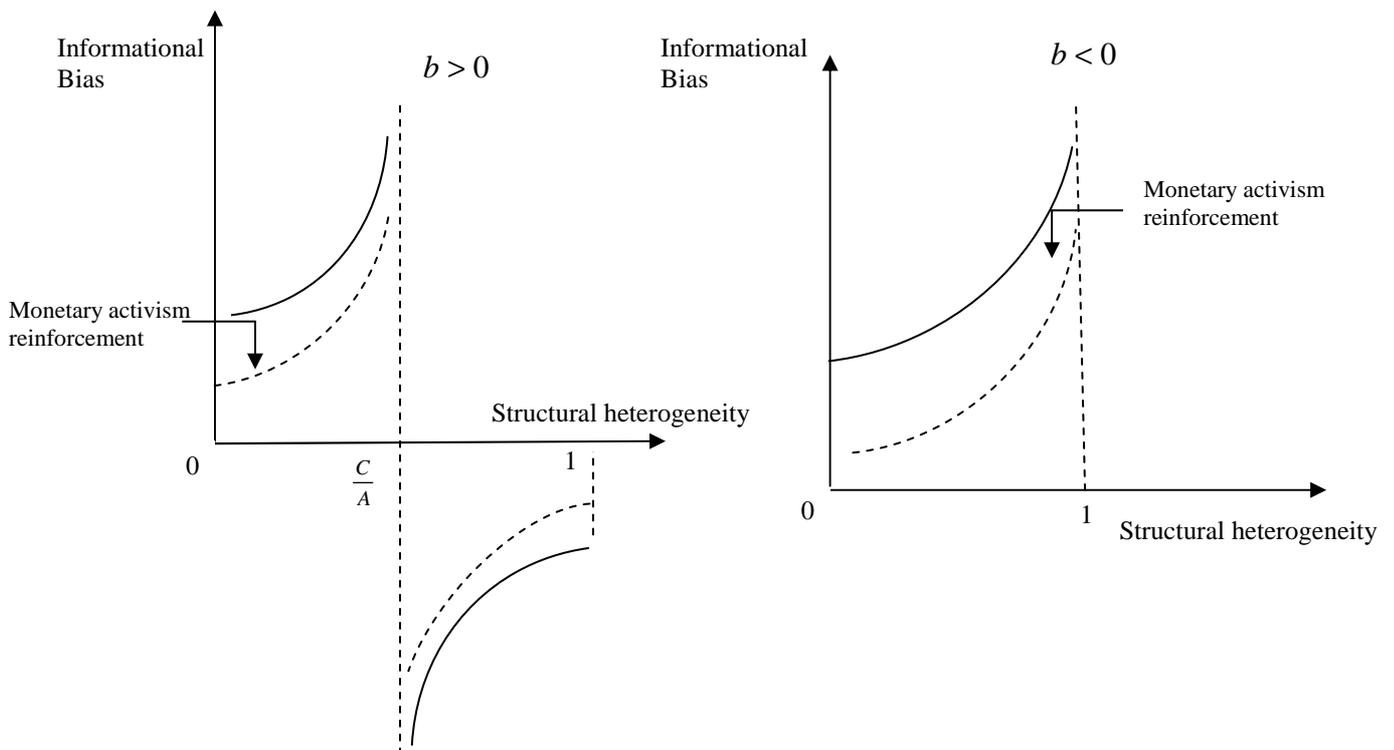

Regarding the governments' behaviour in the case of asymmetric shocks[10], we can first notice that each of them is inclined to overestimate its specific shock so that the Central Bank should be more sensitive to its cyclical environment to the detriment of the neighbour's.

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[10] To simplify the analysis, we take into account the case when the shocks are perfectly asymmetric ($\varepsilon_i = -\varepsilon_j$). A graphical analysis of the intermediate situations (shocks imperfectly asymmetric) is provided in the Appendix.

The differences between the countries in terms of communication strategy can be accounted for by the mechanism analysed previously in the case of the symmetric shocks: as h rises, the country i is less and less inclined to modify its information as long as the Central Bank deals with an important part of its stabilizations needs contrary to the country j which tries to make up for a decrease in the stabilising effects of the single monetary policy by gradually overestimating its shock. Compared to the previous case, the country i's communication strategy doesn't present a breaking point, the informational bias merely decreasing according to the Union's heterogeneity degree (Figure 3). Instead, for the country j, the communication mechanisms are roughly identical to those identified for the symmetric shocks (Figure 2). We can equally notice the same exception as in the case of the symmetric shocks when the fiscal spillovers are positive ($b > 0$) and the degree of the structural heterogeneity is above the threshold value $\bar{h}$ ($\bar{h} = \dfrac{C}{A}$). The mechanisms involved are different from those which accounted for the symmetric shocks: in a case of asymmetric shocks, the country j modifies the nature of its shock in order to increase the variation of the Union's aggregate variables and therefore to reinforce the Central Bank's activism. When h is going up, the single monetary policy is likely to have counterproductive effects on the country i which will have to conduct a reactive fiscal policy favourable to the country j on account of the positive value of the fiscal spillovers.

Figure 3: Country i's informational bias in the case of perfectly asymmetrical shocks
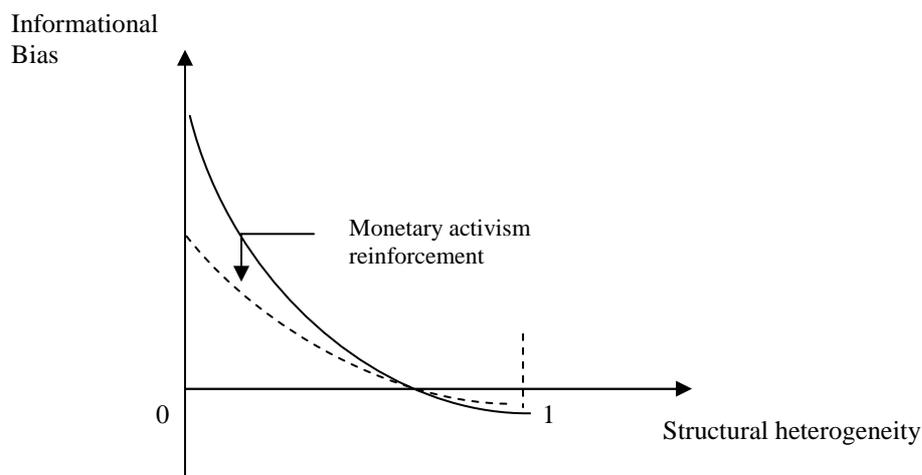
To sum up, we can point out that the governments are generally inclined to transmit inexact messages in order to influence the Central Bank's monetary policy. Indeed, for a revealing equilibrium to be reached, the conditions have to be extremely restrictive involving complete homogeneity at the Union level and absolute monetary activism. When structural and/or cyclical heterogeneities exist, the governments tend to tamper with their private information in order to improve their own welfare. Therefore, the current decentralized system of statistical data collection is little reliable and may well reinforce the Union's informational asymmetry, which may affect its credibility and its cohesion. Under these circumstances, it becomes vital to tackle the issue of the institutional mechanism capable to discipline the governments and eliminate their motivation to modify their private information.

3. Incentive Institutional Mechanisms

In order to avoid the problems caused by the national governments' tampering with their private information, the simplest solution would be to create an independent institution which would gather each Union member's statistical data. From a technical point of view, we can suppose that the European Central Bank or EUROSTAT would have both the expertise and the necessary means to handle such a centralized information gathering efficiently. Nevertheless, the current institutional framework of the Euro zone doesn't allow for this possibility. As a matter of fact, it is very unlikely that the situation changes in the immediate future. Indeed, a centralized collection of the statistical data could be seen by the countries as a loss of their independence and as a sign of lack of confidence in their capacity of collecting and communicating reliable data which could jeopardize the cohesion of the EMU.

Given the rigidity of the actual European policy-mix, a possible solution would be to revise the principle of subsidiarity, currently available, which would not trigger a radical change of the EMU's institutional environment. Thus, while the gathering of the statistical data would be maintained at the national level, an optimum contract would be established encouraging the governments to reveal to the Central Bank the exact information about their specific shock. This optimal contract would have to be a "principal-agent" contract (Walsh (1995)) and would be included in the loss function of the fiscal authorities annihilating their temptation to distort their private information.

If we suppose that the "principal's" objective is to reach a revealing equilibrium within the Union, the "principal" will establish a contract that can determine the "agent" to look for the optimum solution that will preserve it from distorting private information.

The fiscal authority, which is the "agent", will have its loss function modified by a linear contract acting on its instrument of fiscal policy, i.e. the budget deficit.

The loss function of the government i will write:

(11) $\quad L_i^G = \frac{1}{2}\left[\alpha_1 y_i^2 + \alpha_2 g_i^2\right] + G_i g_i$

where G_i is a linear penalty adapted to the fiscal authority of the country i.

The optimum contract that will annihilate the government's temptation to modify the message sent to the Central Bank will be established before the shock takes place. The contract depends both on the message sent by the government to the Central Bank and on the neighbour's specific shock. Thus, in order to discipline the governments, the "principal" must endogenize the public authorities' communication strategy and impose certain constraints on the shocks of the neighbouring country, according to the principle described previously that the optimum announcement of a government is also dependent on the shock of the neighbouring country.

The equation for the optimal contract is obtained by a usual backward resolution and writes:

(12) $\quad G_i = T_i \underline{\theta}_i + E_i \varepsilon_j$

Based on calculations[11], we can identify the two optimum contracts G_{i1} and G_{i2} corresponding to the two values for the coefficients T_i and E_i:

(13a) $\quad G_{i1} = T_{i1}\underline{\theta}_i + E_{i1}\varepsilon_j$

(13b) $\quad G_{i2} = T_{i2}\underline{\theta}_i + E_{i2}\varepsilon_j$

with $\quad T_{i1} = \dfrac{S_i + \sqrt{S_i^2 + 4FR_i(D - \alpha_2 zh + C(1-z))}}{2F}$

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[11] The detailed calculations allowing to identify the solutions for the optimum contracts are available upon request.

$$T_{i2} = \frac{S_i - \sqrt{S_i^2 + 4FR_i(D - \alpha_2 zh + C(1-z))}}{2F}$$

$$E_{i1} = \frac{\left[C(1-z) - \alpha_2 zh - D\right]\left[R_i + \dfrac{a\alpha_1}{DC}\left(\dfrac{S_i + \sqrt{S_i^2 + 4FR_i(D - \alpha_2 zh + C(1-z))}}{2F}\right)\right]}{F\left(\dfrac{S_i + \sqrt{S_i^2 + 4FR_i(D - \alpha_2 zh + C(1-z))}}{2F}\right) + \dfrac{a\alpha_1\alpha_2 z(C + Ah)}{DAC}}$$

$$E_{i2} = \frac{\left[C(1-z) - \alpha_2 zh - D\right]\left[R_i + \dfrac{a\alpha_1}{DC}\left(\dfrac{S_i - \sqrt{S_i^2 + 4FR_i(D - \alpha_2 zh + C(1-z))}}{2F}\right)\right]}{F\left(\dfrac{S_i - \sqrt{S_i^2 + 4FR_i(D - \alpha_2 zh + C(1-z))}}{2F}\right) + \dfrac{a\alpha_1\alpha_2 z(C + Ah)}{DAC}}$$

where $\quad S_i = \dfrac{a\alpha_1}{AC}\left[\dfrac{A(D - \alpha_2 zh + C(1-z))}{D} - \dfrac{\alpha_2 z(C + Ah)}{D}\right]$

$$R_i = \frac{\alpha_1\alpha_2^2 z(C + Ah)(\alpha_2 + \alpha_1 a^2)}{AD^2 C^2}$$

$$F = \frac{4(a\alpha_1 b)^2(\alpha_2 + \alpha_1 a^2)}{A^2 C^2}$$

If we apply the same principle to the country j, we obtain two optimal contracts:

(14a) $\quad G_{j1} = T_{j1}\underline{\theta}_j + E_{j1}\varepsilon_i$

(14b) $\quad G_{j2} = T_{j2}\underline{\theta}_j + E_{j2}\varepsilon_i$

with : $\quad T_{j1} = \dfrac{S_j + \sqrt{S_j^2 + 4FR_j(D + \alpha_2 zh + C(1-z))}}{2F}$

$$T_{j2} = \frac{S_j - \sqrt{S_j^2 + 4FR_j(D + \alpha_2 zh + C(1-z))}}{2F}$$

$$E_{j1} = \frac{\left[C(1-z) + \alpha_2 zh - D\right]\left[R_j + \dfrac{a\alpha_1}{DC}\left(\dfrac{S_j + \sqrt{S_j^2 + 4FR_j(D + \alpha_2 zh + C(1-z))}}{2F}\right)\right]}{F\left(\dfrac{S_j + \sqrt{S_j^2 + 4FR_j(D + \alpha_2 zh + C(1-z))}}{2F}\right) + \dfrac{a\alpha_1\alpha_2 z(C - Ah)}{DAC}}$$

$$E_{j2} = \frac{\left[C(1-z)+\alpha_2 zh - D\right]\left[R_j - \dfrac{a\alpha_1}{DC}\left(\dfrac{S_j - \sqrt{S_j^2 + 4FR_j(D-\alpha_2 zh + C(1-z))}}{2F}\right)\right]}{F\left(\dfrac{S_j - \sqrt{S_j^2 + 4FR_j(D-\alpha_2 zh + C(1-z))}}{2F}\right) + \dfrac{a\alpha_1\alpha_2 z(C-Ah)}{DAC}}$$

where: $S_j = \dfrac{a\alpha_1}{AC}\left[\dfrac{A(D+\alpha_2 zh + C(1-z))}{D} - \dfrac{\alpha_2 z(C-Ah)}{D}\right]$

$R_j = \dfrac{\alpha_1\alpha_2^2 z(C-Ah)(\alpha_2 + \alpha_1 a^2)}{AD^2 C^2}$

We can note that such kind of contracts involve both rules and discretion. Indeed, the discretion preserves the governments' right to react to economic shocks while the rules force the fiscal authorities to reveal the true information about their national economic shocks.

The question that may rise when adopting an optimal contract of this type is that of the identity of the "principal" as the authority able to influence the governments' behaviour by encouraging them to reveal their true information to the Central Bank. Currently, there are several institutions in the EMU placed at the supranational level that defend the general interest of the Union and which are likely to act in order to obtain a revealing equilibrium within the Union. Thus, certain decision-maker authorities at the EU level - like the European Commission and the ECOFIN (Economic and Financial Affairs Council) – or informal authorities at the level of the Euro zone might have the required legitimacy to impose the revealing contracts to the national governments on behalf of the Eurozone's stability and cohesion.

Another institutional means that may allow to reach the revealing equilibrium within the Union, could be to fight against one of the direct causes triggering the governments' deceitful behaviour, which is the extreme rigidity of the current policy-mix in the Euro zone. As we have already pointed out, given the current institutional context that insures the independence of the ECB and defines the principles of the Stability and Growth Pact, the governments' objectives of growth and employment defined at the national level are submitted to the objective of price stability at the aggregate level, which is specific to the ECB. When it was put into practice, this type of economic governance was in line with the necessity of building and defending the credibility of the monetary

Union and of the single currency. But it may well prove less adequate to the current situation as while the control of inflation has been successful for the last years, the economic growth has been rather poor within the Euro zone and very unbalanced among the member countries. The recent example of the world crisis, which has had highly asymmetric effects on the EMU's countries, has proved the rigidity of the policy-mix which is very little concerned with the cyclical asymmetries between the Union's member countries. Moreover, the future enlargement of the EMU to the CEEC's is very likely to increase the structural and cyclical heterogeneities within the Union and thus reinforce the tendency of the governments to distort their private information. There is therefore no doubt that the reform of the economic governance of the Euro zone is a major necessity.

Under these circumstances, the governments would be undoubtedly less tempted to distort their messages to the Central Bank if the monetary policy were more reactive to the national cyclical evolutions. The ECB's objectives should be reviewed by weighting the interest – almost exclusive nowadays- in the price aggregate stability with an appropriate concern about the evolution of the growth and employment at the national level. If we go further with this recommendation, an institutional solution that could facilitate the emergence of a revealing equilibrium could be an enhanced cooperation between fiscal authorities within the Union. Obviously, one cannot aim at a full coordination between all the Union members, since it is difficult to identify common interests between countries that are structurally and cyclically heterogeneous. Nevertheless, it is highly possible to achieve a variable geometry fiscal coordination (Jacquet and Pisani-Ferry (2000), Oros (2008b), Pisani-Ferry (1997)) since it is more easily to decide on common actions to take within a small group of relatively homogeneous countries than at a global level. Due to its flexibility and taking into account the heterogeneity within the Union, such a mechanism could therefore be an appropriate institutional solution insuring a better protection against the economic shocks and stifling considerably the governments' temptation to lie.

Conclusion

In this paper, we have analysed the impact in terms of macroeconomic stabilization of a form of asymmetrical information between the countries of a heterogeneous monetary Union. Considering the heterogeneity of the Union with respect both to the

mechanisms of monetary policy transmission and to the nature of the shocks affecting the Union members, we have assumed that the countries have private information about their specific shocks. We have thus examined whether the governments are inclined to take advantage of this information gap in order to influence indirectly the Central Bank in its choice of monetary policy.

We have proved that without a perfect homogeneity within the Union and an absolute monetary activism, the governments are constantly inclined to distort their messages to the Central Bank. Nevertheless, this opportunist behaviour, which is largely dependent on the nature of the shocks and on the extent of the Union's structural heterogeneity, is not linear, the optimum communication strategies being submitted to threshold effects.

At the institutional level, the results have shown the limits of the subsidiarity principle in collecting statistical data in a heterogeneous monetary Union. If we take into account the EMU, it would be necessary to reform the economic governance in the Euro Zone in order to persuade the governments not to adopt a deceitful behaviour with regard to the ECB. We have suggested several solutions to be studied in order to reform the current policy-mix and to discipline the governments when communicating private information on their economic shocks: adopting an incentive principal-agent contract between the policymakers of the Union; making the single monetary policy more reactive to the cyclical asymmetries between the Union countries; adopting a reinforced fiscal coordination at the level of the group of more homogeneous countries.

The framework that we have adopted in this article can be further developed firstly by extending the model to the supply shocks. Since they can have opposite effects on the output and inflation, it is likely that a conflict of interests arises between the governments and the Central bank when it comes to neutralizing the impact of these shocks. The convergence of the stabilization efforts made by the policymakers in the case of the demand shocks could be replaced, in the case of the supply shocks, by a divergence of the stabilization efforts of the fiscal and monetary authorities (Oros (2008a). The opposition convergence-divergence in the efforts of stabilizing the demand and supply shocks will very likely influence the governments' mechanisms of strategic communication.

Secondly, our current model could also be developed by analysing the governments' strategic behaviour in a dynamic framework involving a repeated game between the policymakers. More exactly, we could analyse the governments' optimum announcements if we suppose that the authorities are able to keep track of the previous economic policy decisions and are sensitive to the issues of credibility and reputation linked to their own decisions of economic policy.

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APPENDIX

We represent the informational bias on the same figure for the two opposite cases:

- symmetrical shocks ($\varepsilon_i = \varepsilon_j$) - a continuous line curve (S)

- perfectly asymmetrical shocks ($\varepsilon_i = -\varepsilon_j$) – a dotted line curve (AS).

Starting with the curve of the symmetrical shocks, the informational bias curve moves from the curve S to the curve AS as the shocks' degree of asymmetry grows, and it reaches the curve AS, in the case of a perfect asymmetry between the shocks. To put it differently, in the case of the imperfectly asymmetrical shocks, the informational bias is placed between the two curves represented in the Figures A.

We will represent below the two countries' informational bias. The relative position of this biases according to the nature of the shocks depends on the sign and the extent of the fiscal spillovers (parameter b).

Figure A1: Country i's informational bias

23
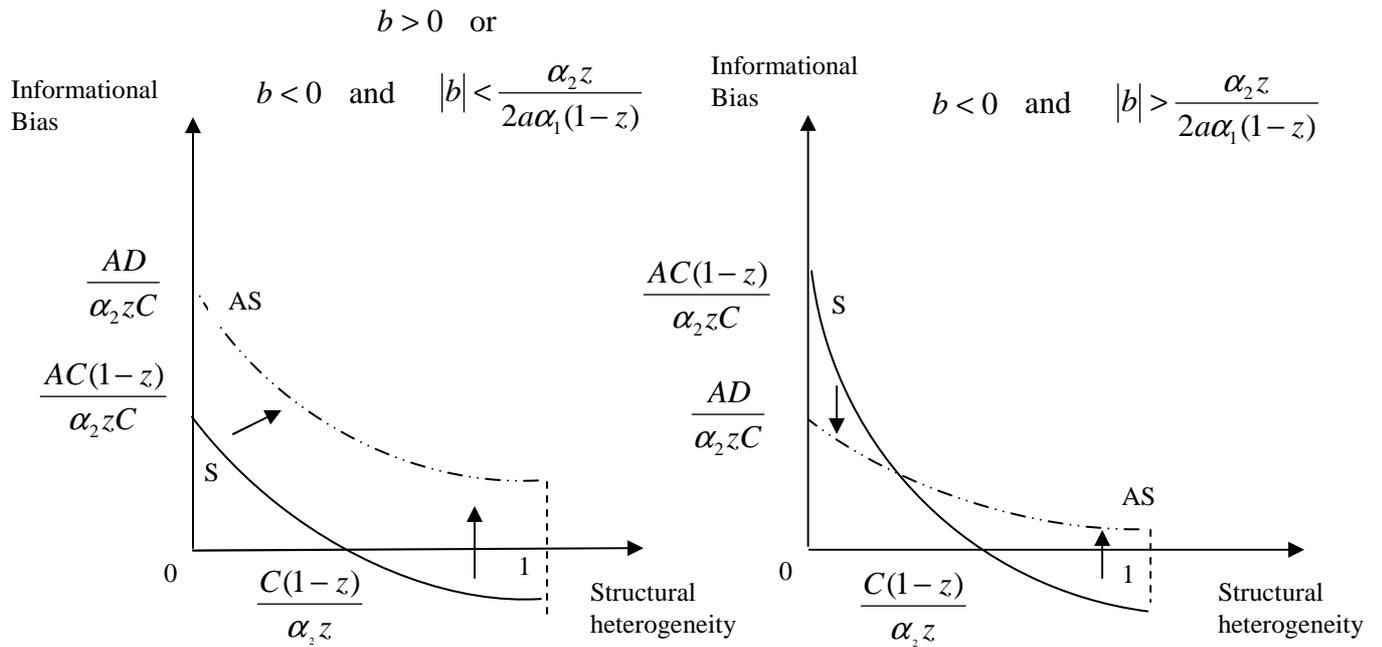
Figure A2: Country j's informational bias

Informational Bias

$b > 0$

Informational Bias

$b < 0$ and $|b| > \dfrac{\alpha_2 z}{2a\alpha_1(1-z)}$

$\dfrac{AD}{\alpha_2 zC}$

AS

S

$\dfrac{A(1-z)}{\alpha_2 z}$

Structural heterogeneity

0 $\quad \dfrac{C}{A} \quad\quad\quad 1$

$\dfrac{A\left[C(1-z)+\alpha_2 z\right]}{\alpha_2 z(C-A)}$

$\dfrac{AD}{\alpha_2 z(C-A)}$

S

AS

S

AS

1

Structural heterogeneity

0

Informational Bias

$b < 0$ and $|b| < \dfrac{\alpha_2 z}{2a\alpha_1(1-z)}$

S

AS

1

0

Structural heterogeneity