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The policy-mix in the Euro Area: The Role of Financial Stability

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Abstract

This paper analyses the impact of monetary and fiscal policies' interaction on the financial stability of the eurozone. Based on the construction of a financial stability index for the entire euro area, we assess the impact in terms of the stability of different configurations of policy-mix using a static Keynesian model in a closed monetary union. Mainly following the nature of fiscal spillovers, we show that fiscal coordination may be useful to improve the quality of the European Monetary Union financial stabilisation. The explicit consideration by the European Central Bank of the aggregate euro area financial stability as one of its macroeconomic objectives makes the non-cooperative game efficient. This configuration allows for a better macroeconomic and financial stabilisation at the aggregate level, which also has a positive effect at an individual level.

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1. Introduction

The current global economic crisis causes us to question the mechanisms of the interaction of economic policies within a currency area. Regarding the eurozone, recent events have clearly demonstrated the inadequacy of its system of economic governance and therefore, brought to light the necessity to reform it, in order to achieve a better systemic financial stabilisation. In this context, the present paper aims to put forward a new policy-mix configuration capable of bringing together the objectives of macroeconomic and financial stability, based on a positive analysis of the interactions of economic policies within the euro area, between the European Central Bank (ECB) and national governments.

Since the creation of the European Monetary Union (EMU), the literature on the policy-mix configuration has been largely organised around two axes. The first axis concerns the credibility problems raised by the articulation between economic policies, and involves possible discrepancies relative to macroeconomic objectives between the national governments and the ECB[1]. The second axis focuses on macroeconomic stabilisation against different types of shocks that could affect the economies of member countries. The analysis of the macroeconomic stabilisation has to take into account a specific institutional context defined by the independence of the ECB and by the constraints of the fiscal discipline imposed on governments by the Stability and Growth Pact[2].

The present paper is part of the second category, adding financial aspects to the dimension of macroeconomic stabilisation. Given their importance for the stability of the eurozone, these financial aspects should be considered explicitly during the implementation of the policy-mix configuration.

With regard to the macroeconomic stabilisation, the results observed in the literature are rather contradictory because of the use of different theoretical frameworks. Thus, Uhlig (2002) shows that the highest quality of macroeconomic stabilisation is achieved when the central bank stabilises the symmetric supply shocks, while governments deal with national demand shocks. This specialisation in the stabilisation of shocks becomes less obvious in Catenaro and Tirelli's (2000) analysis, in which the strategic coordination of fiscal policies can improve the effectiveness of shock stabilisation. Noteworthy studies addressing the same topic are those of Beetsma *et al*. (2001) and Laskar (2003).

Other recent studies on the subject of macroeconomic stabilisation emphasise the presence of economic externalities that can justify the economic policy coordination. In this way, Ferré (2008) shows that in a monetary union where the monetary policy is implemented by the central bank and the fiscal policy is implemented by national governments, fiscal instruments, such as net expenditure, can be designed in order to provide an immediate benefit to a country at the expense of the partner countries which suffer the associated costs. At the same time, the coordination of fiscal policies can have differentiated effects depending on the type of shocks affecting the economy.

Nevertheless, there is an important limitation to these studies concerning the fact that none of them takes into account the close link between macroeconomic stabilisation and systemic financial stability. Imbalances appearing in the financial system quickly spread, and, as a result, public authorities (the central bank and national governments) had to implement intervention strategies to stabilise economic activity during the economic and financial crisis.

The European evidence showed that, in a first step, the actions of the authorities were represented by the provision of market liquidity, as lender of last resort. Subsequently, a reform of the institutional regulation and supervision framework, focusing on policy

[1] See Dixit and Lambertini (2001), Beetsma and Bovenberg (1998, 1999), Beetsma and Uhlig (1999), Dornbusch (1997), and Villieu (2003).
[2] See Uhlig (2002), Mundschenk and Von Hagen (2003), Beetsma *et al*. (2001), and Engwerda *et al*. (2002).

coordination, was implemented (i.e. the Six-Pack and the Treaty on Stability, Coordination and Governance).Their mission is to promote financial stability by strengthening the coordination of economic policies.

In this context, the main contribution of our paper is the investigation of the impact, in terms of the financial stabilisation, of an enhanced cooperation between the economic policymakers within the EMU. For this purpose, we define a theoretical framework where the financial stability is assessed based on an aggregate index as in Albulescu (2012). However, unlike Albulescu (2012) who applied an empirical approach in order to see to what extent an expansionary monetary policy and a budgetary disequilibrium conduct to the financial stability deterioration in eurozone[3], our paper proposes a theoretical framework, based on the interactions between economic policies within a Monetary Union using a Keynesian model. In addition, the analysis of different policy configurations relies on the game theory and we assume that the financial stability can be considered as an explicit objective of the authorities. Based on this framework we intend to provide an answer to the central question of the paper: which would have been the results, in terms of financial stabilisation, of a cooperation framework where the financial stability is considered as an explicit objective of the authorities?

The remainder of the paper is as follows. The second section presents the model used to describe the macroeconomic mechanisms and the loss functions of public authorities (governments and central bank). The third section presents the main results in terms of financial stability, according to different policy-mix configurations. The last section concludes.

2. The model

We use a static Keynesian model within a closed monetary union with two countries (i, j)[4]. The macroeconomic equilibrium are described by demand and supply functions (Oros, 2012) and, as we focus on the issue of the financial stability at the euro area aggregate level, we consider that the EMU is entirely homogeneous, both structurally and from the standpoint of economic shocks affecting the country members. All the variables (except the interest rate) are expressed in logarithms. Thus, the demand function is represented by a standard IS function, widely used in the literature:

$$y_i = ag_i + bg_j - \delta r + \varepsilon \tag{1}$$

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 respectively of the country i; g_j represents the budget deficit of the country j; r represents the short-term interest rate; and ε is the demand shock affecting the countries of the EMU with zero mean and finite variance σ_ε^2.

[3] Albulescu (2012) designed an aggregate financial stability index (*afsi*) for the eurozone and showed that there is no trade-off between the financial stabilisation objective and the classic objectives of the authorities. The construction of the aggregate index is largely based on the International Monetary Fund (IMF) methodology, employed for the calculation of the *financial stress index*.

[4] We have preferred this category of models due to their simplicity and their capacity to illustrate the macroeconomic theoretical ideas. As the paper does not intend to quantitatively apply the proposed model in order to describe economic decisions, this choice seems to be appropriate. Therefore, this model which it is neither calibrated, nor used for simulations, intends only to demonstrate the economic intuition regarding the answer to the main question of the paper.

The national demand of the country i depends positively on its national budget deficit according to a sensitivity below 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 EMU members 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 plays the major part in the transmission of the fiscal spillovers. Finally, the national output is influenced by a demand shock.

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 stabilisation, and therefore leave aside any questions of credibility.

$$\pi_i = \mu\, y_i \tag{2}$$

where: $\mu > 0$, and 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, $\bar{x} = (x_i - x_j)/2$. Regarding shocks, we consider ε, the symmetric shocks affecting the EMU members.

Beyond these macroeconomic mechanisms, our model also introduces the aggregate financial stability index proposed by Albulescu (2012). Without performing the same empirical tests, we are interested here by the sign of the explanatory variables of the aggregate stability index, in order to introduce them in our theoretical model.

The next equation shows the relationship between the stability objective and the classical objectives of the authorities:

$$afsi = ky + d\pi - er - fg \tag{3}$$

Albulescu (2012) calculates the $afsi$ for the eurozone, taking into account ten individual stability indicators. The index is built for each eurozone country and afterwards aggregated to the eurozone level. The data sample spans between 1999Q1 and 2011Q1. The author performs a simple OLS regression and shows that the financial stability is positively influenced by the output and the price level, while the interest rate and the budgetary deficit have a negative impact[5]. Although these results are questionable, they are supported by empirical data. Consequently, we introduce a similar relationship in our theoretical framework.

Having described the macroeconomic and financial framework, we will now analyse the behaviour of the policymakers. The ECB decides on the single monetary policy independently, using its interest rate as a policy instrument in order to minimise its loss

[5]The results of the regression are the following:

$$\underset{\substack{(5.73\\<0.0001)}}{afsi} = \underset{\substack{(3.13\\0.003)}}{2.84} + \underset{\substack{(2.61\\0.012)}}{0.16y} + \underset{\substack{(-3.34\\0.001)}}{0.37\pi} - \underset{\substack{(-1.69\\0.098)}}{0.37r} - 0.10g + \varepsilon_t$$

We observe a positive relationship between the economic growth and the financial stability, similar to Dudley's (2011) idea. At the same time, we notice a positive link between the inflation rate and the financial stability, which confirms the short-term trade-off advanced in the literature (Brousseau and Detken, 2001). Conversely, in crisis periods, the price level decreases as a results of the demand contraction. Furthermore, we observe that a reduced level of the interest rate is associated with a higher level of the financial stability. If we consider the pick of the crisis, we usually observe that the key interest rate is reduced in order to increase the liquidity on the market and therefore, to promote the financial stability. Finally, the financial stability is achieved when the level of the budgetary deficit is reduced. Nevertheless, Albulescu (2012) admits that these results are influenced by the moment of crisis. For example, the decrease of the interest rate sustains the financial stability through the credit activity reviving but only after the crisis' outburst. Before the crisis, an expansionary monetary policy can have an opposite effect.

function (L^M). The central bank is mainly interested in price stabilisation at the aggregate level of the EMU (with a weight β_0), but also in the interest rate smoothing (with a weight β_2)[6].

$$L^M = \frac{1}{2}\left[\beta_0 \pi^2 + \beta_2 r^2\right] \qquad \text{where: } \beta_0 \text{ , } \beta_2 > 0 \tag{4}$$

The governments are in charge of the implementation of the fiscal policies using the budget deficit as a policy instrument. Their aim is to minimise a loss function (L_i^G) which depends on the evolution of national output and budget deficit (the relative weight of these objectives is α_1 and α_2, respectively).

$$L_i^G = \frac{1}{2}\left[\alpha_1 y_i^2 + \alpha_2 g_i^2\right] \qquad \text{where: } \alpha_1 \text{ , } \alpha_2 > 0 \tag{5}$$

3. Efficiency of policy-mix configuration on financial stability

We consider a simultaneous game between governments and the central bank, and we analyse the relative effectiveness in terms of financial stability of different configurations of policy-mix. The first situation corresponds to the current context and it is defined by a non-cooperative game between the authorities and by the absence of an explicit objective of financial stability in the loss functions of the players. This configuration will serve as a benchmark to compare the impact on the aggregate financial stability indicator of the other three policy-mix configurations: fiscal coordination without explicit consideration of the objective of financial stability by the authorities; non-cooperative game among authorities, with an explicit financial stability objective defined by the central bank; and non-cooperative game with an explicit financial stability objective defined by all the public authorities (governments and ECB).

3.1. Non-cooperative equilibrium

In this Nash game between the policymakers, the optimal values of the intervention instruments can be written as follows:

$$\begin{cases} r^N = \dfrac{z\left[(a+b)g + \varepsilon\right]}{\delta} \\ g^N = \dfrac{a\alpha_1(\delta r - \varepsilon)}{\alpha_2 + a\alpha_1(a+b)} \end{cases} \qquad \text{with: } z = \frac{\beta_0 \mu^2}{\beta_0 \mu^2 + \dfrac{\beta_2}{\delta^2}} \tag{6}$$

Using the Equations (6), we obtain the following values for the budget deficit and the equilibrium interest rate:

$$\begin{cases} g^N = -\dfrac{a\alpha_1(1-z)}{D^N}\varepsilon \\ r^N = \dfrac{z\alpha_2}{\delta D^N}\varepsilon \end{cases} \qquad \text{with: } D^N = \alpha_2 + a\alpha_1(a+b)(1-z) \tag{7}$$

[6] The target values of the macroeconomic variables in the policymakers' loss functions are normalised to zero. The level of the interest rate is usually included in the central bank objective function because important fluctuations of the interest rate are not suited, risking thus to destabilise the financial markets.

The Equations (7) allow us to observe that, for stabilising symmetric demand shocks, the stabilisation efforts of governments and of the central bank are convergent. For example, in the case of a negative demand shock, authorities will apply expansive policies: increased public deficit and lower interest rates, in order to stimulate the demand and to boost the activity.

Using Equations (7) we determine the equilibrium values of the production, inflation and aggregate financial stability indicator:

$$\begin{cases} y^N = \dfrac{\alpha_2(1-z)\varepsilon}{D^N} \\ \pi^N = \dfrac{\mu\alpha_2(1-z)\varepsilon}{D^N} \\ afsi^N = \dfrac{1}{D^N}\left[\alpha_2(1-z)(k+d\mu) - \dfrac{e\alpha_2 z}{\delta} + fa\alpha_1(1-z)\varepsilon\right] \end{cases} \tag{8}$$

3.2. Fiscal coordination equilibrium

In this case, the decisions of the governments are coordinated and the new collective loss function will be determined by the sum of all the national loss functions.

$$L^C = L_i^G + L_j^G = \frac{1}{2}\left[\alpha_1(y_i^2 + y_j^2) + \alpha_2(g_i^2 + g_j^2)\right] \tag{9}$$

The aggregate values of budget deficit, interest rates, production and inflation become:

$$\begin{cases} g^C = -\dfrac{(a+b)\alpha_1}{D^C}(1-z)\varepsilon \\ r^C = \dfrac{z\alpha_2}{\delta D^C}\varepsilon \\ y^C = \dfrac{\alpha_2(1-z)\varepsilon}{D^C} \\ \pi^N = \dfrac{\mu\alpha_2(1-z)\varepsilon}{D^C} \end{cases} \quad \text{with: } D^C = \alpha_2 + \alpha_1(a+b)^2(1-z)\,. \tag{10}$$

Using Equation (10), the aggregate indicator of financial stability is:

$$afsi^N = \frac{1}{D^C}\left[\alpha_2(1-z)(k+d\mu) - \frac{e\alpha_2 z}{\delta} + fa\alpha_1(1-z)\right]\varepsilon \tag{11}$$

At the aggregate level, the relative efficiency in terms of macroeconomic stabilisation mainly depends on the sign of the fiscal spillovers (*b*). Thus, if the fiscal spillovers are positive, the fiscal coordination is more effective to stabilise the production and the inflation ($y^C < y^N$ and $\pi^C < \pi^N$). The explanation lies in the fact that the governments are more reactive in this configuration ($\left|g^C\right| > \left|g^N\right|$)[7] and that this reactivity is not thwarted by the

[7]In the presence of symmetric shocks, a positive sign for fiscal spillovers allows each government to benefit from the stabilisation efforts of its partner. In order to maximise the intensity of the stabilisation efforts, the governments must coordinate their fiscal reactions.

intervention of the central bank. Indeed, as demand shocks generate convergent actions of stabilisation from both the governments and the central bank, the reactivity of the latter will be smaller in this case ($r^C < r^N$). On the contrary, a negative sign for the fiscal spillovers causes a more active fiscal policy in the case of a non-cooperative equilibrium ($|g^C| < |g^N|$), making this game configuration more efficient in terms of output and inflation stabilisation ($y^C > y^N$ and $\pi^C > \pi^N$), and allows the central bank to reduce its stabilisation efforts ($r^C > r^N$).

Regarding the financial stability indicator, the relative impact of this game configuration manifests itself through two divergent channels, respectively that of the production and inflation and that of the budget deficit and interest rates. Thus, the financial stability indicator will be better protected against the symmetrical shocks by a fiscal cooperative configuration if, in the presence of positive fiscal spillovers, the surplus of efficiency related to the production and inflation stabilisation (induced by this configuration compared to a non-cooperative equilibrium), is not compensated by the additional cost of stabilisation accepted by public authorities in using their intervention instruments in a fiscal cooperative game – $afsi^N > afsi^C \Rightarrow [(a+b)(1-z)(k+d\mu)] > [f+(a+b)ez]$. However, when fiscal spillovers are negative, fiscal coordination is more efficient in absorbing the impact of demand shocks on the financial stability indicator if the above condition is reversed– $[(a+b)(1-z)(k+d\mu)] < [f+(a+b)ez]$[8].

3.3. The ECB is explicitly concerned with financial stability

We consider a policy-mix configuration in which public authorities make individual and simultaneous decisions (Nash equilibrium), but where the ECB changes its loss function by explicitly taking into account the financial stability indicator (*afsi*)[9]. The new loss function is:

$$L^M = \frac{1}{2}\left[\beta_0^F \pi^2 + \beta_2^F r^2 + \beta_3 afsi^2\right], \qquad \text{with: } \beta_0^F,\ \beta_2^F,\ \beta_3 > 0 \tag{12}$$

In the construction of this augmented loss function, we consider that the relative importance bestowed by the central bank upon its initial objectives (price stability and interest rate smoothing) has not been modified by the existence of an additional objective. In other words, the balance between the preference for price stability and the preference for interest rate smoothing remains the same ($\frac{\beta_0}{\beta_2} = \frac{\beta_0^F}{\beta_2^F}$).

Applying the same approach as before, the equilibrium values of budget deficit, interest rate, output and inflation become:

[8]If we look at the individual government level, the relative impact on welfare is not directly identifiable. Thus, irrespective of the nature of the fiscal spillovers, a better stabilisation of the output implies stronger fiscal cost, so, in terms of loss function, the final impact will be conditioned by the relative importance paid by governments to stabilising the economic activity and the budget deficit.

[9]The current debates triggered by the crisis in the eurozone focus on financial stability as an ECB goal. The need to reform the system of the EMU economic governance, with particular attention given to financial indicators, is obvious. This policy-mix configuration can be associated with a form of cooperation between the authorities, in that the financial stability affects the individual welfare of all member countries of the EMU and not only that of the ECB.

$$\begin{cases} g_{afsi} = -\dfrac{a\alpha_1}{V}\left(\dfrac{\beta_2^F}{\delta^2}+\dfrac{\beta_3}{\delta^2}\psi e\right)\varepsilon \\ r_{afsi} = \dfrac{\alpha_2\left(\beta_0^F\mu^2+M\right)+a\alpha_1\dfrac{\beta_3}{\delta}\psi}{\delta V}\varepsilon \\ y_{afsi} = \dfrac{\alpha_2}{V}\left(\dfrac{\beta_2^F}{\delta^2}+\dfrac{\beta_3}{\delta^2}\psi e\right)\varepsilon \\ \pi_{afsi} = \dfrac{\mu\alpha_2}{V}\left(\dfrac{\beta_2^F}{\delta^2}+\dfrac{\beta_3}{\delta^2}\psi e\right)\varepsilon \end{cases} \tag{13}$$

Using Equations (13), the aggregate financial stability indicator takes the following value:

$$afsi_{afsi} = \frac{1}{\delta V}\left(\frac{\alpha_2\beta_2^F(k+d\mu)}{\delta}-\alpha_2\beta_0^F\mu^2 e+\frac{a\alpha_1\beta_2^F f}{\delta}\right)\varepsilon \tag{14}$$

with: $V = \alpha_2 T + a\alpha_1\left(\dfrac{\beta_2^F}{\delta^2}(a+b)+\dfrac{\beta_3}{\delta^2}\psi\left((a+b)+f\delta\right)\right)$, $T = \dfrac{\beta_2^F}{\delta^2}+\beta_0^F\mu^2+\dfrac{\beta_3}{\delta^2}\psi^2$,

$M = \dfrac{\beta_3}{\delta}\psi(k+d\mu)$ and $\psi = (k+d\mu)\delta + e$

When comparing the relative stabilisation effectiveness of this game configuration with the initial baseline situation (non-cooperative equilibrium and absence of explicit financial stability objective), several factors can be underlined. First, we observe a better stabilisation of the output and inflation as compared to the initial configuration ($y > y_{afsi}$, $\pi > \pi_{afsi}$). The explanation lies on the fact that taking into account the *afsi* indicator, the central bank increases the relative importance given to output stabilisation and inflation. Therefore, the stabilisation efforts made by the monetary authority to absorb the impact of the economic shocks on these two macroeconomic objectives are amplified. Following this reasoning and having in mind the convergence of efforts undertaken by the fiscal and monetary authorities to stabilise the output and inflation, the strengthening of the monetary activism encourages the governments to reduce their own efforts of stabilization ($|g| > |g_{afsi}|$). In this context, from the governments' point of view, in a homogeneous monetary union their individual welfare will be improved by the introduction of a financial stability objective in the loss function of the ECB, due to its positive effect in stabilising the domestic output, allowing also to smooth the fiscal activism.

Second, the introduction of the *afsi* indicator in the objective function of the ECB generates an enhanced monetary activism compared to the initial situation ($r < r_{afsi}$) if $\alpha_2\beta_2(k+d\mu)+a\alpha_1 f\beta_2 > e\delta\alpha_2\beta_0\mu^2$. The explanation is based on the appearance of a possible divergence in the implementation of the governments and the central bank's economic policy instruments, due to the existence of a stability objective in the loss function of the latter. Thus, if governments are mainly interested in the stabilisation of the activity (high α_1), the fiscal policies will be highly reactive, which could reinforce the financial stability zone imbalance in the presence of a financial stability indicator highly sensitive to

the fiscal instrument (high f). The ECB would then strengthen its monetary activism in order to alleviate this imbalance. This mechanism can be described using the previous example related to the negative demand shock affecting the EMU, a shock which generates expansive policies on the part of the authorities to stabilise the macroeconomic variables. If the indicator *afsi* is particularly sensitive to the fiscal developments, it may experience a significant deterioration after a strong fiscal activism, reflecting a strong interest of the governments in the stabilisation of the output. Under these circumstances, the ECB is tempted to increase its expansionary intervention in order to approach the financial stability indicator of its target set in the objective function of the monetary authority.

Another mechanism that could explain the strengthening of the monetary activism following the explicit concern of the ECB for the euro area financial stability, is the high sensitivity of the *afsi* indicator to output and to inflation developments (high k and d), and therefore to the shocks affecting the EMU. In this case, a negative demand shock may significantly deteriorate the quality of the indicator, hence the need for the ECB to strengthen its monetary activism in order to absorb this destabilising effect. Its intervention will be all the more strong, as the demand will be little influenced by the evolution of the interest rate (low δ), which will limit the stabilising effects on the *afsi* indicator.

Third, if we compare the relative effectiveness in terms of financial stability of the two policy-mix configurations, the fact that the ECB takes into account this objective has a positive effect if $\alpha_2\beta_2(k+d\mu)+a\alpha_1 f\beta_2 > e\delta\alpha_2\beta_0\mu^2$. We thus find the same condition allowing the strengthening of the monetary activism in this game configuration as in the baseline situation, supposing that there is no financial stability objective in the loss functions of the authorities. The objective of financial stability in the EMU follows perfectly the evolution of the economic policy implemented by the authority which is in charge of it. This result is quite significant since it confirms the effectiveness of the intervention of the ECB in the field of financial stability, provided that the monetary authority is willing to assume such a responsibility. In other words, the single central bank can manage the evolution of the aggregate indicator of financial stability in the EMU.

In institutional terms, this is a result that can have a major impact on the eurozone's economic system of governance. By agreeing to expand its prerogatives, the ECB could succeed in controlling the evolution of the EMU financial stability, which would have important consequences for the credibility and cohesion of the EMU. This raises obvious concerns related to the implementation of this system. It requires a thorough reform of the current institutional context structured around the independence of the ECB and of the Stability and Growth Pact. In this institutional context, 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. Given the rigidity of this governance system, the reform seems necessary as it is no longer adapted to the current context, characterised by growing concerns related to the eurozone's financial stability and accompanied by low inflation and rather weak performance in terms of economic growth, with wide disparities among the member countries. Thus, the fact that the ECB takes into account the financial stability could offer a solution to reform the economic governance of the eurozone and to better respond to the macroeconomic and financial situation in the EMU.

3.4. The ECB and the governments are explicitly concerned with financial stability

In this section, we describe a policy-mix configuration in which all the authorities (central bank and national governments) explicitly take into account in their individual loss functions, the financial stability objective (*afsi*). This game configuration fits into the current debate

triggered by the crisis and highlights the need to reform the EMU economic governance, with particular attention to financial indicators.

The new loss function of the governments can be written as follows:

$$L_i^G = \frac{1}{2}\left[\alpha_1^F y_i^2 + \alpha_2^F g_i^2 + \alpha_3 afsi^2\right], \qquad \text{with: } \alpha_1^F,\ \alpha_2^F,\ \alpha_3 > 0 \tag{15}$$

As in the previous case, we consider that the introduction of an additional objective in the loss function of a public authority does not change the relative weight assigned to its traditional objectives. Thus, in the case of the governments, we have: $\frac{\alpha_1}{\alpha_2} = \frac{\alpha_1^F}{\alpha_2^F}$.

In this game configuration, the equilibrium values of budget deficit, interest rate, output and inflation become:

$$\begin{cases} g_{G\_afsi} = -\dfrac{a\alpha_1^F}{V^G}\left(\dfrac{\beta_2^F}{\delta^2} + \dfrac{\beta_3}{\delta^2}\psi e\right)\varepsilon + \dfrac{\alpha_3\left(\dfrac{(a+b)(k+d\mu)-f}{2}\right)\left(\dfrac{\beta_0^F\mu^2 e}{\delta} - \dfrac{\beta_2^F}{\delta^2}(k+d\mu)\right)}{V^G}\varepsilon \\ r_{G\_afsi} = \dfrac{\alpha_2^F\left(\beta_0^F\mu^2 + M\right) + a\alpha_1^F\dfrac{\beta_3}{\delta}\psi f}{\delta V^G}\varepsilon - \dfrac{\alpha_3\left(\dfrac{(a+b)(k+d\mu)-f}{2}\right)\beta_0^F\mu^2 f}{\delta V^G}\varepsilon \\ y_{G\_afsi} = \dfrac{\alpha_2^F}{V^G}\left(\dfrac{\beta_2^F}{\delta^2} + \dfrac{\beta_3}{\delta^2}\psi e\right)\varepsilon - \dfrac{\alpha_3\beta_2^F f}{\delta^2 V^G}\left(\dfrac{(a+b)(k+d\mu)-f}{2}\right)\varepsilon \\ \pi_{G\_afsi} = \dfrac{\mu\alpha_2^F}{V^G}\left(\dfrac{\beta_2^F}{\delta^2} + \dfrac{\beta_3}{\delta^2}\psi e\right)\varepsilon - \dfrac{\mu\alpha_3\beta_2^F f}{\delta^2 V^G}\left(\dfrac{(a+b)(k+d\mu)-f}{2}\right)\varepsilon \end{cases} \tag{16}$$

The aggregate financial stability indicator becomes:

$$afsi_{G\_afsi} = \frac{1}{\delta V^G}\left(\frac{\alpha_2^F\beta_2^F(k+d\mu)}{\delta} - \alpha_2^F\beta_0^F\mu^2 e + \frac{a\alpha_1^F\beta_2^F f}{\delta}\right)\varepsilon \tag{17}$$

with: $V^G = \alpha_2^F T + a\alpha_1^F\left(\frac{\beta_2^F}{\delta^2}(a+b) + \frac{\beta_3}{\delta^2}\psi\left((a+b) + f\delta\right)\right) + \frac{\alpha_3}{\delta}\left(\frac{(a+b)(k+d\mu)-f}{2}\right)H$

$$H = \frac{\beta_2^F}{\delta}\left((a+b)(k+d\mu) - f\right) - \beta_0^F\mu^2\left((a+b)e + f\delta\right)$$

If we analyse the efficiency of this game configuration in terms of financial stability, a first important element is the relative influence of the aggregated macroeconomic variables on the financial stability indicator. Thus, when $(a+b)(k+d\mu) - f < 0$, the presence of a common financial stability objective for all the public authorities is beneficial compared to the case where financial stability is an exclusive concern of the ECB ($afsi_{afsi} > afsi_{G\_afsi}$). In this case, in order to analyse the financial stabilisation optimality, it is necessary to compare the initial configuration (supposing that there is no stability objective for the authorities) with the configuration in which financial stability is a common goal for the ECB and governments. By comparing these two configurations, we have found the same condition as in the previous section allowing a surplus of efficiency when there is no explicit stabilising objective for the

authorities ($\alpha_2\beta_2(k+d\mu)+a\alpha_1 f\beta_2 < e\delta\alpha_2\beta_0\mu^2$). In other words, the presence of a common financial stability objective, even beneficial compared to the intermediate case (only the ECB focuses on this objective), does not guarantee the optimality of the financial stabilisation at the EMU level.

In the opposite case, supposing that $(a+b)(k+d\mu)-f>0$, the first element to highlight relates to the fact that the existence of a common objective is not beneficial compared to the case where only the central bank assumes the financial stability objective if ($\alpha_2\beta_2(k+d\mu)+a\alpha_1 f\beta_2 < e\delta\alpha_2\beta_0\mu^2$). Thus, the optimum situation in terms of financial stability corresponds to the current situation where there is no explicit objective of financial stability for public authorities. In other words, the important concern of the central bank over price stability (β_0 high), together with its large autonomy in the use of its instrument of intervention (β_2 low), does not require an explicit objective of financial stability in the loss function of the monetary authority, provided that the indicator of financial stability is sensitive to the monetary reactions (*e* high).

On the contrary, it is possible to identify a situation where the simultaneous presence of an objective of financial stability in the loss functions of the authorities can prove effective: ($(a+b)\left(\frac{\beta_2^F}{\delta}(k+d\mu)-\beta_0^F\mu^2 e\right) > f\left(\frac{\beta_2^F}{\delta}+\beta_0^F\mu^2\delta\right)$). In this case, the ECB must reduce the relative importance of price stability,[10] whereas a monetary stimulus must have a limited impact on both the financial stability indicator (*e*) and on the activity and inflation (δ). If this condition is not satisfied ($(a+b)\left(\frac{\beta_2^F}{\delta}(k+d\mu)-\beta_0^F\mu^2 e\right) < f\left(\frac{\beta_2^F}{\delta}+\beta_0^F\mu^2\delta\right)$), the definition of a common objective of financial stability for the ECB and the national governments is counterproductive. The optimal situation requires that the ECB specialises exclusively in dealing with this objective.

4. Conclusions

This paper has aimed to analyse the impact of different configurations of policy-mix between national governments and the ECB in terms of financial stability. Currently, this is a problem of real concern because, under the effects of the crisis, the reform of the EMU economic governance system is more legitimate than ever. Given its fundamental role in the overall stability and cohesion of the euro area, the issue of financial stability plays an important part in the debates about the direction of the governance of the EMU.

The impact of the financial stabilisation was evaluated in four policy-mix configurations. The first corresponds to the situation before the crisis, a non-cooperative game between authorities and the lack of the financial stability objective in their loss functions. As a consequence of the current crisis, the issue of cooperation between authorities has gained ground, as shown by the recent establishment of financial stability committees in the EMU. In response to this evolution, the second policy-mix configuration proposes the coordination between fiscal policies within the eurozone. The third configuration involves the introduction of an explicit goal of financial stabilisation in the ECB loss function. The last configuration analyses the opportunity to consider the financial stability as a common objective of the ECB and national governments.

[10] The trade-off between price stability and financial stability appears in this context.

Using, as reference and benchmark the non-cooperative equilibrium configuration without any explicit financial stability objective set by the authorities, we have shown that fiscal coordination can improve the quality of financial stability at the aggregate level. This is true, mainly if fiscal spillovers are positive and if the stability indicator is more sensitive to changes in the output and inflation than to budget deficit and interest rate. On the contrary, if the ECB is explicitly concerned with financial stabilisation, it is able to better absorb the impact of symmetric shocks, with positive effects in terms of aggregate and individual welfare. The simultaneous presence of a financial stability objective for all public authorities may be counterproductive, thus triggering the policy-mix configuration towards the specialisation of economic policies. The central bank would be in the best position to take into account the evolution of the financial stability indicator in achieving its economic policy objectives.

In institutional terms, the results show the limitations of the EMU current governance system and confirm the necessity to reform it. The current governance principles, justified at the time of their introduction (about twenty years ago) by the concern to build and defend the credibility of the EMU and of the single currency, must be improved, and the eurozone must evolve. Its future depends on it.

The proposed model has however several limitations. First, we have proposed a static approach and we have assumed a similar size for the governments, yet being aware of the fact that a dynamic model would be more suited for the model calibration and empirical validation. Moreover, in a dynamic framework, the level of the public debt can also be considered given its importance for the Eurozone countries. Thus, the presence of the public debt could deteriorate the evolution of the economic activity mainly through the interest rate channel. The mechanisms describing the output gap will be thus more complex, which could influence the results of the analysis.

Second, in our analysis we have considered only demand shocks, but the model can be developed by considering also supply shocks, which can have opposite effects on the output and inflation, being susceptible of generating a conflict of interests between governments and the central bank when it comes to neutralising the impact of these shocks. The convergence of the stabilisation efforts made by the fiscal and monetary authorities in the case of the demand shocks could be replaced, in the case of the supply shocks, by a divergence of the stabilisation efforts made by these policymakers. The opposition convergence-divergence in the efforts of stabilising the demand and supply shocks will very likely influence the macroeconomic equilibriums and thus the outcomes in terms of financial stability of the monetary union.

Finally, the demand equation (Equation 1) can also integrate the financial stability level, as it positively influences the economic growth. We have considered the stability indirectly, through a demand shock. However, the explicit examination of the stability level, as a factor influencing the output, could considerably increase the relevance of the analysis and could thus be the subject of future developments.

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