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Document de travail n° 2006–25

Octobre 2006

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Fiscal Policy in a Monetary Union Under Alternative Labour-Market Structures

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July 17, 2006

Abstract

This paper examines the welfare and stabilisation implications of alternative fiscal decision rules in a monetary union with a common monetary policy, such as the European Monetary Union (EMU). We develop a two-country model under monetary union in presence of asymmetries. Fiscal policies are assumed alternatively non-cooperative (decentralised) and cooperative (centralised) and labour markets are characterised by decentralised and centralised wage setting. The central issue of the paper is the design of the appropriate fiscal policy rule by comparing and evaluating the performance of alternative arrangements to distribute the power over fiscal authorities between the centre of the union and the individual members of the union. The main result of this paper reveals that a decentralized fiscal policy rule, where the member states conduct independent fiscal policies, with centralised wage setting in labour markets of monetary union members is the appropriate institutional design. This institutional arrangement would improve the social welfare and stabilize better than others the idiosyncratic shocks hitting the economies of the monetary union members.

Keywords : Policy-mix, EMU, labor market institutions

JEL classification : E58, E52, E63

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1 Introduction

The launch of the Economic and Monetary Union (EMU) in January 1999 implied a considerable change in the policy mix of the European Union. Since that date, national monetary policies of the EMU-member countries are completely centralized in the hands of the European Central Bank (ECB) aiming at price stability. On the other hand, governments of member countries formulate separately fiscal policy decisions keeping the interests of their countries under the constraints of the single monetary policy and the Growth and Stability Pact.

The relatively uncoordinated nature of this exercise raised the fundamental issue concerning the policy mix in a monetary union such as the euro zone, where fiscal policy and labour-market institutions have largely retained their national status until now. The question addressed in this paper is how, in a monetary union, the interaction between centralised monetary policy and decentralised fiscal policy and labour-market institutions affects the short-term stabilisation policy as well as the social welfare. In fact, there are a number of policy questions that involve interactions between the different institutions operating in a monetary union such as the EMU. Among them, Acocella and Bartolomeo (2001) suggest the possibility for trade unions of internalizing external effects stemming from wage setting in a national context; the possibility for governments of internalizing macroeconomic spillovers deriving from public expenditure at national level and finally the interactions between fiscal and monetary authorities.

Concerning the first question, since the early research by Calmfors and Driffill (1988), a growing literature has been focused on the interaction among wage-bargaining structures, central bank independence, and inflation performance. Cubitt (1992, 1995) and Skott (1997) have showed that centralisation of wage bargaining can significantly influence the optimal choices of a central bank. Sockice and Iversen (2000), Iversen (1999), Guzzo and Velasco (1999) and Cukierman and Lippi (1999, 2001) have developed alternative frameworks for exploring the implications of increased wage-setting centralization for various macroeconomic variables. A common feature of all these analyses is that they examine only the relationships between the monetary policy and the degree of centralization of wage bargaining and their effects on the economic performance. In addition, the second and third question, concerning the interdependence between the common monetary policy and national fiscal policies, has been extensively examined in the economic literature. A growing literature (see, Beetsma and Bovenberg, 1998, 1999; Beetsma et al., 2001; Dixit, 2000; Dixit and Lambertini, 2000,2001; Uhlig, 2002) has analyzed recently possible policy mix problems in a monetary union. In this context, the existence of externalities and free-riding incentives may tend to imply that non-cooperative fiscal policies do not yield efficient policy outcomes in a monetary union. However, these interactions between fiscal and monetary policies in a monetary union should not be viewed as independent from the relationships between the monetary policy and the degree of centralization of wage bargaining.

This paper studies the interaction between monetary policy and alternative (decentralized or centralized) national fiscal policies in a monetary union under differ-

entiated national labor market institutions. the primary argument in this context is that, once exchange rate are irrevocably fixed in a monetary union and monetary policy can only be used to stabilize aggregate symmetric shocks, a system of fiscal policy-making and wage-setting must be in place to equilibrate transitory cyclical economic instability in union member-states. According to this argument, the debate over the fiscal policy implications in a monetary union focuses mainly on the effects of transitory idiosyncratic shocks, causing asymmetric effects across the country-members of the monetary union. In this context, the design of optimal fiscal policy and labor market institutions in a monetary union requires the clarification of the distribution of the power over the policy decision-making between the centre of the union and the individual member states. In this respect, committee decisions can be made in several ways.

There is a large literature on different types of collective decision-making procedure. Von Hagen and Süppel (1994) compare a union-wide perspective with decisions based on nationalistic voting by assuming a federal central bank governed by a council consisting of two alternative types of appointees: union-wide governors and country representatives designed to make his decision by a simple majority rule. Union-wide governors desire to stabilize the union's inflation and output, whereas country representatives are concerned with regional economic welfare. Matsen and Roisland (2005), focus on four alternative types of decision-making procedure that are relevant for interest rate decisions in a monetary union : a "union rule", where the central bank only focuses on union-wide aggregates; a "Benthamite rule" (utilitarian rule), where the central bank minimizes the sum of national loss functions; a "majority rule", where each board member votes for the interest rate that minimizes losses in their respective home country; and a "consensus rule", where the interest rate is set as the average of the desired interest rates of each national board member. The differences between the first and the second decision-making procedure have been analyzed by De Grauwe (2000), Nolan (2002) and Gros and Hefeker (2002a,b).

The present paper contributes to the literature by comparing two alternative types of fiscal policy decision-making procedure in a monetary union under different degrees of wage-bargaining centralization. We will focus on two general types of decision-making procedure that are particularly relevant for fiscal policy decisions in a monetary union. These are: a "decentralized rule", where the member states conduct independent fiscal policies; a "Benthamite rule" (utilitarian rule), according to which a union-wide fiscal authority minimizes the sum of national loss functions. Following the tradition in the recent literature on monetary policy rules in a monetary union (see e.g. Van Aarle and Huart, 1999; De Grauwe, 2000; Hughes-Hallet and Viegi, 2001), we consider the problem of monetary and fiscal policy-mix in a model of a two-country monetary union, in which different labor market institutions are distinguished in each country by the degree of bargaining centralization in wage setting. By taking into account the diversity in the national labor market institutions, we compare the welfare implications of the interaction between a union-wide monetary policy and two alternative decision rules for fiscal policymaking (decentralized and centralized) in the presence of differentiated labor market structure

(centralized and decentralized wage setting).

The rest of the paper is organized as follows. Section 2, presents the basic theoretical framework of a two-country monetary union. Section 3 present the results under decentralized and centralized fiscal policy decision making procedure in the presence of two different labor market institutions (with centralized and decentralized wage setting). In Section 4, we compare the social welfare implications and the stabilization policy implications for the alternative decision-making regimes. Section 5 summarizes our results.

2 A two-country monetary union

The model employed is a standard static two-country model under a monetary union. The two countries are assumed to be symmetric, and all domestic and foreign variables are respectively denoted by 1 and 2.

2.1 Firms

In each country i ($i = 1, 2$) product markets are competitive and firms face a standard production function featuring decreasing returns to scale in labour given by

$$y_i = al_i + \theta_i, \quad 0 < a < 1 \quad (1)$$

where y_i is the output (in logs), l_i the employment (in logs) and θ_i a supply side or productivity shock (distributed with variance $\sigma_\theta^2 > 0$ around a zero mean) faced by firms in country i . Firms decide on labour demand and output by maximizing their profits. Thus, labour demand is given by

$$l_i = \ln \arg \max_{L_i} \{P_i(1 - \tau_i)Y_i - W_iL_i \mid Y_i = L_i^a\Theta_i\}, \quad (2)$$

where capital letters denote the according non-logarithmic variables. P_i is the price level, W_i is the nominal wage and τ_i is a distorsionary tax affecting firms. Firms produce a homogenous good and stand in perfect competition. Maximizing profits yields the labour demand function:

$$l_i = \tilde{l}_i + \alpha(p_i - w_i - \tau_i) + \epsilon_i, \quad (3)$$

where $\tilde{l}_i = 1/(1-a) \ln(a)$ stands for natural level of employment, $\alpha = 1/(1-a) > 0$, and $\epsilon_i = \theta_i/(1-a)$ is a random term distributed with mean zero and variance $\sigma_\epsilon^2 > 0$. For convenience and without loss of generality, the natural level of output in each country, \tilde{l} , is normalized to zero. Price level p_i in each country i is assumed to clear the goods market. Thus, an aggregate demand generated by quantity equation defines the price level p_i as

$$p_i = m - y_i \quad (4)$$

where m is the money supply fixed exogenously by the monetary union monetary authorities. Nominal wages in each economy w_i are set through a bargaining either at a centralized level or at a decentralized level.

2.2 Unions

In a first labour market regime, we assume that nominal wages in both countries are set by atomistic trade unions which try to minimize deviations of real wages from their real wage targets, v_i , as set out in the following objective function:

$$\min_{w_i} V_i = (1/2) E (w_i - p_i - v_i)^2 \quad (5)$$

Solving conditional on expected values, we obtain the reaction function:

$$w_i = p_i^e + v_i \quad (6)$$

where $p_i^e = Ep_i$ is the rationally expected price level. In a second labour market regime, we assume that in both countries a single centralized union determine the nominal wage at the beginning of each period aiming for full employment by preserving the real wages growth in line with productivity. This is set out by

$$\min_{w_i} V_i = (1/2) E \left[(w_i - p_i - v_i)^2 + \delta (l_i - \tilde{l}_i)^2 \right] \quad (7)$$

Using equation (3) and solving conditional on expected values for taxes and inflation, losses are minimized if

$$w_i = \pi_i^e - \left(\frac{\delta}{1 + \delta} \right) \tau_i^e + \left(\frac{1}{1 + \delta} \right) v_i \quad (8)$$

where $\pi_i^e (\equiv Ep_i - p_{i,-1})$ is the expected inflation rate in country i . In this context, once nominal wage level is defined at the beginning of each period, employment l_i in each country becomes demand determined following equation (3).

2.3 Monetary Union

The two economies forming this monetary union are assumed to be identical in size. In monetary union, consistency requires the following adding-up constraints:

$$y = (1/n) \sum_{i=1}^n y_i, \quad l = (1/n) \sum_{i=1}^n l_i, \quad p = (1/n) \sum_{i=1}^n p_i$$

$$\tau = (1/n) \sum_{i=1}^n \tau_i, \quad w = (1/n) \sum_{i=1}^n w_i, \quad \epsilon = (1/n) \sum_{i=1}^n \epsilon_i$$

where n is the number of monetary union member countries. Thus, monetary policy only focuses on monetary union-wide aggregates of inflation rate, π (with $\pi \equiv p - p_{-1}$) and employment l . Further, this monetary policy is delegated to a

Common Central Bank (*CCB*) managed by a council consisted entirely by *governors*, chosen through a centralized appointment procedure (see Hagen and Süppel, 1994; De Grauwe, 2000). This monetary policy will be derived by minimising a generic quadratic loss function defined as

$$\min_{\pi} L^{CCB} = (1/2) \left[\pi^2 + \lambda \left(l - \tilde{l} \right)^2 \right] \quad (9)$$

where $\lambda \geq 0$ is the relative importance, in the CCB's view, of stabilizing output levels across the union as a whole. So, l is the average level of employment in the monetary union, with target \tilde{l} . For $\lambda = 0$, we say that *CCB* is hardnosed about inflation. The implicit assumption here is that the union participants are of equal size and exert the same influence on the union monetary policy. In opposite, fiscal policy focuses mainly on the effects of transitory idiosyncratic shocks, causing asymmetric effects across the member states of the monetary union.

2.4 Fiscal Policy

Consider then alternative fiscal policy decision rules in the monetary union. Consider first the case of a decentralized fiscal policy rule, where the member states of the monetary union conduct independent or non-cooperative fiscal policies. The fiscal policy instrument is the tax rate τ_i in country i , which is assumed to minimise a loss function defined over inflation π , employment l_i and public spending, g_i as follows:

$$\min_{\tau_i} L_i^G = (1/2) \left[\pi^2 + \mu \left(l_i - \tilde{l}_i \right)^2 + \phi \left(g_i - \tilde{g}_i \right)^2 \right], \quad \mu, \phi > 0 \quad (10)$$

where μ and ϕ correspond to the weights of employment and government spending objectives, respectively, relative to the weight of the inflation objective. They are assumed to be identical across the union participants. The first-best for inflation corresponds to price stability, the first-best level of employment corresponds to the natural rate of employment, \tilde{l}_i (assumed equal to zero) and the first-best of government spending, \tilde{g}_i (> 0), can be interpreted as the optimal share of non-distortionary output to be spent on public goods if (non-distortionary) lump-sum taxes would be available. Further, government budget constraint in each country i can be approximated by (see Alesina and Tabellini, 1987) :

$$g_i = \tau_i + \pi_i \quad (11)$$

where public spending, g_i and τ_i is the tax revenue as a share of non-distortionary output, and $\pi_i \equiv p_i - p_{i,-1}$ the inflation rate in country i . For convenience, we will assume that public expenditures g_i can not be financed by seigniorage revenues in this monetary union (i.e., $\pi_i = 0$), reflecting the fiscal policy implications of the stability pact constraining the ability of the EMU countries to finance budget deficits by seigniorage revenues. Finally, an alternative decision-making procedure is a cooperative fiscal policy rule, in which a union-wide council of Fiscal Country Representatives (*FCR*) minimizes the sum of the individual loss functions, as

$$\min_{\tau} L^{FCR} = (1/n) \sum_{i=1}^n L_i^G \quad (12)$$

This union-wide fiscal authority set the common tax rate τ so as to minimize the preceding aggregate loss function. Turn next to the question of how alternative fiscal policy-making rules with differentiated labour market institutions should be designed in the monetary union to perform social welfare and to stabilize idiosyncratic shocks hitting the member countries of the monetary union.

3 Alternative policy decision regimes

3.1 Independent fiscal policies

Consider first the case where the countries conduct independent fiscal policies in combination with the common union-wide monetary policy. Thus, fiscal policies decisions are completely decentralized in the hands of the national governments in the presence respectively of decentralised and centralized wage setting in each member state.

3.1.1 The optimal policy mix

In this institutional setting, the Common Central Bank sets the union-wide inflation rate π to minimize the loss function (9) and both national fiscal authorities choose the tax rates τ_i in their own countries to minimize their respective loss functions (10). We consider the time-consistent optimal solutions under discretion. From the first order conditions for π and τ_i , we obtain the following reaction functions:

$$\pi = \frac{\lambda}{1 + \lambda} (w + \tau - \epsilon) \quad (13)$$

$$\tau_i = \frac{\mu}{\mu + \phi} (\pi - w_i + \epsilon_i), \quad i = 1, 2 \quad (14)$$

Solving the equations system (13) and (14), we obtain :

$$\pi = \frac{\lambda\phi}{\mu + \phi(1 + \lambda)} (w - \epsilon) \quad (15)$$

$$\tau_1 = \frac{\mu\lambda\phi(w_2 - \epsilon_2) - [\lambda\phi + 2(\mu + \phi)](w_1 - \epsilon_1)}{2(\mu + \phi)(\mu + \phi + \lambda\phi)} \quad (16)$$

$$\tau_2 = \frac{\mu\lambda\phi(w_1 - \epsilon_1) - [\lambda\phi + 2(\mu + \phi)](w_2 - \epsilon_2)}{2(\mu + \phi)(\mu + \phi + \lambda\phi)} \quad (17)$$

The preceding equations clarify that the emerging equilibrium depends on the wage formation mechanism in each country. Thus, to understand the interaction between

monetary and fiscal policymaking, we must incorporate an additional policy issue that involve interaction between the fiscal policymaking rule operating in the monetary union and the national labour market institutions in the monetary union. In the following, we analyse two alternative labour market regimes, both of them are symmetric, with either full decentralization or complete centralization bargaining for nominal wage setting.

3.1.2 *Decentralised wage-setting*

In a first labour market regime, we assume that nominal wages in both countries are set by atomistic trade unions which try to minimize deviations of real wages from their real wage targets, v_i , as set out in the objective function (5) and in the resulting reaction function (6). Taking rational expectations of (15), we obtain :

$$\pi^e = \left(\frac{\lambda\phi}{\mu + \phi} \right) v \quad (18)$$

where $v \equiv (1/n) \sum_{i=1}^n v_i$. Thus, the optimal solutions under monetary and fiscal discretion and decentralized fiscal policies with decentralised wage setting (denoted by *DD*) are given by :

$$\begin{aligned} \pi^{DD} &= \left(\frac{\lambda\phi}{\mu + \phi} \right) v - \left(\frac{\lambda\phi}{\mu + \phi(1 + \lambda)} \right) \epsilon \quad (19) \\ \tau_1^{DD} &= \frac{\mu\epsilon_1}{\mu + \phi(1 + \lambda)} + \frac{\mu\lambda\phi(\epsilon_1 - \epsilon_2)}{2(\mu + \phi)(\mu + \phi + \lambda\phi)} - \frac{\mu v_1}{\mu + \phi} \\ \tau_2^{DD} &= \frac{\mu\epsilon_2}{\mu + \phi(1 + \lambda)} + \frac{\mu\lambda\phi(\epsilon_2 - \epsilon_1)}{2(\mu + \phi)(\mu + \phi + \lambda\phi)} - \frac{\mu v_2}{\mu + \phi} \\ l_1^{DD} &= \frac{\phi\epsilon_1}{\mu + \phi(1 + \lambda)} + \frac{\lambda\phi^2(\epsilon_1 - \epsilon_2)}{2(\mu + \phi)(\mu + \phi + \lambda\phi)} - \frac{\phi v_1}{\mu + \phi} \\ l_2^{DD} &= -\frac{\phi v_2}{\mu + \phi} + \frac{\phi\epsilon_2}{\mu + \phi(1 + \lambda)} + \frac{\lambda\phi^2(\epsilon_2 - \epsilon_1)}{2(\mu + \phi)(\mu + \phi + \lambda\phi)} \end{aligned}$$

and, assuming that the weight given to each country i in the decision process is the same and not chosen proportional to the size or the population of each country, the union-wide aggregate level of employment is given as

$$l^{DD} = \left(\frac{\phi}{\mu + \phi(1 + \lambda)} \right) \epsilon - \left(\frac{\phi}{\mu + \phi} \right) v \quad (20)$$

3.1.3 *Centralised wage-setting*

In a second labour market regime, we assume that in both countries a single centralized union determine the nominal wage at the begining of each period aiming for full employment by preserving the real wages growth in line with productivity as is set out in the objective function (7) and the reaction function (8). The optimal

solutions under monetary and fiscal policy discretion and decentralized fiscal policies with centralised wage setting (denoted by DC) are given by :

$$\pi^{DC} = \left(\frac{\lambda\phi}{\mu + \phi(1 + \delta)} \right) v - \left(\frac{\lambda\phi}{\mu + \phi(1 + \lambda)} \right) \epsilon \quad (21)$$

$$\tau_1^{DC} = \frac{\mu\epsilon_1}{\mu + \phi(1 + \lambda)} + \frac{\mu\lambda\phi(\epsilon_1 - \epsilon_2)}{2(\mu + \phi)(\mu + \phi + \lambda\phi)} - \frac{\mu v}{\mu + \phi(1 + \delta)}$$

$$\tau_2^{DC} = \frac{\mu\epsilon_2}{\mu + \phi(1 + \lambda)} + \frac{\mu\lambda\phi(\epsilon_2 - \epsilon_1)}{2(\mu + \phi)(\mu + \phi + \lambda\phi)} - \frac{\mu v}{\mu + \phi(1 + \delta)}$$

Therefore, the optimal solutions for the national employment are given by

$$l_1^{DC} = \frac{\phi\epsilon_1}{\mu + \phi(1 + \lambda)} + \frac{\lambda\phi^2(\epsilon_1 - \epsilon_2)}{2(\mu + \phi)(\mu + \phi + \lambda\phi)} - \frac{\phi v}{\mu + \phi(1 + \delta)}$$

$$l_2^{DC} = \frac{\phi\epsilon_2}{\mu + \phi(1 + \lambda)} + \frac{\lambda\phi^2(\epsilon_2 - \epsilon_1)}{2(\mu + \phi)(\mu + \phi + \lambda\phi)} - \frac{\phi v}{\mu + \phi(1 + \delta)}$$

and the union-wide level of employment is given as :

$$l^{DC} = \left(\frac{\phi}{\mu + \phi(1 + \lambda)} \right) \epsilon - \left(\frac{\phi}{\mu + \phi(1 + \delta)} \right) v \quad (22)$$

3.2 Cooperative fiscal policy

Turn next to consider the combination or policy-mix of the common monetary policy and cooperative fiscal policies decisions and centralised in the hands of a common fiscal authority where the members are country representatives.

3.2.1 Optimal policy mix

We present the results of the strategic interactions between monetary and fiscal policy. Common Central Bank sets the union-wide inflation rate to minimize their loss function (9) and the national representatives in the common fiscal committee choose the union-wide tax rate τ minimizing the sum of national loss functions(10). In this institutional setting, we take the time-consistent optimal solutions under discretion. From the first order conditions for π and τ in the problems (9) and (10), we obtain the following reaction functions:

$$\pi = \frac{\lambda}{1 + \lambda} (\tau + w - \epsilon)$$

$$\tau = \frac{\mu}{\mu + \phi} (\pi - w + \epsilon)$$

Solving the system of the preceding equations, we have :

$$\pi = \left(\frac{\lambda\phi}{\mu + \phi(1 + \lambda)} \right) (w - \epsilon) \quad (23)$$

$$\tau = \left(\frac{\mu}{\mu + \phi(1 + \lambda)} \right) (\epsilon - w) \quad (24)$$

3.2.2 Decentralised wage-setting

Assuming atomistic nominal wage bargaining in the two countries of the monetary union and a monetary policy decided according to a "union rule" and fiscal policy by a committee of country representatives, we obtain the following time-consistent solutions under monetary and fiscal discretion and centralized fiscal policies with decentralised wage setting (denoted by CD) :

$$\pi^{CD} = \left(\frac{\lambda\phi}{\mu + \phi} \right) v - \left(\frac{\lambda\phi}{\mu + \phi(1 + \lambda)} \right) \epsilon \quad (25)$$

$$\tau^{CD} = \left(\frac{\mu}{\mu + \phi(1 + \lambda)} \right) \epsilon - \left(\frac{\mu}{\mu + \phi} \right) v \quad (26)$$

$$l_1^{CD} = \frac{\mu v_2}{2(\mu + \phi)} + \frac{\phi \epsilon_1}{\mu + \phi(1 + \lambda)} + \frac{(\mu + \lambda\phi)(\epsilon_1 - \epsilon_2)}{2(\mu + \phi + \lambda\phi)} - \frac{(2\phi + \mu) v_1}{2(\mu + \phi)}$$

$$l_2^{CD} = \frac{\mu v_1}{2(\mu + \phi)} + \frac{\phi \epsilon_2}{\mu + \phi(1 + \lambda)} + \frac{(\mu + \lambda\phi)(\epsilon_2 - \epsilon_1)}{2(\mu + \phi + \lambda\phi)} - \frac{(2\phi + \mu) v_2}{2(\mu + \phi)}$$

and the union-wide aggregate level of employment is given as

$$l^{CD} = - \left(\frac{\phi}{\mu + \phi} \right) v + \left(\frac{\phi}{\mu + \phi(1 + \lambda)} \right) \epsilon \quad (27)$$

3.2.3 Centralised wage-setting

Finally, we will assume that both countries in the monetary union experience centralized or cooperative fiscal policies in the presence of centralised wages bargaining (denoted by CC). We obtain :

$$\pi^{CC} = \left(\frac{\lambda\phi}{\mu + \phi(1 + \delta)} \right) v - \left(\frac{\lambda\phi}{\mu + \phi(1 + \lambda)} \right) \epsilon \quad (28)$$

$$\tau^{CC} = \left(\frac{\mu}{\mu + \phi(1 + \lambda)} \right) \epsilon - \left(\frac{\mu}{\mu + \phi(1 + \delta)} \right) v$$

$$l_1^{CC} = \frac{\phi \epsilon_1}{\mu + \phi(1 + \lambda)} + \frac{(\mu + \lambda\phi)(\epsilon_1 - \epsilon_2)}{2(\mu + \phi + \lambda\phi)} - \frac{\phi v}{\mu + \phi(1 + \delta)}$$

$$l_2^{CC} = \frac{\phi\epsilon_2}{\mu + \phi(1 + \lambda)} + \frac{(\mu + \lambda\phi)(\epsilon_2 - \epsilon_1)}{2(\mu + \phi + \lambda\phi)} - \frac{\phi v}{\mu + \phi(1 + \delta)}$$

and the union-wide aggregate level of employment is given as

$$l^{CC} = \left(\frac{\phi}{\mu + \phi(1 + \lambda)} \right) \epsilon - \left(\frac{\phi}{\mu + \phi(1 + \delta)} \right) v \quad (29)$$

The question arising here is which is the appropriate policy regime in the monetary union between the four previous alternative decision policy rules.

4 Comparison of the policy regimes

The ultimate judgement of the previous alternative policy decision rules should be how they affect welfare and stabilisation, which are respectively measured by the loss function for the representative agent in the monetary union and the variance of the employment and inflation in each country.

4.1 Welfare implications

In this section, we analyse qualitatively welfare implications assuming that monetary union is populated by a continuum of individual agents. All agents within monetary union are assumed to be identical and share preferences that depend on employment level l and inflation rate π . Welfare is represented by the loss function of the union's representative agent as

$$L = (1/2) (\pi^2 + \gamma l^2), \quad \gamma > 0 \quad (30)$$

We assume that the preferences concerning inflation stability versus output stability is captured by the parameter $\gamma \geq 0$, which is assumed to be identical in both countries. The expected value $E(L)$ of (30) will be used to evaluate the welfare implications of the four alternative decision-making regimes in this monetary union. Using equations (19) and (20) in the loss function (30), the expected loss under independent fiscal policies and decentralised wage setting (DD) follows immediately:

$$E(L^{DD}) = \frac{\phi^2(\gamma + \lambda^2)}{2} \left[\frac{v^2}{(\mu + \phi)^2} + \frac{2(1 + \rho)}{(\mu + \phi + \lambda\phi)^2} \sigma_\epsilon^2 \right] \quad (31)$$

Using now equations (21) and (22) in the loss function (30), the expected loss under non-cooperative national fiscal policies and centralised wage setting (DC) is given by

$$E(L^{DC}) = \frac{1}{2} \phi^2(\gamma + \lambda^2) \left\{ \left[\frac{v}{\mu + \phi(1 + \delta)} \right]^2 + \left[\frac{1}{2(\mu + \phi + \lambda\phi)} \right]^2 2(1 + \rho) \sigma_\epsilon^2 \right\} \quad (32)$$

Comparing then the expected losses reported in equations (31) and (32), we can establish the first proposition about the welfare implications of the alternative policy decision rules.

Proposition 1 *The expect loss in the presence of decentralised fiscal policies and centralised wage bargaining is smaller than with a decentralised fiscal policies and decentralised wage bargaining.*

$$E(L^{DD}) > E(L^{DC})$$

Proof. Using equations (31) and (32), it is strainforward to find that :

$$E(L^{DD}) - E(L^{DC}) = (1/2)\phi^2(\gamma + \lambda^2) [1/(\mu + \phi)^2 - 1/(\mu + \varphi + \delta\phi)^2] v^2 \geq 0 \quad \blacksquare$$

Turn next to consider the expected loss under centralised or cooperative fiscal policies and decentralised wage setting. Thus, using equations (25) and (27) in the loss function (30), the expected loss (denoted by CD) is given by

$$E(L^{CD}) = \frac{1}{2}\phi^2(\gamma + \lambda^2) \left\{ \left(\frac{v}{\mu + \phi} \right)^2 + \left(\frac{1}{\mu + \phi + \lambda\phi} \right)^2 2(1 + \rho) \sigma_\epsilon^2 \right\} \quad (33)$$

Finally, using equations (28) and (29) in the loss function (30), the expected society's welfare loss in the case of centralised fiscal policies with centralised wage setting (CC) is given by

$$E(L^{CC}) = \frac{1}{2}\phi^2(\gamma + \lambda^2) \left\{ \left[\frac{v}{\mu + \phi(1 + \delta)} \right]^2 + \left[\frac{1}{2(\mu + \phi + \lambda\phi)} \right]^2 2(1 + \rho) \sigma_\epsilon^2 \right\} \quad (34)$$

Comparing then the the results in terms of expected losses reported in equations (31) and (32), we can establish a second proposition concerning the welfare implications of the alternative policy decision rules.

Proposition 2 *The expect loss in the prensence of centralised fiscal policies and centralised wage bargaining is smaller than with centralised fiscal policies and decentralised wage setting.*

$$E(L^{CD}) > E(L^{CC})$$

Proof. Using equations (33) and (33), it is strainforward to find that :

$$E(L^{CD}) - E(L^{CC}) = (1/2)\phi^2(\gamma + \lambda^2) [1/(\mu + \phi)^2 - 1/(\mu + \varphi + \delta\phi)^2] v^2 > 0 \quad \blacksquare$$

The intuition behind these two propositions concerning the welfare implications of the alternative policy regimes, is that the expected society's welfare loss is always smaller in the case of centralised wage setting, $E(L^{DC})$ and $E(L^{CC})$, for the both fiscal policy regimes (non-cooperative and cooperative fiscal policy rule).

4.2 Stabilization implications

In this section, we analyse the stabilisation implications the variance of the employment and inflation in each country. In this respect, we focus our analysis on the variability of inflation and output in the following two extreme special cases: the case of perfect asymmetry in the national shocks (i.e. $\rho = -1$), and the case of perfect symmetry in the national shocks (i.e. $\rho = 1$).

4.2.1 *Symmetric shocks*

Consider first the case in which monetary union countries are affected by perfectly symmetric shocks ($\rho = 1$). Using the results reported in Appendix A, we can establish the following proposition:

Proposition 3 *When shocks hitting both monetary union countries are symmetrical ($\rho = 1$), we can not conclude which of the two fiscal regimes will stabilise better employment.*

Proof. Using the inflation and employment variances reported in Appendix A, it is straightforward to find that:

$$\text{Var}(\pi^{CC/CD}) - \text{Var}(\pi^{DC/DD}) = 0, \text{Var}(l_i^{CC/CD}) - \text{Var}(l_i^{DC/DD}) = 0$$

Using the assumption ($\rho = 1$), we obtain :

$$\text{Var}(\pi^{CC/CD}) = \text{Var}(\pi^{DC/DD}) = \frac{\lambda^2 \phi^2}{2(\mu + \phi + \lambda\phi)^2} \sigma_\epsilon^2$$

Therefore, we find that : $\text{Var}(\pi^{CC/CD}) - \text{Var}(\pi^{DC/DD}) = 0$.

Using then, the assumption ($\rho = 1$), we obtain :

$$\text{Var}(l_i^{CC/CD}) = \text{Var}(l_i^{DC/DD}) = \frac{\phi^2}{(\mu + \phi + \lambda\phi)^2} \sigma_\epsilon^2$$

Accordingly, we find that : $\text{Var}(l_i^{CC/CD}) - \text{Var}(l_i^{DC/DD}) = 0$

where $\text{Var}(l_i^{CC/CD})$ indicates the variance of the output in the presence of centralised fiscal policies with centralised (CC) or decentralised (CD) wage bargaining. Similarly, $\text{Var}(l_i^{DC/DD})$ denotes the variance of the output in country i in the case of decentralised fiscal policy with centralised (DC) or decentralised (DD) wage bargaining.

consequently, in consequence, , so,

4.2.2 Asymmetric shocks

Consider now the case in which individual countries are affected by perfectly asymmetric shocks ($\rho = -1$). The comparison of the results obtained in appendix A helps us to establish our last proposition.

Proposition 4 *When shocks are asymmetrical ($\rho = -1$), decentralised fiscal policies with centralised or decentralised wage bargaining stabilise better employment in both countries than centralised fiscal policies with decentralised or centralised wage bargaining.*

Proof. Using the inflation and employment variances reported in Appendix A, it is straightforward to find that:

$$\text{Var}(\pi^{CC/CD}) = \text{Var}(\pi^{DC/DD}) = 0, \quad \text{Var}(l_i^{CC/CD}) > \text{Var}(l_i^{DC/DD})$$

Using the assumption ($\rho = -1$), we obtain :

$$\text{Var}(\pi^{DC/DD}) = 0 \quad \text{and} \quad \text{Var}(\pi^{CC/CD}) = 0$$

Therefore, we find that : $\text{Var}(\pi^{CC/CD}) - \text{Var}(\pi^{DC/DD}) = 0$.

Using then, the assumption ($\rho = -1$), we obtain :

$$\text{Var}(l_i^{DC/DD}) = \frac{(\phi(\mu + \phi) + \lambda\phi^2)^2}{(\mu + \phi)^2(\mu + \phi + \lambda\phi)^2} \sigma_\epsilon^2 \leq \sigma_\epsilon^2$$

$$\text{Var}(l_i^{CC/CD}) = \frac{4(\mu + \phi + \lambda\phi)^2 + 2(\mu + \lambda\phi)(\mu + \lambda\phi + 2\phi)}{4(\mu + \phi + \lambda\phi)^2} \sigma_\epsilon^2 \geq \sigma_\epsilon^2$$

Consequently, we find that : $\text{Var}(l_i^{CC/CD}) - \text{Var}(l_i^{DC/DD}) =$

$$\begin{aligned} & [4(\mu + \phi + \lambda\phi)^2 + 2(\mu + \lambda\phi)(\mu + \lambda\phi + 2\phi)] \sigma_\epsilon^2 / 4(\mu + \phi + \lambda\phi)^2 \\ & - [(\phi(\mu + \phi) + \lambda\phi^2)^2] \sigma_\epsilon^2 / (\mu + \phi)^2(\mu + \phi + \lambda\phi)^2 > 0 \quad \blacksquare \end{aligned}$$

We demonstrate in the appendix A that the variance of output under a centralised fiscal policy is always bigger than the variance of the supply shocks. At the same time, we show that the variance of output under a decentralised fiscal policy is smaller than the variance of the shocks and in this respect decentralised fiscal policy stabilise better employment. The comparison of these results indicates that, in the case of perfectly asymmetric shocks in a monetary union, the regime where a common monetary authority constituting by union-wide governors exist in the presence of decentralised national fiscal policies with decentralised or centralised wage

bargaining is the appropriate institutional design. By taking into account the results of the previous section we come to the conclusion that delegate the fiscal policy, in a monetary union, to a council of country representatives with centralised wage bargaining in union-members labor markets is the appropriate institutional design that would stabilize better the regional idiosyncratic supply shocks in a monetary union.

5 Conclusion

In this paper, we examine the policy and wealth consequences of alternative fiscal policy and labor market institutional arrangements through which national fiscal policies interact with the common monetary policy in a monetary union, such as the European Monetary Union (EMU). The central issue of the paper is the design of the appropriate fiscal policy institutions by comparing alternative arrangements to distribute the power over fiscal authorities between the center of the union and the individual members of the union and evaluating their performance. To do so we develop a model of a two-country monetary union functioning in an asymmetric environment, where fiscal policies are alternatively decentralised and centralised, and labor markets are characterised by decentralised and centralised wage bargainings. Thus, we analyse the fiscal policy making in an environment like the Euroland one, which is characterised by the existence of nation-states with their own idiosyncrasies, and policy-makers who may take decisions jointly but also keep the interests of their countries. The main result of this paper reveal that, delegate the fiscal policy in a monetary union to a council of country representatives with centralised wage bargaining in union-members labor markets is the appropriate institutional design that would stabilize better the regional idiosyncratic supply shocks in a monetary union.

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Appendix

A The calculus of variances

(i) Using π^{DD} and l_i^{DD} (with $i = 1, 2$), we obtain respectively the following variances of inflation rate $\text{Var}(\pi^{DD})$ and employment level $\text{Var}(l_i^{DD})$ for the case of the first policy regime (i.e., independnet fiscal policies with decentralised wage setting) :

$$\text{Var}(\pi^{DD}) = \frac{1}{2} \frac{\lambda^2 \phi^2}{(\mu + \phi + \lambda \phi)^2} (1 + \rho) \sigma_\epsilon^2 \quad (35)$$

$$\text{Var}(l_i^{DD}) = \frac{(\lambda \phi^2)^2 + \left[1 - \frac{2\lambda \phi^2}{2\phi(\mu + \phi) + \lambda \phi^2} \rho\right] [2\phi(\mu + \phi) + \lambda \phi^2]^2}{4(\mu + \phi)^2 (\mu + \phi + \lambda \phi)^2} \sigma_\epsilon^2 \quad (36)$$

where ρ denotes the correlation coefficient of the national idiosyncratic shocks. We obtain these results under the assumption that $\sigma_{\epsilon_1}^2 = \sigma_{\epsilon_2}^2 = \sigma_\epsilon^2$. A possible justification of this assumption is that the two countries in the monetary union are assumed of equal size.¹

(ii) Using then π^{DC} and l_i^{DC} , we obtain respectively the following variances of inflation rate $\text{Var}(\pi^{DC})$ and employment level $\text{Var}(l_i^{DC})$ for the case of the second policy regime (i.e., independnet fiscal policies with centralised wage setting) :

$$\text{Var}(\pi^{DC}) = \frac{1}{2} \frac{\lambda^2 \phi^2}{(\mu + \phi + \lambda \phi)^2} (1 + \rho) \sigma_\epsilon^2 \quad (37)$$

$$\text{Var}(l_i^{DC}) = \frac{(\lambda \phi^2)^2 + \left[1 - \frac{2\lambda \phi^2}{2\phi(\mu + \phi) + \lambda \phi^2} \rho\right] [2\phi(\mu + \phi) + \lambda \phi^2]^2}{4(\mu + \phi)^2 (\mu + \phi + \lambda \phi)^2} \sigma_\epsilon^2 \quad (38)$$

(iii) Using π^{CD} and l_i^{CD} , we obtain respectively the following variances of inflation rate $\text{Var}(\pi^{CD})$ and employment level $\text{Var}(l_i^{CD})$ for the case of the third policy regime (i.e., centralised fiscal policies with decentralised wage setting) :

$$\text{Var}(\pi^{CD}) = \frac{\lambda^2 \phi^2}{2(\mu + \phi + \lambda \phi)^2} (1 + \rho) \sigma_\epsilon^2 \quad (39)$$

$$\text{Var}(l_i^{CD}) = \frac{(\mu + \lambda \phi)^2 + \left[1 - \frac{2(\mu + \lambda \phi)}{\mu + 2\phi + \lambda \phi} \rho\right] (\mu + 2\phi + \lambda \phi)^2}{4(\mu + \phi + \lambda \phi)^2} \sigma_\epsilon^2 \quad (40)$$

¹From the solution $\text{Var}(\pi) = \left[\frac{\lambda \phi}{2(\mu + \phi + \lambda \phi)}\right]^2 [\sigma_{\epsilon_1}^2 + \sigma_{\epsilon_2}^2 + 2\text{cov}(\epsilon_1, \epsilon_2)]$ and using the equality, $\text{cov}(\epsilon_1, \epsilon_2) = \rho \sqrt{\sigma_{\epsilon_1}^2 \cdot \sigma_{\epsilon_2}^2}$, we obtain : $\text{Var}(\pi) = \frac{1}{2} \left(\frac{\lambda \phi}{\mu + \phi + \lambda \phi}\right)^2 (1 + \rho) \sigma_\epsilon^2$.

(iv) Finally, using π^{CC} and l_i^{CC} , we obtain respectively the variances of inflation rate $\text{Var}(\pi^{CC})$ and employment level $\text{Var}(l_i^{CC})$ for the case of the fourth policy regime (i.e., centralised fiscal policies with centralised wage setting) :

$$\text{Var} (\pi^{CC}) = \frac{\lambda^2 \phi^2}{2(\mu + \phi + \lambda\phi)^2} (1 + \rho) \sigma_\epsilon^2 \quad (41)$$

$$\text{Var} (l_i^{CC}) = \frac{(\mu + \lambda\phi)^2 + \left[1 - \frac{2(\mu + \lambda\phi)}{\mu + 2\phi + \lambda\phi} \rho\right] (\mu + 2\phi + \lambda\phi)^2}{4(\mu + \phi + \lambda\phi)^2} \sigma_\epsilon^2 \quad (42)$$

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