

Wage and Public Expenditure Setting in a Monetary Union[#]

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Abstract: European countries have progressively integrated from the point of view of trade and investment and have a common currency now. By contrast, labour market and fiscal institutions have largely retained their national status. The aim of this paper is threefold. First, the effects of trade union international cooperation to internalise external effects stemming from wage setting at a national level are examined. Second, the paper investigates the likelihood for governments of internalising macroeconomic spillovers deriving from national-oriented public expenditure. Third, the interactions between fiscal and monetary authorities are considered.

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Introduction

European countries have progressively integrated from the perspective of trade and investment and have a common currency now. On the contrary, labour market and fiscal institutions have largely retained their national status, but changes are on the way. On the one side, European unions have committed themselves to the aim of achieving increased employment and purchasing power through cross-border coordination of bargaining policy (see, e.g., the Doorn declaration of September 1998). On the other side, for the first time the Lisbon European Council of March 2000 has indicated common targets in terms of growth and employment. European employment target raises the question of a possible conflict with the pre-eminent objective of the European Central Bank, i.e., the price stability, since fiscal authorities must respect the Growth and Stability Pact. In an integrated monetary union with

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positive international expenditure externalities, however, limits to budget deficit can be satisfied at different levels of public expenditure in the member countries according to whether fiscal policy is coordinated or not.

In more general terms there are a number of policy questions that involve interactions between the different institutions operating in a monetary union such as the European Monetary Union. Among them there are the following ones:

- a) the possibility for trade unions of internalising external effects stemming from wage setting in a national context;
- b) the possibility for governments of internalising macroeconomic spillovers deriving from public expenditure at a national level;
- c) the interactions between fiscal and monetary authorities.

Question under a) are related to the positive and negative effects of various levels of centralised wage-bargaining, from complete decentralisation to complete centralisation. These have been the object of an extensive literature at least since Bruno and Sachs (1985) and Tarantelli (1986),¹ but mainly in a closed-economy setting. Calmfors and Driffill (1988) and others underline the effects of the wage-bargaining centralisation degree.² According to Calmfors and Driffill, there is wage restraint in economies with an extreme degree of decentralisation or centralisation. Complete decentralisation (wage bargaining at the firm level) would ensure a nominal wage restraint and a higher employment level through the effects of competition between unions. The foundation of cooperative wage determination or complete centralization, i.e. wage bargaining at the level of the whole national area, derives from the possibility to internalise the effects of wage setting at the level of each single region, industry or firm on the consumer price index of all the regions, industries or firms of the national economy. This would have the same result as complete decentralisation on wages and employment.

External effects of wage setting at a national level have the same foundation as those stemming from bargaining at a lower (sub-national) level. In wage setting at a national level perception of the inflationary consequences for a wider than national area is limited and unions tend to be aggressive, since they can beggar-their-neighbour. This is a powerful argument in favour of international wage cooperation. It is important to note, however, that international cooperation between unions – as distinct from their cooperation at a national level – introduces a new dimension. Unions no longer face, as they do in a national context, a single policymaker (the government) or a couple of policymakers (the government and the central bank). In fact, there is a multiplicity of policymakers: at least two governments and one or more central banks. This complicates the picture and can

lead to different outcomes. Zervoyianni (1997) considers a two-country model with unions and governments and shows that:

- i) union cooperation still improves welfare;
- ii) cooperation between the unions and the individual country governments may fail to produce Pareto improvements. In this paper we intend to enlarge the number of policymakers involved to include both governments and the central bank.³

Question under b) has been extensively examined in the economic literature on the advantages of international cooperation, but less so in a monetary union context, where cooperating national governments face a single monetary authority. Fiscal policy cooperation may be founded on the existence of negative or positive spillovers. If there are negative spillovers coordination leads to a reduction in government expenditure, whereas positive spillovers imply increased government expenditure in the coordinated case, if there is nominal inertia (see Mundell, 1968; Hamada, 1985; Svensson, 1987; van der Ploeg, 1993).

In a game theoretical framework, Dixon and Santoni (1997) have shown that positive spillovers from government expenditure arise in a monetary union with unemployment, a fixed money supply and unionised labour markets. One of the purposes of this paper is to analyse whether the outcome is similar to Dixon and Santoni's in a setting with an active central bank and the possibility of centralized wage setting, which adds questions a) and c) to question b). In our analysis a simple model, inspired to Gylfason and Lindbeck (1986), is bent to the specificities of a monetary union where the central bank sets the nominal interest rate directly.

The model

Three types of agents (firms, unions, and fiscal authorities) operate in two symmetric countries and a single central bank operating for the whole integrated area, which is a closed with respect to the rest of the world. Perfect mobility of financial capital⁴ implies that the interest rate is the same in both countries. Each country is specialized in the production of one good (or one basket of goods). Goods are imperfect substitutes. There is perfect competition between firms within each country, but imperfect competition as between firms operating in the two countries.

In each country, national firms maximise profits by the demand for labour and national monopoly unions set wages (if they do not act cooperatively) or for the whole area (if they cooperate). Governments set the balanced budget level of public expenditure in each area in a cooperative or non-cooperative way. Wages, budget levels and the interest rate are set simultaneously.

Our baseline framework is an IS-AS model. The model consists of two equations for each country. All variables are in logs.⁵

$$n_i = -\sigma (r - \pi^e_i) + \alpha g_i + \beta g_j - \tau (p_i - p_j) \quad (1)$$

$$n_i = (p_i - w_i) \quad (2)$$

$$n_j = -\sigma (r - \pi^e_j) + \alpha g_j + \beta g_i - \tau (p_j - p_i) \quad (3)$$

$$n_j = (p_j - w_j) \quad (4)$$

$$v_i = (1-h)p_i + hp_j \quad (5)$$

$$v_j = (1-h)p_j + hp_i \quad (6)$$

where i and j denote the two countries, n is employment; p is the price of the composite commodity, g is public expenditure, w is the wage rate, π^e is the expected inflation rate, v is the consumer price index, or CPI. The expected rate of inflation is reasonably defined as $E_{t-1} v_t - v_{t-1}$ (see Preston, Pagan, 1982, p.296). Furthermore, perfect foresight and an initial price parametrically set equal to zero are assumed. Hence $E_{t-1} v_t = v_t$ and $\pi^e = v_t$ hold. Since our model is deterministic, the assumption of perfect foresight is equivalent to that of rational expectations.⁶

Equations (1) and (2) represent IS and AS in country i ; equations (3) and (4) are IS and AS in country j . Following recent literature, we take the nominal interest rate as the instrument of monetary policy, as opposed to a monetary supply aggregate. This dispenses us with specifying a money market equilibrium condition (i.e., an LM curve; see Walsh, 1998, p.214).

Demand is decreasing in the real interest rate (as an effect of the saving-investment behaviour by the private sector) and the product prices differential (competitiveness effects on foreign trade). It increases in home public expenditure and foreign public expenditure (exports). The latter is a shortcut, with no loss of generality, to spillovers from country j to country i taking place through country j 's imports. Equation (2) is a standard supply representation for profit-maximising firms.

Equations (5) and (6) define consumer price indexes. CPIs are weighted averages of prices of domestic and foreign goods. h is a function of the degree of openness. As customary, we assume $h < 1/2$.

Solving the previous system of equations, we obtain the reduced form of the model:

$$n_i = -A_0 r + E_1 g_i + E_2 g_j - (1-A_1) w_i + A_2 w_j \quad (7)$$

$$v_i = -A_0 r + D_1 g_i + D_2 g_j + B_1 w_i + B_2 w_j \quad (8)$$

$$n_j = -A_0 r + E_2 g_i + E_1 g_j + A_2 w_i - (1-A_1) w_j \quad (9)$$

$$v_j = -A_0 r + D_2 g_i + D_1 g_j + B_2 w_i + B_1 w_j \quad (10)$$

Where:

$$A_0 = \sigma / (1 - \sigma);$$

$$A_1 = (1 - \sigma + \tau + h\sigma) / ((1 - \sigma)(1 - \sigma + 2\tau + 2h\sigma)) > A_2 = (\tau + h\sigma) / ((1 - \sigma)(1 - \sigma + 2\tau + 2h\sigma)); A_1 > B_1 = (1 - h)A_1 + hA_2 > B_2 = hA_1 + (1 - h)A_2 > 0; E_1 = (\alpha A_1 + \beta A_2) > E_2 = (\alpha A_2 + \beta A_1); D_1 = (1 - h)E_1 + hE_2 > D_2 = hE_1 + (1 - h)E_2 > 0.$$

Parameters: A_0, A_1, A_2 , are the elasticities of the domestic price with respect to the nominal interest rate, nominal domestic wage, and nominal foreign wage, respectively. Therefore, $(1 + A_0)$, $(1 - A_1)$ and $(1 - A_2)$ are the elasticities of the real interest rate, the real domestic wage, the real foreign wage rate with respect to the nominal interest rate, the nominal domestic wage and the nominal foreign wage, respectively.

All the above elasticities are the reduced form elasticities. Therefore, elasticities include direct and *feedback* effects of each control variable on output and the CPI (i.e., an increase in public expenditure affects output not only directly, but also indirectly, since it implies a reduction in the domestic production price, the real wage and the real interest rate – E_I summarizes all these effects). The elasticity of investment to the nominal interest rate increases in σ , but when σ tends to one the elasticity tends to be infinite. When $\sigma = 0$ ($\sigma = 1$), investment is inelastic (infinitely elastic) to the nominal interest rate. When $\sigma > 1$, setting higher nominal interest rates raises employment and reduces prices. Hence, in this paper, $\sigma \in (0, 1)$ is reasonably assumed.

We also assume, as usual, $\eta_v = (1 - B_1)$ and $\eta_p = (1 - A_1)$ to be positive. The former is the elasticity of the real wage to the nominal wage (when the real wage is calculated on the basis of the CPI). The latter is the elasticity of the real wage (and employment, since equations (2) and (4) hold) to the nominal wage (when the real wage is calculated on the basis of production prices). According to our assumption, unions raise real wages by rising nominal wages at the cost of a lower employment level.⁷

The reader should also note that government expenditure of each country has positive (negative) spillovers on the employment (price) level of the other country. We consider a simultaneous policy game between the central bank, national governments and national unions.⁸ These players maximise the following utility functions:

$$V = -\frac{1}{2}(v_i + v_j)^2 + s(n_i + n_j) \quad (11)$$

$$G_k = -\frac{1}{2}(n_k - n_k^g)^2 - t_k v_k \quad k = \{i, j\} \quad (12)$$

$$U_k = -\frac{1}{2}(w_k - v_k - w_k^u)^2 + q_k n_k \quad k = \{i, j\} \quad (13)$$

where V is the utility function of the central bank, G_k and U_k are those of the government and the union of the k country, respectively; n_k^g and w_k^u are government k 's and union k 's bliss points, respectively.

Linear quadratic specifications are used to represent the policymakers' preferences to depict a situation where there are three types of institutions, unions, governments and a central bank, each caring for a different target in a pre-eminent way. We admit a multiplicity of objectives for each type, but we consider as more interesting (and realistic, with reference to the European context) the case where the relevance of different targets for each institution is not the same, which, translated into analytic terms, implies using a quadratic form for the primary objective and a linear form for the secondary one.⁹ In any case the symmetry of the semi-linear form in the preference functions of the central bank and the governments tends to stress the difference in the pre-eminent objective of the two institutions.

The central bank's preference function, linear in employment and quadratic in the price level, emphasises the weight often put on inflation by this institution (as it is in the case of the European Central Bank). Priority given to employment by governments justifies a preference function quadratic in employment (and linear in inflation) and is consistent with a situation, like the one emerging in the past months in Europe, after the Lisbon meeting.

The specification of unions' preference function, linear in employment and quadratic in the real wage, similarly emphasises the weight associated with the latter variable by this institution in European labour markets; there is no apparent need to include inflation (or the price level) as an additional argument, as some authors (see Gylfason and Lindbeck, 1994) would suggest – in order to take account of effects that would occur in a realistic open economy (when a closed economy is actually modelled) – since we have considered two integrated countries: any negative consequence on employment resulting from a too aggressive wage policy is built in the working of an open economy such as the one depicted in our structural model.¹⁰

Non-cooperative solutions

Nash non-cooperative solutions are obtained by solving the system of equations derived from agents' maximisation problems. Each player maximises its preference function (equation (11) or equation (12) or equation (13)) with respect to its control variable, i.e. the nominal interest rate for the central bank, the nominal wage rate in each country for each union and the public expenditure in each country for each government.

Solving the central bank problem yields the following first order condition:

$$2\sigma r - (\alpha + \beta)(g_i + g_j) + w_i + w_j + \frac{s}{1-\sigma} = 0 \quad (14)$$

The solutions of the unions' problems in the two countries yield the following first order conditions:

$$A_0 r - (\alpha B_1 + \beta B_2)g_i - (\alpha B_2 + \beta B_1)g_j + \eta_v w_i - B_2 w_j - w_i^u + \frac{\eta_p}{\eta_n} q_i = 0 \quad (15)$$

$$A_0 r - (\alpha B_1 + \beta B_2)g_j - (\alpha B_2 + \beta B_1)g_i + \eta_v w_j - B_2 w_i - w_j^u + \frac{\eta_p}{\eta_n} q_j = 0 \quad (16)$$

The solutions of the governments' problems yield the following first order conditions:

$$A_0 r - E_1 g_i - E_2 g_j + \eta_p w_i - A_2 w_j + n_i^g - \frac{\alpha B_1 + \beta B_2}{E_1} t_i = 0 \quad (17)$$

$$A_0 r - E_1 g_j - E_2 g_i + \eta_p w_j - A_2 w_i + n_j^g - \frac{\alpha B_1 + \beta B_2}{E_1} t_j = 0 \quad (18)$$

Solving the equation system formed by equations (14), (15), (16), (17), and (18), we obtain the following result:

$$n_i^{NC} = \frac{n_i^g - n_j^g}{2} - \frac{1}{2} \frac{\alpha B_1 + \beta B_2}{E_1} (t_i - t_j) - \frac{w_i^u + w_j^u}{2} + \frac{1}{2} \frac{\eta_p}{\eta_v} (q_i + q_j) \quad (19)$$

$$v_i^{NC} = \frac{(1-2h)}{4h} \left[n_i^g - n_j^g - \frac{\alpha B_1 + \beta B_2}{E_1} (t_i - t_j) + w_i^u - w_j^u - \frac{\eta_p}{\eta_v} (q_i - q_j) \right] + \frac{1}{2} s \quad (20)$$

$$(w - v)_i^{NC} = w_i^u - \frac{\eta_p}{\eta_v} q_i \quad (21)$$

Expressions similar to equations (19), (20) and (21) hold for country j .

According to equation (21), the union in i gets a real wage lower than its real wage target. Monetary policy is neutral (i.e., the employment level in the two countries does not depend on the weight assigned by the central bank to employment). By contrast, fiscal policy affects employment, unless the governments have the same preferences (i.e. $n_i^g = n_j^g$ and $t_i = t_j$).¹¹ Moreover, if the countries are fully symmetric ($w_i^u = w_j^u$ and $q_i = q_j$ also hold), the level of inflation, v , depends only on the central bank's preference and a standard inflation bias is present.

Each union tries to maximise its preference function by raising its nominal wage. In doing so it considers employment losses, but it does not take account of the negative externality on the other country's real wage. This turns out to be a sort of wage illusion, not because of the central bank's reaction, but as an effect of a similar choice – and illusion – on the side of the other country's union. The two unions are really

involved in a prisoner's dilemma game; they set a nominal wage which corresponds to a real wage higher than the (Pareto) efficient one.

Fiscal policy cooperation

The central bank's and unions' maximisation problems are the same as those analysed in the above section. Governments instead maximise the following common utility preference:

$$\Omega^{GC} = \frac{1}{2}G_i + \frac{1}{2}G_j \quad (22)$$

Solution of the governments' problems yields the following first order conditions:

$$\frac{(\alpha + \beta)}{1 - \sigma} r - (B_1^2 + B_2^2)g_i - 2B_1B_2g_j + (\eta_p B_1 - A_2 B_2)w_i - (A_2 B_1 - \eta_p B_2)w_j + B_1 n_i^g + B_2 n_j^g - D_1 t_i - D_2 t_j \quad (24)$$

$$\frac{(\alpha + \beta)}{1 - \sigma} r - (B_1^2 + B_2^2)g_j - 2B_1B_2g_i + (\eta_p B_1 - A_2 B_2)w_j - (A_2 B_1 - \eta_p B_2)w_i + B_1 n_j^g + B_2 n_i^g - D_1 t_j - D_2 t_i \quad (24)$$

We obtain the equilibrium values of employment and the CPIs by solving the equation system formed by equations (14), (15), (16), (23), and (24):

$$n_i^{GC} = \frac{n_i^g - n_j^g}{2} - \frac{1 - 2h}{2}(t_i - t_j) - \frac{w_i^u + w_j^u}{2} + \frac{\eta_p}{\eta_v}(q_i + q_j) \quad (25)$$

$$v_i^{GC} = \frac{(1 - 2h)}{4h} \left[n_i^g - n_j^g + (1 - 2h)(t_i - t_j) + w_i^u - w_j^u - \frac{\eta_p}{\eta_v}(q_i - q_j) \right] + \frac{1}{2s} \quad (26)$$

$$(w - v)_i^{GC} = w_i^u - \frac{\eta_p}{\eta_v} q_i \quad (27)$$

The values of gains from cooperation accruing to country i (in terms of the specific objectives and not of satisfaction) can be obtained by subtracting the values of non-cooperative solutions from the values of cooperative ones:

$$\Delta^{GC} n_i = \frac{h}{2} \frac{(\alpha + \beta)}{(1 - \sigma)E_1} (t_i - t_j) \quad (28)$$

$$\Delta_i v^{GC} = \frac{(1 - 2h)}{4} \frac{(\alpha + \beta)}{(1 - \sigma)E_1} (t_i - t_j) \quad (29)$$

$$\Delta^{GC} (w - v)_i = 0 \quad (30)$$

Similar expressions hold for country j .

Cooperation has an effect on employment and consumer prices only if governments have different objectives. In this case each government can exchange one objective for the other and (presumably) raise its satisfaction level. The government whose preference for price stability is higher can achieve a higher level of employment when it cooperates with the other government (since, in this case, it would share the latter's preferences, which are more employment-oriented), while the other government can achieve a lower level of inflation, through international cooperation.

The reason why coordination affects the outcomes of the game only if there is a difference on the weights put by the governments on price stability lies in the opposition of the pre-eminent objectives of the governments (employment) and the central bank (price stability): the latter reacts to a coordinated rise in government expenditure in the two countries, which results in higher levels not only of employment but also of prices in both countries. To preserve price stability the central bank raises the interest rate, thus completely *neutralising* the rise in employment and prices induced by the governments' action.

This can be seen if we express the levels of w_i and w_j as a function of r , g_i and g_j in the unions' first order conditions and substitute them into the reaction function of the central bank (14), we get

$$r = \frac{1}{2} \frac{(\alpha + \beta)}{\sigma} (g_i + g_j) + \frac{1}{2\sigma} (w_i'' + w_j'') - \frac{1}{2} \frac{\eta_p}{\eta_v} \frac{(q_i + q_j)}{1 - \sigma} - \frac{s}{2} \quad (31)$$

By differentiating this expression with respect to we obtain:

$$dr = \frac{1}{2} \frac{(\alpha + \beta)}{\sigma} dg \quad (32)$$

By totally differentiating equations (7) and (9), considering equation (32)¹² and assuming , we have . This means that the positive effect on employment of raising government expenditures is exactly compensated by the effect on the same variable of the rise in the interest rate operated by the central bank as a reaction to the higher level of government expenditures deriving from governments' cooperation.

Contrary to conclusions drawn by Dixon and Santoni (1997), positive spillovers from government expenditure no longer arise in a monetary union with an active central bank.¹³

Cooperation between unions

In this section we assume that unions act cooperatively by maximizing the following function:

$$\Omega^{UC} = \frac{1}{2}U_i + \frac{1}{2}U_j \quad (33)$$

The central bank and the governments behave as described by equations (14) and (17)-(18), respectively. First order conditions for country i and j are:

$$A_0^2 r + (D_1 \eta_k - D_2 B_2) g_j - (D_2 \eta_k + D_1 B_2) g_i - (\eta_k^2 + B_2^2) w_j - 2 \eta_k B_2 w_i + \eta_k w_j'' - B_2 w_i'' - \eta_p q_j - A_2 q_i = 0 \quad (34)$$

$$A_0^2 r + (D_1 \eta_k - D_2 B_2) g_j - (D_2 \eta_k + D_1 B_2) g_i - (\eta_k^2 + B_2^2) w_j - 2 \eta_k B_2 w_i + \eta_k w_j'' - B_2 w_i'' - \eta_p q_j - A_2 q_i = 0 \quad (35)$$

The equilibrium solutions in this case are obtained by solving the equation system given by equations (14), (17), (18), (34), and (35):

$$n_i^{UC} = \frac{n_i^g}{2} - \frac{1}{2} \frac{\alpha B_1 + \beta B_2}{\alpha A_1 + \beta A_2} (t_i - t_j) - \frac{w_i'' + w_j''}{2} + \frac{q_i + q_j}{2} \quad (36)$$

$$v_i^{UC} = \frac{1-2h}{4h} \left[n_i^g - n_j^g - \frac{\alpha B_1 + \beta B_2}{\alpha A_1 + \beta A_2} (t_i - t_j) + w_i'' - w_j'' - q_i + q_j \right] + \frac{s}{2} \quad (37)$$

$$(w - v)_i^{UC} = w_i'' - \frac{\eta_p + A_2}{\eta_v + A_2} q_i - \frac{B_2 - A_2}{\eta_v + A_2} (q_i + q_j) \quad (38)$$

Similar results can be obtained for country j .

The gains from cooperation accruing in terms of policy objectives can be obtained by subtracting the values of the non-cooperative solutions from those of cooperative ones:

$$\Delta^{UC} n_i = \frac{1}{2} \frac{A_1 - A_2}{\eta_v} (q_i + q_j) \quad (39)$$

$$\Delta^{UC} v_i = -\frac{1-2h}{4} \frac{A_1 - A_2}{\eta_v} (q_i - q_j) \quad (40)$$

$$\Delta^{UC} (w - v)_i = -h \left(\frac{A_1 - A_2}{\eta_v + B_2} \right) \left(\frac{B_2}{\eta_v} q_i + q_j \right) \quad (41)$$

Since $A_1 - A_2 > 0$, employment is higher than in the non-cooperative case. Correspondingly, inflation is lower (higher) than in the non-cooperative case in the country whose union has a higher (lower) preference for employment, i.e., a higher (lower) q_k . In the case of symmetric trade unions ($q_i = q_j$) unions' cooperation has an unambiguous positive effect on social welfare in each country. This result is in line with the recent study of Coricelli *et al.* (2000), who find a positive effect of centralisation on economic social welfare when unions do not take account of inflation and firms act in a monopolistic competition market.¹⁴

The real wage differs from that in the non-cooperative case. Now each union considers the effects of its actions on the utility of its homologue. Therefore, the equilibrium real wage depends on the preferences of both unions. The real wage is always lower than in non-cooperative case.¹⁵

Simultaneous cooperation between unions and governments

In this section we analyse the solution that derives from the simultaneous cooperation of governments, on one side, and unions, on the other side. It can be obtained by solving the system of equations (14), (23), (24), (34), and (35):

$$n_i^{U/G} = \frac{(n_i^g - n_j^g)}{2} - \frac{1-2h}{2}(t_i - t_j) - \frac{w_i^s + w_j^s}{2} + \frac{q_i + q_j}{2} \quad (42)$$

$$v_i^{U/G} = \frac{1-2h}{4h} \left[n_i^g - n_j^g + (1-2h)(t_i - t_j) + w_i^s - w_j^s + \frac{\eta_p}{\eta_v}(q_i - q_j) \right] - \frac{s}{2} \quad (43)$$

$$(w - v)_i^{U/G} = w_i^u - \frac{\eta_p + A_2}{\eta_v + A_2} q_i - \frac{A_1 - A_2}{\eta_v + A_2} h(q_i + q_j) \quad (44)$$

Similar expressions hold for the other country.

Gains from cooperation between unions and, at the same time, between governments are as follows:

$$\Delta^{U/G} n_i = \frac{1}{2} \frac{A_1 - A_2}{\eta_v} (q_i + q_j) + \frac{h}{2} \frac{(\alpha + \beta)}{(1 - \sigma) E_1} (t_i - t_j) \quad (45)$$

$$\Delta^{UIG} v_i = -\frac{1-2h}{4} \frac{A_1 - A_2}{\eta_v} (q_i - q_j) + \frac{1-2h}{4} \frac{(\alpha + \beta)}{(1-\sigma)E_1} (t_i - t_j) \quad (46)$$

$$\Delta^{UIG} (w - v)_i = -h \left(\frac{A_1 - A_2}{\eta_v + B_2} \right) \left(\frac{B_2}{\eta_v} q_i + q_j \right) \quad (47)$$

The real wage is equal to that found in the previous section. It is lower than in the non-cooperative case. If governments put the same emphasis on prices, the employment level is certainly higher than in the non-cooperative case. A price level different than that associated with the non-cooperative case can result only if the preference of unions and/or those of governments are different.

Notice that equation (45) is the sum of equations (28) and (36), whereas equation (46) is the sum of equations (29) and (37). This implies that there are no cross institutional externalities; i.e. there are no further gains from cooperation between governments and unions than those that can accrue in the case of cooperation between either governments or unions.

Simultaneous cooperation between central bank and governments

In this section, we assume that the central bank and governments act cooperatively, by maximizing the following function:

$$\Omega^{BG} = \frac{1}{3}V + \frac{1}{3}G_i + \frac{1}{3}G_j \quad (48)$$

Following the same procedure as above we obtain the following equilibrium values:

$$n_i^{BG} = \frac{n_i^g - n_j^g}{2} - \frac{1-2h}{2} (t_i - t_j) + \frac{w_i^s + w_j^s}{2} + \frac{1}{2} \frac{\eta_p}{\eta_v} (q_i + q_j) \quad (49)$$

$$v_i^{BG} = v_i^{GC} - \frac{1}{4} (n_i^g + n_j^g + w_i^u + w_j^u + q_i + q_j + t_i + t_j) \quad (50)$$

$$(w - v)_i^{BG} = w_i^u - \frac{\eta_p}{\eta_v} q_i \quad (51)$$

Similar expressions hold for the other country.

Gains from cooperation between central bank and between governments are as follows:

$$(52) \quad \Delta^{BG} n_i = \frac{h (\alpha + \beta)}{4 (1 - \sigma) E_1} (t_i - t_j)$$

$$(53) \quad \Delta^{BG} v_i = \frac{(1 - 2h) (\alpha + \beta)}{4 (1 - \sigma) E_1} (t_i - t_j) - \frac{1}{4} (n_i^g + n_j^g + w_i^u + w_j^u + q_i + q_j + t_i + t_j)$$

$$(54) \quad \Delta^{BG} (w - v)_i = 0$$

These are the same outcomes derived in the fiscal cooperation case, except for the inflation bias, which is reduced by the second term on the right hand side of equation (53).

Conclusions

In this paper, we have analysed the effects of cooperation between unions and/or public authorities (governments and the common central bank) in a common-currency area.

Summarizing our results, we found that cooperation between public authorities has limited effects on employment and inflation – no effects in case of symmetry. This occurs because the positive effect on employment of raising government expenditures is exactly compensated by the effect on the same variable of the rise in the interest rate operated by the central bank as a reaction to the higher level of government expenditures deriving from governments' cooperation. As a consequence also prices do not change.

Assuming symmetry, cooperation between the central bank and national governments also does not affect unemployment, but it reduces inflation. Unemployment can be reduced only by changing central bank preferences and paying a cost in term of inflation in a very Phillips curve fashion or, if government are asymmetric and cooperate. In this case, however, one country only can benefit in terms of employment, but has to pay a cost in terms of higher prices.

On the contrary, cooperation between unions can improve employment, since unions cooperation eliminates the negative externalities associated with the decentralized setting of nominal wages. If we consider the case of symmetric trade

unions, unions' cooperation has an unambiguous positive effect on employment and, thus, on social welfare in each country.

By considering the simultaneous cooperation between unions, on the one hand, and governments, on the other hand, we have shown that there are no cross institutional externalities. In other words, there are no further gains from cooperation between governments and unions than those that can accrue in the case of cooperation between either governments or unions.

Our results show that effects of cooperation among public authorities have limited effect on reducing unemployment. By contrast, agreements among trade unions can increase the social welfare by reducing unemployment without raising inflation. Therefore, such agreements as the Doorn declaration go in the right direction according to our model.

NOTES

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¹ Tarantelli (1986) was published posthumous. Tarantelli's ideas on the advantages of centralisation in wage bargaining were laid down at least as back as 1982.

² More recent contributions are Bleaney (1996), Skott (1997), Cukierman and Lippi (1999), and Coricelli *et al.* (2000). Rama (1994), Soskice and Iversen (1998), and Grüner and Hefeker (1999) have extended the analysis to an open economy.

³ To be fair, Zervoyianni considers governments whose preference functions are quadratic in both employment and inflation. This might have the same outcome as considering both governments, whose predominant objective is employment, and a central bank, having inflation as its overriding target. One of the purposes of this paper is to check the validity of such a correspondence.

⁴ We do not consider the implications of allowing firms to be mobile as between the two countries.

⁵ The full derivation of the model from the levels (taking account of the governments' budget constraints) can be found in the working paper version of this work (see Acocella and Di Bartolomeo, 2001, Appendix A).

⁶ We are aware of the fact that our assumptions about expectations can lead to specific results. We are however interested in showing the *possibility* of outcomes different from those derived in the literature.

Such a possibility would also arise in our model with assumptions about expectations different from those of this paper.

⁷ Here different possible regimes are not considered. See Acocella and Di Bartolomeo (2001: Appendix B).

⁸ This assumption implies that all players have to form rational expectation about the other players' actions. Another common assumption used by the literature is that of unions' leadership; it implies that nominal wages are set a period in advance. We focus on the Nash equilibrium to isolate the effects of the existence of unions in the labour markets from those coming from the existence of sticky wage contract.

⁹ See Hughes Hallett and Rees (1983), and Blinder (1997). Considering alternative preference functions each quadratic in both its two arguments may have different implications, since it implies that the marginal rates of substitution between the two arguments depend on both arguments and not only on the quadratic one as for the linear-quadratic case used in the paper. See Acocella and Di Bartolomeo (2002) for a full discussion about this argument.

¹⁰ In addition, critical remarks to such an argument are raised by Acocella and Ciccarone (1997).

¹¹ On circumstances affecting non-neutrality in games involving monopoly unions see Acocella and Ciccarone (1997) and Acocella and Di Bartolomeo (2002).

¹² Equation [32] is a kind of Taylor rule derived endogenously on the basis of a maximization process followed by the central bank.

¹³ For the same reasons, similar effects hold in van Aarle *et al.* (2002) in a dynamic context without trade unions.

¹⁴ Recall that in our case unions are associated with national firms that are monopolistic competitors in the international goods market.

¹⁵ It has to be noted that the cooperative solution between unions may be unfeasible since real wages are reduced. We have however checked that the solution is feasible for a large set of reasonable parameters.

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