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The Scope for Policy Coordination between the United States and Europe : Implications of Asymmetric Labor Markets**

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Abstract

This paper emphasizes the structural differences in the American and European labor markets and examines the implications of these asymmetries for the scope of policy coordination between these economies. Strategic aspects of monetary and fiscal policies are analyzed as a game between a country with real wage rigidity(Europe) and a country with nominal wage rigidity(U. S.). The paper presents simple examples which show that the nature of the noncooperative equilibrium in this asymmetric framework depends on the strategy variables chosen by the countries. Policy coordination is redundant if money supplies are the only instruments used by both players. The noncooperative fiscal policy game is inefficient, and policy coordination becomes redundant again when both monetary and fiscal policies are employed. These results illustrate that an appropriate assignment of policy instruments can be a substitute to policy coordination in generating an efficient solution to the international policy game.

I. Introduction

The nature of policy interdependence among the industrial countries has recently been the subject of extensive research activity.[1] Modelling the United States (US) and

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1. Game theoretical analysis of policy coordination has been pioneered by Hamada(1974 and 1976). For subsequent developments see Oudiz and Sachs (1984 and 1985), Taylor (1985), Canzoneri and Gray (1985), Rogoff (1985), Miller and Salmon (1985), Hughes Hallett (1986 a, b), Laskar (1986), and Jones(1987). Horne and Masson (1988), Fischer (1988) and Canzoneri and Henderson (1988) review the literature and current issues.

the rest of the OECD as two large and identically symmetric economies, the majority of existing studies have demonstrated that, in general, uncoordinated policy actions lead to inefficient outcomes, implying potential gains from policy coordination.[2] Despite the emphasis put on the framework of symmetric countries, the period of disinflation and the following period of recovery in the OECD area have been characterized by significant asymmetries. Of particular concern are the differences in the unemployment rates in Europe and the US and the fiscal and current account imbalances across the OECD countries. These asymmetries can not readily be explained within the context of symmetric models, as two symmetric countries normally end up with the same output level at the noncooperative euilibrium and the effects of their policies on exchange rates and current accounts cancel each other out.

This paper stresses the structural differences in the American and European labor markets, and examines the policy interdependence between the US and Eupope as a game between a country with real wage rigidity (Europe) and a country with nominal wage rigidity (US). Within this framework we inquire whether noncooperative policy making leads to an efficient solution or whether policy coordination assumes a positive role in generating an efficient outcome to the benefit of all parties. The simple examples presented show that the scope for policy coordination depends on the strategy variables chosen by the countries. To highlight the interaction between the monetary-fiscal policy mixes and the nature of the noncooperative equilibria in an asymmetric model, this paper considers the cases in which both monetary and fiscal policies are used as strategy variables in addition to the cases in which either of them is utilized. It is demonstrated that the noncooperative Cournot-Nash equilibrium is efficient and policy coordination redundant when only monetary policies are used. The outcome of the fiscal policy game is inefficient, and policy coordination becomes redundant once again when both monetary and fiscal policies are used.

The paper is motivated by the considerable evidence pointing out differential wage adjustment processes in the US and Europe. Bruno and Sachs (1979, 1985) and Branson and Rotemberg (1980), among others, provide evidence for nominal wage rigidity in the US and real wage rigidity in Europe. Although the implications for the transmission of macroeconomic policies of different wage adjustment patterns have been investigated in

2. A notable exception is Rogoff (1985) where it is demonstrated that coordination does not necessarily improve welfare as it exacerbates the credibility problem of policy makers. Kehoe(1986) reaches a similar conclusion. See Carraro and Giavazzi (1988) for a more recent treatment.

earlier studies,[3] the role of labor market asymmetries in policy coordination has been explored in few papers. Oudiz and Sachs (1984) consider asymmetric economies in their expirical study of gains from coordination, and Canzoneri and Gray (1985) allow symmetric as well as asymmetric spillovers in their analysis of monetary policy games. Hughes-Hallett (1986a, 1986b) concludes that the asymmetries between the US and Erurope play a critical role in the uneven distribution of the gains from coordination between these economies. Similarly, most of the literature has focused on monetary policy games. Few studies have considered the strategic aspects of fiscal policies[4] but the use of both monetary and fiscal policy instruments at the same time has not been analyzed in theoretical models.[5]

The paper is organized as follows : section Ⅱ introduces the asymmetric model underlying the analysis of policy interdependence ; section Ⅲ examines the scope for macroeconomic policy coordination in three stages ; and section Ⅳ provides the conclusion.

Ⅱ. A Two-Country Macroeconomic Model

The subsequent analysis of policy interdependence between the US and Europe is based on the reduced form equations of a medium-term two-country model. Table 1 presents the equations of the model.

Variables referring to the US (foreign country) are denoted with an asterisk and the home country variables appear without an asterisk. All variables are in logarithms except for interest rates. Parameters are represented by Greek letters with numerical subscripts and all parameters are defined positively. Europe is assumed to produce a single good, y, which is physically distinct from the output of the US, y^*. The exchange rate is defined as the units of European currency per unit of US dollars, so that an increase in $\tau \equiv e+p^*-p$ implies a terms of trade deterioration for Europe. Equations (1) and (7) are obtained by solving the domestic and foreign goods market equilibrium conditions simultaneously.[6] Equations (2) and (8) are the standard LM curves.

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3. See Argy and Salop (1979), and Sachs (1980) for the transmission of macroeconomic policies under alternative labor market specifications ; and Argy and Salop (1983), Branson and Rotemberg (1980) and Klundert and Ploeg (1989) for extensions to two-country models.
4. Johansen (1982), Kehoe (1986 and 1987) and Turnovsky (1988) analyze fiscal policy coordination using theoretical models.
5. See Oudiz and Sachs (1984), McKibbin and Sachs (1988), and Hughes-Hallett (1986a, 1986b) for simulations of monetary and fiscal policy games.

Table 1 : The Model

Home Country (Europe)

(1) $y^d=-\alpha_1 r+\alpha_2(e+p^*-p)+\alpha_3 g^*+g$
(2) $m-p=\alpha_4 y-\alpha_5 r$
(3) $y^s=\tilde{\lambda}(p-w)$
(4) $w=w_0+\theta p^l+\sigma y$
(5) $p^l=\lambda p+(1-\lambda)(e+p^*)$
(6) $y^d=y^s$

Foreign Country (US)

(7) $y^{*d}=-\beta_1 r^*-\beta_2(e+p^*-p)+\beta_3 g+g^*$
(8) $m^*-p^*=\beta_4 y^*-\beta_5 r^*$
(9) $y^{*s}=\tilde{\gamma}^*(p^*-w^*)$
(10) $w^*=w_0^*+\theta^* p^{l*}+\sigma^* y^*$
(11) $p^{l*}=\lambda^* p^*+(1-\lambda^*)(p-e)$
(12) $y^{*d}=y^{*s}$
(13) $r=r^*$

The central part of the model is the specification of the aggregate supply. Output is supplied by profit maximizing, perfectly competitive firms [equations (3) and (9)]. The wage rate demanded by the labor unions depends on the consumer price index, p^l, the output level and a shift parameter [equations (4) and (10)]. The price index is a weighted average of domestic and foreign goods prices [equations (5) and (11)]. Substituting (4) and (5) into (3), we can write the aggregate supply function as :

(14) $y^s=\delta[(1-\theta)p-w-\theta(1-\lambda)\tau\,]$; $\delta\equiv\dfrac{\tilde{\gamma}}{(1+\sigma\tilde{\gamma})}$

Two special cases of (14) arise when there is complete indexation ($\theta=1$) and when

6. Since there is no monetary growth, and hence no continual inflation in the model, the nominal interest rate is used in (1) and (7).

wages are not indexed at all ($\theta=0$). The terms of trade enter (14) unless $\theta=0$, because of the Purvis-Sachs effect [see Purvis (1976) and Sachs (1980)].[7] On the other hand, the price of the domestic good affects output as long as wages are less than completely indexed. The model is solved assuming full indexation in Europe and no indexation in the US.

The model is constructed for the analysis of interdependence in the medium-run characterized by the end of the exchange rate-price dynamics. Hence, prices adjust to equate aggregate demand and supply [equations (6) and (12)] and the uncovered interest rate parity requires the domestic and foreign interest rates be equal to each other [equation (13)].

Table 2 displays the transmission of policy disturbances[8]. A monetary expansion in Europe depreciates the nominal exchange rate and raises the price level equiproportionately, with no effect on τ and r ; and hence on y, y^* and p^*. American monetary policy is positively transmistted to domestic price and output levels ; positively transmitted to the European output level and negatively to the European price level. The effects of a European fiscal expanision are to increase output and prices in the US, and to raise the output level in Europe. The European price level may fall with a strong Purvis-Sachs effect in the aggregate supply. The own-country effects of a US fiscal expansion are to raise output and prices. An expansionary US fiscal policy increases the European price level as well, but its output effect is ambiguous. Provided that it leads

Table 2 : Policy Multipliers

Policy	y	y^*	p	p^*	τ	r
m	0	0	1	0	0	0
m^*	+	+	−	+	−	−
g	+	+	−/+	+	−	+
g^*	−/+	+	+	+	+/−	+

7. Firms demand labour according to the real wage in terms of the home good. Workers supply labour according to the real wage in terms of a consumption basket which includes the imported and domestic goods. A change in τ induces a change in employment through its differential effect on the real wage rates relevant for firms and workers.
8. For brevity, only the policy multipliers are presented. Algebraic expressions of these and other multipliers and the technical details of derivations are available from the author upon request.

to a real depreciation of the European currency, y falls, and this is assumed to be the case in the rest of the paper.[9]

These spillover effects are driven by the differential impact of the terms of trade movements on the economies with asymmetric labour markets. The changes in τ influence y via its effect on the aggregate supply and a real depreciation of the European currency contracts the level of output. On the other hand, changes in τ affect y^* through the aggregate demand side. A real depreciation of the US dollar increases the competitiveness of the US good and therefore constitutes an expansionary shock.

Ⅲ. Coordination of Macroeconomic Policies

Each country is assumed to have a quadratic loss function in deviations of output and price levels from their target values. The noncooperative equilibrium concept used in this paper is the Cournot-Nash (C-N) solution : each country chooses its strategy variable(s) to minimize its own loss function, taking the behaviour of the other country as given. On the other hand, a cooperative equilibrium must : (i) be Pareto efficient, and (ii) yield a payoff to each country which is no less than what could be achieved without cooperation. The set of solutions that satisfy the first condition form the efficiency locus whereas those that satisfy both criteria are referred to as the contract locus.

A. Coordination of Monetary Policies

In this section countries are assumed to use monetary policy as their only strategy variables. The reaction function of Europe, R, is derived from the solution to the following problem :

$$\max U=-\frac{1}{2}[(y-\bar{y})^2+c(p-\bar{p})^2]$$

subject to $m^*=\bar{m}^*$, and the reduced form of the model. A similar optimization by the US yields the American reaction function, R^*. Table 3 displays these reaction functions as well as the ones pertaining to the games analyzed below.

The C-N equilibrium occurs at the intersection of R and R^* and is illustrated in Figure 1. Since m does not affect y, the reaction function of Europe, R, shows the com-

9. These results are similar to those of Argy and Salop (1983) but are driven by the differences in indexation, rather than in money illusion.

binations of m and m^* which stabilize p, and is the locus of points where the European indifference curves have horizontal slopes. As the US monetary policy affects both y^* and p^*, R^* shows the value of m^* that minimizes the total loss (price and output deviations). The European montary policy has no effect on y^* and p^* ; thus the indifference curves of the US are horizontal.

An important property of the C-N solution is that it is *efficient* and hence, there is no scope for coordinating monetary policies. This follows from the nature of the contract locus associated with the game. The US minimizes its total loss function subject to an upward sloping supply curve. R^* indicates the American money supply which moves the aggregate demand to the optimal point on the supply curve. Since R^* is horizontal, the C-N equilibrium value of m^* corresponds to the optimal money supply for the US. Thus, in the absence of coordination the US can assure the highest payoff subject to its supply curve, and any m^* other than the one given by R^* makes it worse off. This shrinks the contract locus to a single point located at the intersection of the reaction functions. Consequently, the C-N solution is efficient and can not be improved upon by cooperation, implying that policy coordination is redundant.

B. Coordination of Fiscal Policies

In this part of the analysis it is assumed that real government expenditures are the only strategy variables used by both parties. The C-N equilibrium for this game is illustrated in Figure 2. The American reaction function is negatively sloped : a rise in g increases both p^* and y^* and the US reacts by contracting. The slope of R is positive.[10] At the noncooperative equilibrium the indifference curves of the US and Europe cut each other. Therefore g and g^* can be rearranged to increase the welfare of one country, without making the other-worse off. In other words, the C-N solution is inefficient and can be improved upon by policy coordination.

C. Coordination of Monetary and Fiscal Policies

In this case there are two reaction functions for each economy which show the op-

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10. Applying the methodology developed by Oudiz and Sachs (1984) we find that for the initial equilibrium be a Nash solution

$c=-\frac{\eta_{10}}{\eta_{11}}\left[\frac{y-\bar{y}}{p-\bar{p}}\right]$ and, $(y-\bar{y})$ and $(p-\bar{p})$ have opposite signs.

These conditions ensure that the slope of R is positive.

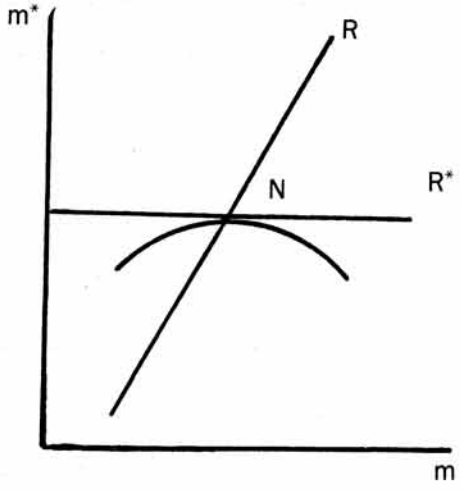

Figure 1 : The Cournot-Nash Equilibrium in Monetary Policies

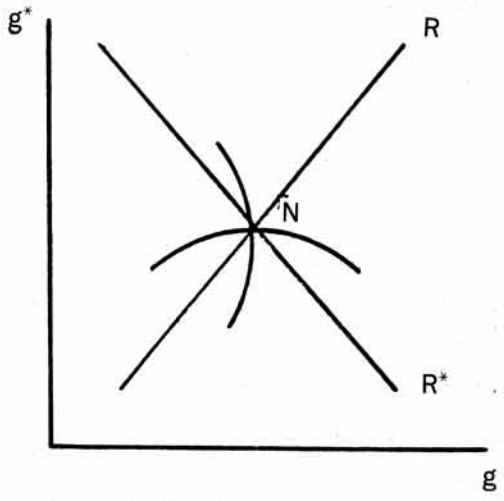

Figure 2 : The Cournot-Nash Equilibrium in Fiscal Policies

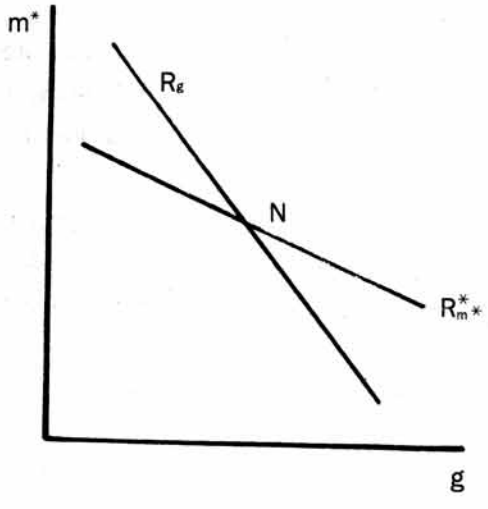

Figure 3 : The Cournot-Nash Equilibrium in Monetary and Fiscal Policies

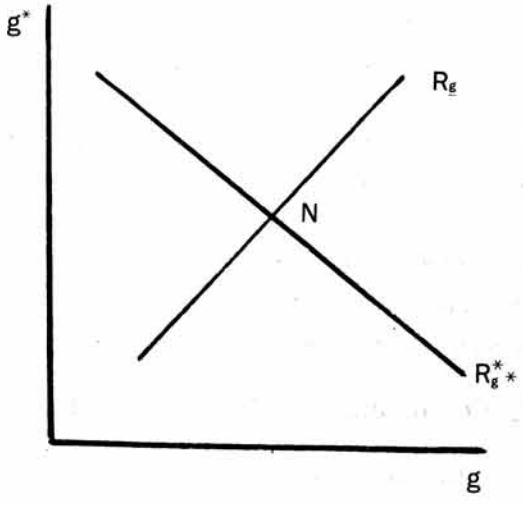

Figure 4 : The Cournot-Nash Equilibrium in Monetary and Fiscal Policies

asized. First, the European fiscal and monetary policies are two independent instruments which enable Europe to maintain a total loss of zero by controlling its price level with m and stabilizing its output level with g. However, we can not find independent solutions for optimal American monetary and fiscal policies.[11] This follows from the fact that m^* and g^* are both aggregate demand policies and the US can achieve only one of its targets by any combination of these instruments.

Second, the C-N solution is efficient and can not be improved upon by coordination regardless of the instrument choice of the US. The case in which the US uses monetary policy is illustrated in Figure 3. Here g^* is exogenous to the system. As m does not enter the other reaction functions, the C-N values of m^* and g are located at the intersection of R_g and R^*_{m*} which are both negatively sloped. If, on the other hand, the strategy variable of the US is fiscal policy, m^* is exogenous to the system and the C-N equilibrium is derived by solving the remaining reaction functions The equilibrium is illustrated in Figure 4.

Since Europe has two independent instruments, it will be on its bliss point along R_g in both figures. On the other hand, loss of the US is minimized along the American reaction functions as these curves show the combinations of the American and European policies that move the aggregate demand curve of the US to the optimal point on its aggregate supply. Therefore, the eifficiency locus of the game shrinks to a single point which is located at the intersection of the European and American reaction functions. This renders the Cournot-Nash equilibrium efficient and policy coordination redundant : the payoffs of the players can not be increased through coordination above the levels implied by the noncooperative equilibrium.

Ⅳ. Conclusion

The simple examples provided in this paper demonstrate that the asymmetries in the labour markets of the US and Europe have important implications for the scope of coordinating their macroeconomic policies. The noncooperative actions of the players lead to the unique point on the contract locus if money supplies are the only strategy variables used by them. This makes coordination redundant in the monetary policy game.

11. The rank of the equation system that determines m^* and g^* is one. Thus, only one of them can be determined as a function of the other.

timal responses of their monetary and fiscal policies. The C-N equilibrium is found by solving this four-equation system. Several aspects of the equilibrium should be emph-

Table 3 : Reaction Functions

Monetary Policies

$$R : m=\eta_1 m^*-\eta_2 g-\eta_3 g^*-\varepsilon_1+\bar{p}$$

$$R^* : m^*=\frac{1}{(\eta_{13}^2+c^*\eta_0^2)}[\eta_{13}\eta_{14}+c^*\eta_0\eta_5)g-(\eta_{13}\eta_{15}+c^*\eta_0\eta_6)g^*-(\eta_{13}\varepsilon_4+c^*\eta_0\varepsilon_2)$$
$$+(\eta_{13}\bar{y}^*+c^*\eta_0\bar{p}^*)]$$

Fiscal Policies

$$R : g=\frac{1}{(\eta_{10}^2+c\eta_2^2)}[\eta_{10}\eta_{11}+c\eta_2\eta_3)g^*+(\eta_9\eta_{10}-c\eta_1\eta_2)(m^*-w^*)-(\eta_{10}\eta_{16}+c\eta_2\eta_4)w+\eta_{10}\bar{y}$$
$$-c\eta_2(m-\bar{p})]$$

$$R^* : g^*=-\frac{1}{(\eta_{15}^2+c^*\eta_6^2)}[(\eta_{14}\eta_{15}+c^*\eta_5\eta_6)g+(\eta_{13}\eta_{15}-c^*\eta_0\eta_6)m^*-(\eta_{13}\eta_{15}+c^*\eta_6\eta_7)w^*$$
$$+(\eta_{15}\eta_{16}+c^*\eta_6\eta_8)w-\eta_{15}\bar{y}^*-c\eta_6\bar{p}]$$

Monetary and Fiscal Policies

1. Fiscal policy in the US

$$R_m : m=\eta_1 m^*-\eta_2 g-\eta_3 g^*-\varepsilon_1\bar{p}$$

$$R_g : g=\frac{1}{\eta_{10}}[-\eta_{11}g^*-\eta_9 m^*-\varepsilon_3+\bar{y}]$$

$$R_{m*}^*=-\frac{1}{\eta_0}\{\eta_5 g+\eta_6 g^*+\mu[\bar{y}^*+\bar{p}^*-\varepsilon_2-\varepsilon_4]\}, \text{ and } g^*=\bar{g}^*$$

2. Monetary policy in the US

$$R_{g*}^* : g^*=-\frac{1}{\eta_6}\{\eta_5 g+\eta_0 m^*+\mu[\bar{y}^*+\bar{p}^*-\varepsilon_2-\varepsilon_4]\}$$

$m^*=\bar{m}^*$, and R_m and R_g are same as above.

[η's are reduced form coefficients and ε's are functions of exogenous variables].

However, there is scope for coordinating fiscal policies as the Cournot-Nash solution is inefficient. Finally, when both instruments are utilized the noncooperative outcome becomes efficient and policy coordination does not improve the welfare of the players. These results provide a potential explanation for the failure of the attempts to coordinate monetary policies in the first half of the 1980's, and for the concentration of coordination discussions on fiscal policy in the second half of the 1980's. Moreover, it lends support to the argument of Feldstein (1988) that appropriate changes in domestic policies can be regarded as an alternative to policy coordination in generating efficient outcomes.

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