# *EFFECTS OF SUPPLY SHOCK IN A MONETARY UNION UNDER RULES AND DISCRETION*

*Gaurango Banerjee, University of Texas at Brownsville*

**ABSTRACT**

The paper examines the implications of a common supply shock under the setting of a common monetary authority and separate fiscal authorities. A two-country setup is considered in which the monetary policy for the countries is jointly managed by the common central bank, while the fiscal policy in each country is conducted by the respective governments. Monetary and fiscal policy making is undertaken under the alternative regimes of rules and discretion. The expressions for output and inflation are compared in the alternative regimes in the presence of an adverse supply shock and a beneficial supply shock.

**INTRODUCTION**

The paper considers a two-country model with a common central bank similar to the European Central Bank, and separate fiscal authorities similar to governments of member countries in the European Monetary Union (EMU). In this paper, the effects of an adverse and beneficial supply shock will be analyzed under alternative scenarios of commitment and discretion. Specifically, the implications of a common productivity shock (adverse and beneficial) on output and inflation will be the focus of this paper. The productivity disturbance is a symmetric disturbance that affects both countries in the same way. The macroeconomic stabilization effects on inflation and output in the presence of the supply shock are analyzed. The paper analyzes the effects of shocks on deviations of output and inflation from their target levels in each country. The paper also analyzes the effects of shocks under alternative scenarios of commitment and discretion by the common central bank and the separate fiscal authorities. Under commitment, the actual taxes and inflation are equal to the expected values. In the discretionary scenario, the taxes and inflation may differ from their expected values. Comparisons between the discretionary and commitment scenarios could have policy implications on the central bank and fiscal authorities' ability to meet their target inflation and output levels.

In the model, the common monetary authority chooses the composite inflation rate for the two countries, while the fiscal authorities choose the tax rates for their respective countries. Each authority minimizes its own losses. The losses for the monetary authority and fiscal authorities are represented as weighted sum of squared deviations of inflation, output, and government expenditures from their target levels. In the context of the EMU, these target levels are set according to the convergence criteria in the Maastricht Treaty.

In section II, a two-country model with separate fiscal authorities and a common monetary authority is considered. The stabilizing properties under the different scenarios of commitment and discretion will be analyzed in response to the common supply shock in subsections IIA-D. Conclusions are presented in section III.

## POLICY MAKING UNDER COMMON SUPPLY SHOCK

The model under consideration in this paper is a two-country extension of the closed economy framework of Alesina and Tabellini (1987), with the inclusion of stochastic disturbance terms. The common productivity shock affects both countries similarly. The variables are expressed in logarithmic form and time subscripts are omitted where possible for notational convenience. Asterisks denote foreign country variables. As in Bryson et al. (1993), the two fiscal authorities choose the respective tax rates for each country. However, unlike Bryson et al., a single monetary authority chooses a composite inflation for the two countries. The composite inflation rate is a weighted average of the inflation rates in the two countries.
The production function in the two countries is represented as

$$y = al + x \tag{1a}$$

$$y^* = al^* + x \tag{1b}$$

where $y$ $(y^*)$ is the log of home(foreign) country output, $l(l^*)$ is the log of employment level at home (abroad), and $x$ is a white noise productivity shock common to both countries.

The monetary authority chooses a composite inflation rate, which is a weighted average of the inflation rates in the two countries:

$$\Pi_t^c = \phi \Pi_t + (1-\phi)\Pi_t^* \tag{2}$$

The government budget constraints used are modified versions of the Alesina and Tabellini (1987) budget constraint. As in Alesina and Tabellini (1987), the government expenditure (g) is represented as the ratio of nominal government spending to nominal income. The government expenditure is assumed to be financed partly from direct taxation, and the remaining from the common seigniorage revenues.

$$g_t = \tau_t + \Omega\, \Pi_t^c \tag{3a}$$

$$g_t^* = \tau_t^* + (1-\Omega)\, \Pi_t^c \tag{3b}$$

A fraction of the common seigniorage revenues is allocated by the common monetary authority to each of the countries. As in Alesina and Tabellini (1987), this model does not consider the intertemporal dimension of the government budget constraint. Government expenditures are determined once tax rates and money seigniorage have been chosen. Unlike Alesina and Tabellini, the model in this paper considers the common money seigniorage for the two countries chosen by a single central bank.

Profits of domestic firms is represented by the following equation:

$$\text{Profit} = \beta(1-\tau)PY + (1-\beta)(1-\tau^*)PY - WL \qquad (4)$$

where $Y = L^a X$ (in levels), L= employment level, W= wage level, X= common productivity shock, and a= elasticity of output with respect to labor. $\beta$ is the fraction of home output consumed at home, while (1-$\beta$) is the remaining portion of the home output consumed in the foreign country. The home country sales revenues are taxed at the domestic tax rate, while the sales revenues in the foreign country are taxed at the foreign tax rate.

Labor employed is chosen such that profits of representative firms are maximized in each country. The first-order conditions for profit maximization yield the following log-linear labor demand functions (with constant term suppressed) in the two countries:

$$l^d = -b[w - p - x + \beta\tau + (1-\beta)\tau^*] \qquad (5a)$$

$$l^{*d} = -b[w^* - p^* - x + (1-\beta)\tau + \beta\tau^*] \qquad (5b)$$

where *b=1/(1-a).* Labor demand depends negatively on real wages and tax rates and positively on the common productivity shock.

The labor supply functions are represented as:

$$l_t^s = c(w_t - \hat{p}_t) \qquad (6a)$$

$$l_t^{*s} = c(w_t^* - \hat{p}_t^*) \qquad (6b)$$

where, w and w* represents the log of the nominal wages in country 1 and 2, respectively. As in Duca and VanHoose (1990), labor is assumed to be relatively immobile between the two countries, but the output of both countries are consumed by workers in each country. The workers value real wages they earn in terms of the aggregate consumer price index, which accounts for the price levels in both the countries. In contrast, the firms value the real wages they pay in terms of the prices of the products which they produce. Thus, the aggregate consumer price index enters the labor supply functions while the home price levels enter the labor demand functions. Labor supply is equated with labor demand to get the Walrasian, full-information wage. The contract wage, which equals the expected value of the full-information wage, is then used in the labor demand function. Output is obtained by substituting the labor demand function into the production function:

$$y = \frac{a}{(b+c)}\{b^2(\Pi - \Pi^e) + bc(\Pi - \hat{\Pi}^e) - b^2\beta(\tau - \tau^e) - bc\beta\tau - b^2(1-\beta)(\tau^* - \tau^{*e}) - bc(1-\beta)\tau^* + b(b+c)x\} \qquad (7a)$$

$$y^* = \frac{a}{(b+c)}\{b^2(\Pi^* - \Pi^{*e}) + bc(\Pi^* - \hat{\Pi}^{*e}) - b^2\beta(\tau^* - \tau^{*e}) - bc\beta\tau^* - b^2(1-\beta)(\tau - \tau^e) - bc(1-\beta)\tau + b(b+c)x\} \qquad (7b)$$

The nominal income equilibrium condition shows the relationship between nominal income and desired private nominal spending as well as government spending. As in Bryson et al. (1993), it may be represented as follows:

$$P_t Y_t = [(1-\tau_t)P_t Y_t]^{\beta}.P_t^{-(1+\theta)}.[(1-\tau_t^*)P_t^* Y_t^*]^{(1-\beta)}.(E_t P_t^*)^{\theta} + G_t \quad (8)$$

where E denotes nominal exchange rate in terms of home currency per unit of foreign currency. In
case of a common currency, we can consider E=1. $\theta > 0$ shows the degree of market integration and
increases with greater market integration. Dividing by *PY* on both sides of equation (8), and taking logs we obtain:

$$z = \frac{1-\beta}{\theta}[\Pi_t - \Pi_t^* - \tau_t + \tau_t^* + y_t - y_t^*] \quad (9)$$

where equation (9) represents the real exchange rate depreciation in terms of the relative output, inflation and tax rates in the two countries. The composite price level, $\hat{\Pi} = \beta\Pi + (1-\beta)\Pi^*$, is substituted into equations (7a) and (7b) to get the domestic and foreign aggregate supply function
in terms of the real exchange rate depreciation:

$$y = \frac{a}{(b+c)}\{(b^2+bc)(\Pi-\Pi^e) - b^2\beta(\tau-\tau^e) - bc\beta\tau - b^2(1-\beta)(\tau^*-\tau^{*e}) - bc(1-\beta)\tau^*$$

$$- bc(1-\beta)z^e + b(b+c)x\} \quad (10a)$$

The aggregate supply in country 2 is obtained similarly:

$$y^* = \frac{a}{(b+c)}\{(b^2+bc)(\Pi^*-\Pi^{*e}) - b^2(1-\beta)(\tau-\tau^e) - bc(1-\beta)\tau - b^2\beta(\tau^*-\tau^{*e}) - bc\beta\tau^*$$

$$+ bc(1-\beta)z^e + b(b+c)x\} \quad (10b)$$

Equations (10a) and (10b) show that discretionary monetary and fiscal policy may have effects on real output when the actual price level and tax rates differ from the expected values.

The desired or target output would be the level of output without any tax distortions. The full-information non-distorted output in each country may be expressed as:

$$\bar{y} = \frac{-abc}{(b+c)}(1-\beta)z \quad (11a)$$

$$\bar{y}^* = \frac{abc}{(b+c)}(1-\beta)z \tag{11b}$$

The policy makers attempt to minimize deviations of output from the nondistorted level. The following expressions are obtained for deviations of output from the target level in countries 1 and 2, respectively:

$$(y-\bar{y}) = \frac{ab}{(b+c)}\{(b+c)(\Pi-\Pi^e) - b\beta(\tau-\tau^e) - c\beta\tau - b(1-\beta)(\tau^*-\tau^{*e}) - c(1-\beta)\tau^* - c(1-\beta)(z^e - z) + (b+c)x\} \tag{12a}$$

$$(y^*-\bar{y}^*) = \frac{ab}{(b+c)}\{(b+c)(\Pi^*-\Pi^{*e}) - b\beta(\tau^*-\tau^{*e}) - c\beta\tau^* - b(1-\beta)(\tau-\tau^e) - c(1-\beta)\tau - c(1-\beta)(z^e - z) + (b+c)x\} \tag{12b}$$

The loss functions for the common monetary authority and the fiscal authorities are represented by equations (13) and (14), respectively. These are modified versions of the loss functions employed by Alesina and Tabellini (1987) and Bryson, et al.(1993). In this paper, the deviation of a common inflation for both countries from a target level is considered. The deviation of output and government spending of each country from their target levels is considered.

$$V^{MA} = \frac{1}{2}(\Pi_t^c)^2 + \mu_1\{\frac{\Psi}{2}(y_t - \bar{y})^2 + \frac{2-\Psi}{2}(y_t^* - \bar{y}^*)^2\} + \mu_2\{\frac{\Psi}{2}(g - \bar{g})^2 + \frac{2-\Psi}{2}(g^* - \bar{g}^*)^2\} \tag{13}$$

where $\mu_1 > 0, \mu_2 > 0,$ and $\bar{g}$ = target government spending, with $\bar{g}$ >0.

$$V^{FA} = \frac{1}{2}[(\Pi_t^c)^2 + \delta_1(y_t - \bar{y})^2 + \delta_2(g_t - \bar{g})^2] \tag{14a}$$

$$V^{*FA} = \frac{1}{2}[(\Pi_t^c)^2 + \delta_1(y_t^* - \bar{y}^*)^2 + \delta_2(g^* - \bar{g}^*)^2] \tag{14b}$$

Inflation target is set at zero, while the desired output level is denoted by the non-taxdistorted level. The target or optimal government spending is set at a positive level. Government expenditure below this level would imply insufficient public

spending by the fiscal authorities, while expenditure above the target level would mean excessive socially inefficient expenditure. As in Alesina and Tabellini (1987), the fiscal authorities are assumed to put at least as much weight on the output and government spending objective relative to inflation as compared to the monetary authority (i.e., $\delta_1 \geq \mu_1$ and $\delta_2 \geq \mu_2$).

***Monetary and Fiscal Discretion Scenario***

In the initial case, we consider the scenario of monetary and fiscal discretion with insular fiscal authorities. The monetary and fiscal authorities act in a *discretionary* manner with respect to their private sectors in the choice of the common inflation and tax rates, respectively.

Reduced form solutions under monetary and fiscal discretion in the presence of the common productivity shock (x) are given by:

$$(y)^{MFD} = \frac{-abc\delta_2 \bar{g} + (b+c)\delta_2 abx}{(b+c)\delta_2 + abc[\delta_1 D + \Omega(\mu_1\delta_2 B + \mu_2\delta_1 AD)]} \quad (15a)$$

$$(\Pi^c)^{MFD} = \frac{abc(\mu_1\delta_2 B + \mu_2\delta_1 AD)\bar{g} - (b+c)ab(\mu_1\delta_2 B + \mu_2\delta_1 AD)x}{(b+c)\delta_2 + abc[\delta_1 D + \Omega(\mu_1\delta_2 B + \mu_2\delta_1 AD)]} \quad (15b)$$

where,

$$A = 2\psi\Omega, \quad B = \frac{2\psi ab}{\phi} \quad D = ab\beta + \frac{abc}{(b+c)\theta}(1-\beta)^2[1 + ab\beta - ab(1-\beta)]$$

The parameters included in A, B, and D have been defined earlier in the model.

A negative productivity shock (a negative value for x), which affects both countries' economies in the same way, increases the domestic and foreign inflation rate. The composite inflation rate, which is a weighted average of the domestic and foreign inflation rates, therefore rises with a negative productivity shock, as can be seen in equation 15(b). Output falls in both the domestic and foreign country due to the negative productivity shock. This fact is observed from the expression for output in equation (15a). A beneficial supply shock ( positive value for x) increases output and reduces the composite inflation.

***Monetary and Fiscal Commitment Scenario***

Next, we consider the effects of a common productivity shock under the scenario of monetary and fiscal *commitment.* The monetary and fiscal authorities act in a committed manner with their respective private sectors in the choice of the composite inflation rate and tax rates, respectively.

The reduced-form solutions under monetary and fiscal commitment are given by:

$$y^{MFC} = \frac{-abc\delta_2 \bar{g} + (b+c)\delta_2 abx}{(b+c)\delta_2 + abc[\delta_1 E + \Omega\mu_2\delta_1 AE]} \tag{16a}$$

$$(\Pi^c)^{MFC} = \frac{abc\mu_2\delta_1 AE\,\bar{g} - (b+c)ab\mu_2\delta_1 AEx}{(b+c)\delta_2 + abc[\delta_1 E + \Omega\mu_2\delta_1 AE]} \tag{16b}$$

where,

$$E = \frac{abc}{(b+c)}\beta$$

The remaining parameters in the above reduced form solutions have been defined earlier. For similar reasons discussed under the scenario of monetary and fiscal discretion, a negative (positive) productivity shock causes output to fall (rise) and the composite inflation rate to increase (decrease).

***Comparisons between MFD and MFC scenarios without shocks***

On comparing the reduced form solutions of output, inflation, and government spending between the discretionary and commitment scenarios, without shocks, the following results are obtained. It is observed that output under monetary and fiscal discretion (MFD) is greater than that under monetary and fiscal commitment (MFC) under certain restrictions. The restrictions refer to c<1, which implies that labor supply is inelastic with respect to real wage in each country, and $\beta \geq 0.5$, which requires that in each country workers consume at least as much of home output as foreign output. An inelastic labor supply (c < 1) and an elastic labor demand with respect to real wages ( b=1/(1-a) > 1 ) implies that the labor supply curve is relatively steeper than the labor demand curve. In such a situation, if increased aggregate demand causes labor demand to shift outwards due to a derived demand effect, the increase in employment and output would be small compared to the increase in wages.

The committed monetary authority has to honor its announced inflation rate. An inelastic labor supply causes output gain to be small with inflation due to the steepness of the labor supply curve in relation to the labor demand curve. Therefore, the committed monetary authority has a lower incentive to set high inflation rate as the output gain is small compared to the rise in wage rate.

The discretionary monetary authority, on the other hand, is able to reduce the discrepancy between actual output and non-taxdistorted output by choosing a higher inflation rate than that expected by the private sector. As a result, the discretionary monetary authority chooses a higher inflation rate. From the point of view of the committed fiscal authorities, an inelastic labor supply curve relative to the labor demand curve provides an incentive to set higher taxes. This may be attributed to the fact that the steepness of the labor supply curve compared to the labor demand curve causes output loss to be small, when the labor demand curve shifts to the left with higher taxes. In fact, with a steep labor supply curve, the wage rates may fall more

than the reduction in output. Therefore, committed fiscal authorities have an incentive to set higher tax rates. The higher taxes under commitment compensates for the lower seigniorage revenues resulting from lower inflation in the commitment case.

The discretionary fiscal authorities may tend to choose lower tax rates than the committed authorities for short-term economic stimulus. The discretionary authorities choices of lower taxes may be compensated by the higher seigniorage revenues obtained on choosing a higher inflation rate. The higher tax distortions under commitment would be responsible for lowering output compared to the discretionary regime.

On comparing the two regimes in the absence of the supply shock, inflation is higher in the discretionary scenario while taxes are higher under the commitment scenario. When the difference between taxes in the commitment and discretionary regimes are greater than the difference between seigniorage revenues, then the tax effect is said to dominate the seigniorage effect. Alternatively, when the difference between the seigniorage revenues in the discretionary and commitment scenarios are greater than the difference between the tax revenues, the seigniorage effect would dominate the tax effect.

***Comparisons between MFD and MFC scenarios in presence of Supply Shock***

Comparisons of output and inflation between the *discretion* and *commitment* scenarios, in the presence of the productivity shock, depends on the relative dominance of the tax effect and the seigniorage effect. The tax effect and seigniorage effect can be measured by comparing the government budget constraints under discretion and commitment scenarios:

$$g^{MFD} \gtreqless g^{MFC}$$

$$\Rightarrow \tau_t^{MFD} + \Omega(\Pi^C)^{MFD} \gtreqless \tau_t^{MFC} + \Omega(\Pi^C)^{MFC}$$

$$\tau_t^{MFC} > \tau_t^{MFD}, \&$$

$$(\Pi^C)^{MFD} > (\Pi^C)^{MFC}$$

$$(\tau_t^{MFC} - \tau_t^{MFD}) > \Omega[(\Pi^C)^{MFD} - (\Pi^C)^{MFC}]$$

If the final inequality is satisfied then the tax effect dominates the seigniorage effect, and the government spending under commitment is greater than under discretion. This follows from the government budget constraint. On the other hand, if the seigniorage effect dominates, then government spending under discretion is higher.

***Tax effect dominates the Seigniorage effect :***

When the tax effect dominates the seigniorage effect, a larger after-tax real income may become available in a discretionary environment. The lower taxes under *discretion* could outweigh the higher inflation, and result in a high after-tax real income. This could induce a larger number of firms to enter the market and the demand may become more elastic than under the *commitment* scenario. In the *commitment* case, the firms would ex ante know their after-tax real income, and there may be no tax incentives for new firms to enter the market. As a result, the demand

would be relatively inelastic under the commitment scenario. Under this situation, the leftward shift in the aggregate supply curve, due to the adverse supply shock, would cause a larger output (or, a smaller contraction in output) under *commitment* relative to the discretionary scenario. Thus, when the tax effect dominates the seigniorage effect, the output objective (say, in terms of the convergence criteria) might be better met under a policy commitment scenario in the presence of an adverse supply shock. In the presence of a beneficial supply shock, on the other hand, a rightward shift in the aggregate supply curve would cause a larger output gain under the discretionary scenario due to the relatively elastic aggregate demand curve.

Inflation comparisons could be explained using a similar line of reasoning. Under a discretionary setting, the fiscal authorities could choose a lower tax rate than that expected by the private sector in order to increase output. This would cause a larger after-tax real income for firms, compared to the *commitment* scenario, if the tax effect dominates the seigniorage effect. The demand may become more elastic under the *discretionary* scenario with entry of firms. As a result, inflation could be lower under discretion in the presence of the adverse productivity shock. Therefore, the inflation objective may be better satisfied under a discretionary environment, when the tax effect dominates the seigniorage effect. In the presence of a positive supply shock, inflation would be lower under commitment due to relatively inelastic aggregate demand.

***Seigniorage effect dominates the Tax effect***

If the seigniorage effect dominates the tax effect, then the higher inflation under *discretion* would reduce after-tax real income, and may induce firms to leave. The demand could then become more inelastic under *discretion* causing output to be higher (or, a smaller decline in output) than under commitment, with a given shift in the aggregate supply curve, following an adverse productivity shock. Under commitment, lower inflation would cause an increase in after-tax real income and as more firms enter, aggregate demand may be more elastic. In this situation, the output objective could be better met under a discretionary policy framework. Under a beneficial supply shock, output gain is larger under the commitment policymaking as the aggregate demand is more elastic

If seigniorage effect dominates the tax effect, after-tax real income would fall due to the choice of a higher inflation by the *discretionary* monetary authority. The decrease in the number of firms could make the demand more inelastic under this environment, and result in a higher inflation following a given adverse supply shock. Commitment policy would better meet the inflation convergence criteria under this situation. Under a beneficial supply shock, on the other hand, inflation would be lower under the discretionary setting as the demand is relatively inelastic. The government expenditure is determined from the seigniorage revenues and taxes. As the inflation and output comparisons depend on the relative size of the tax effect and the seigniorage effect, so would the government expenditure comparisons between the two scenarios. Summarizing the outcomes under the adverse productivity shock in Table 1, it is seen that the output objective and the inflation objective are better met in the discretionary or commitment scenario depending on the relative dominance of the tax effect and the seigniorage effect.

**Table 1**
**Adverse Supply Shock matrix**

| | Tax effect(TE) > Seigniorage effect (SE) | SE > TE |
|---|---|---|
| Commitment | Output objective<br>a. $y^{MFC} > y^{MFD}$ | Low Inflation objective<br>b. $(\pi^c)^{MFC} < (\pi^c)^{MFD}$ |
| Discretion | Low Inflation objective<br>c. $(\pi^c)^{MFD} < (\pi^c)^{MFC}$ | Output objective<br>d. $y^{MFD} > y^{MFC}$ |

where, $y^{MFC}$ : Output under Monetary and Fiscal Commitment

$y^{MFD}$ : Output under Monetary and Fiscal Discretion

$(\pi^c)^{MFC}$ : Inflation under Monetary and Fiscal Commitment

$(\pi^c)^{MFD}$ : Inflation under Monetary and Fiscal Discretion

**Table 2**
**Beneficial Supply Shock matrix**

| | Tax effect(TE) > Seigniorage effect (SE) | SE > TE |
|---|---|---|
| Commitment | Low inflation objective<br>e. $(\pi^c)^{MFC} < (\pi^c)^{MFD}$ | Output objective<br>f. $y^{MFC} > y^{MFD}$ |
| Discretion | Output objective<br>g. $y^{MFD} > y^{MFC}$ | Low inflation objective<br>h. $(\pi^c)^{MFD} < (\pi^c)^{MFC}$ |

Table 2 summarizes the scenarios under which the output objective and the low inflation objective are best met in the presence of a positive beneficial supply shock.

**CONCLUSION**

A negative productivity shock which affects both countries' economies in the same way, increases the domestic and foreign inflation rate due to the reduction in aggregate supply in the two economies. The composite inflation rate, which is a

weighted average of the domestic and foreign inflation rates, therefore rises with a negative productivity shock. Output falls in both
domestic and foreign country due to the negative productivity shock. Under a beneficial supply shock, domestic and foreign inflation rates fall, and output increases in both countries.

Comparisons of output, inflation and government expenditure between the *discretion* and *commitment* scenarios, in the presence of the productivity shock, depends on the relative dominance of the tax effect and the seigniorage effect, as discussed in detail in section II. Summarizing the outcomes under the adverse productivity shock, the following conclusions are obtained. The output objective and the inflation objective are better met in the discretionary or commitment scenario depending on the relative dominance of the tax effect and the seigniorage effect. When the tax effect dominates the seigniorage effect the output objective is better met under the commitment scenario, while the inflation objective is better achieved in the discretionary scenario. When the seigniorage effect dominates the tax effect, the commitment scenario is desirable for meeting the low inflation objective, while the discretion scenario is suitable for the output objective. In the presence of a beneficial supply shock, the output objective is better achieved under the discretionary setting while the low inflation objective occurs better under commitment when the tax effect dominates the seigniorage effect. If the seigniorage effect dominates, the output objective is better met under the policy commitment setting, while the low inflation objective is better achieved under the discretionary scenario.

## REFERENCES

Alesina, A. and G.Tabellini (1987) "Rules and Discretion with Noncoordinated Monetary and Fiscal Policies," *Economic Inquiry* 25, 619-630.

Bryson, J., H. Jensen and D.VanHoose (1993) "Rules, Discretion and International Monetary and Fiscal Policy Coordination," *Open Economies Review* 4, 117-132.

Bryson, J. (1994) "Macroeconomic Stabilization through Monetary and Fiscal Policy Coordination: Implications for the European Monetary Union," *Open Economies Review* 5, 307-326.

Cukierman, A.(1994) *Central Bank Strategy, Credibility, and Independence: Theory and Evidence,* Cambridge: MIT Press

Duca, J. (1987) "The spillover effects of nominal wage rigidity in a multisector economy," *Journal of Money, Credit, and Banking* 19, 117-121.

Duca, J. and D. VanHoose (1990) "Optimal Monetary Policy in a Multisector Economy with an Economywide Money Market," *Journal of Economics and Business* 42, 253-263.

Rogoff, K. (1985) "Can international monetary policy be counterproductive?" *Journal of International Economics* 18, 199-217.

Tabellini, G. (1990) "Domestic politics and the international coordination of fiscal policies," *Journal of International Economics* 28, 245-265.

Van Aarle, B. and F. Huart (1999) "Monetary and fiscal unification in the EU: a stylized analysis," *Journal of Economics and Business* 51, 49-66.