Monetary-Fiscal Policy Interactions and Commitment Versus Discretion in a Monetary Union*

Avinash Dixit [a], Luisa Lambertini [b,†]

[a] *Princeton University*
[b] *University of California, Los Angeles*

Abstract

We consider monetary-fiscal policy interactions in a monetary union. If monetary and fiscal authorities have different ideal output and inflation targets, the Nash equilibrium output or inflation or both are beyond the ideal points of all authorities. Leadership of either authority is better. Fiscal discretion entirely negates the advantage of monetary commitment: the optimal monetary rule is equivalent to discretionary leadership of monetary over fiscal policy. Agreement about ideal output and inflation creates a monetary-fiscal symbiosis, yielding the ideal point despite disagreement about the relative weights of the two objectives, for any order of moves, without fiscal coordination, and without monetary commitment.

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†Corresponding Author: Department of Economics, University of California, Los Angeles, CA 90095–1477, USA. Tel: (310) 206-1256; fax: (310) 825-9528
E-mail addresses: dixitak@princeton.edu (A. Dixit), luisa@econ.ucla.edu (L. Lambertini)

1 Introduction

The Economic and Monetary Union (EMU) in Europe has a common central bank that decides monetary policy, but each member country's government decides its own fiscal policy. The Maastricht Treaty stipulates that the European Central Bank (ECB) should be independent of day-to-day political control from the member countries. This raises some new issues for the conduct of monetary and fiscal policies in the EMU. First, the monetary policy of the ECB and the fiscal policies of the member countries are decided separately (as a non-cooperative game); this leads to a Nash or leadership equilibrium depending on the structure of the game. Second, the ECB is likely to be more conservative than the politicians who run the treasuries in the member countries, either by explicit mandate or by natural inclination. This conservatism may concern both the ideal levels of outputs and inflation and the tradeoffs among them. This conflict of objectives raises the possibility that the resulting equilibrium is suboptimal.

In this paper we examine the interaction of monetary and fiscal policies in a monetary union and find some new results and suggestions regarding the design of the policy institutions. We consider a model where monetary and fiscal policies affect output and inflation, and the policymakers have possibly conflicting objectives regarding outputs, inflation and the tradeoffs among them. Because some prices are set in advance, an unanticipated monetary expansion raises output and inflation. An unanticipated fiscal expansion of demand, especially if financed by distortionary taxation, reduces supply but puts an upward pressure on prices; an unanticipated supply-side fiscal policy, such as a reduction in distortionary taxation or a production subsidy, increases the supply of goods, and it may also lower private demand and prices if financed by lump-sum taxation. When monetary policy is discretionary, the conflict of objectives leads to a non-cooperative race between the monetary and the fiscal authorities. With fiscal policies trying to achieve output beyond the central bank's ideal, and the monetary policy trying to achieve inflation below the fiscal authorities' ideal, in the resulting Nash equilibrium both inflation and output can be more extreme than the ideal points of all policymakers. In this setting, giving leadership (first-mover advantage) to either the monetary or the fiscal authorities can produce less extreme outcomes. The authorities with first-mover advantage anticipate the reaction of the second-moving authorities and avoid the suboptimal race between policies.

Concerning central bank independence, we find that the value of precommitment in monetary policy is completely negated if fiscal policies are discretionary. It is well known that in a model of monetary policy alone, precommitment (in the form of rule specifying how the actual policy will respond to all possible realizations of the stochastic shocks) leads to better outcomes, as it eliminates the inflation bias. With discretionary fiscal policy, the ex-post reaction functions of the fiscal authorities act as constraints on the monetary rule. The optimal monetary rule delivers the same outcome as discretionary leadership of monetary policy over fiscal policies for every realization of the shocks.

These results suggest that, when there is a conflict of objectives among the monetary and fiscal authorities, constraints on fiscal policy, perhaps along the lines of the limits set by the Pact for Stability and Growth, may be useful in shifting the fiscal reaction functions and achieve more desirable output-inflation outcomes.

If the central bank and the governments agree on the ideal levels of output and inflation, the desired goals are achieved despite any disagreement about the relative importance of the two goals, irrespective of which authority moves first, despite lack of cooperation among the policy-makers and without the need for monetary commitment. This result, which we call the symbiosis of monetary and fiscal policies, indicates that achieving a consensus among policymakers on the ideal levels of output and inflation is more important than other institutions in eliminating extreme and suboptimal outcomes.

2 Literature Review

Several works have considered the interaction of monetary and fiscal policies in a monetary union. Sibert (1992), Levine and Brociner (1994) and Beetsma and Bovenberg (1998) consider monetary-fiscal interaction in a monetary union where the purpose of fiscal policy is the provision of public goods. This literature suggests that a monetary union with decentralized fiscal decisions and discretionary monetary policy produces an inflationary bias and excessive spending on public goods; fiscal coordination or fiscal leadership may discipline fiscal and monetary policy. In this paper, we focus on the countercyclical role of fiscal policy. We consider a central bank and a government with possibly conflicting goals over output and inflation, and study the equilibria with and without monetary commitment, including Nash and leadership equilibria.

Dixit and Lambertini (2000 a) study in detail the case where the monetary and fiscal authorities agree about the ideal levels of output and inflation. This paper generalizes the work of Dixit and Lambertini (2000 a) to allow for the monetary and fiscal authorities to have different ideal outcomes.

Cooper and Kempf (2000) analyze monetary and fiscal policy with and without a monetary union in a two-country setting where the monetary and fiscal authorities agree on the policy goals. Unlike the setting of our model, the two authorities share a budget constraint in Cooper and Kempf. Each person gets an idiosyncratic shock that determines their preference between home and foreign goods; moreover, there is a cash-in-advance requirement in the currency of the good to be purchased and the exchange rate market cannot be accessed after the idiosyncratic shock is realized. The benefits of joining the union are that individuals can hold the optimal quantity of money; the costs are that each fiscal authority is tempted to raise its own GDP via expansionary monetary policy, passing on some of the costs to the other country in the form of higher common prices. When the monetary authority has leadership, a monetary union is Pareto-improving; however, if the fiscal authorities have leadership or monetary transfers to the fiscal authorities are constrained, a monetary union is welfare improving only if the aggregate shocks are highly correlated.

3 The Model

We consider a Barro-Gordon (1983) type model with n countries belonging to a monetary union. There is a common central bank, and n fiscal authorities, one in each member country. The central bank chooses a policy variable π_0, such as the money supply or a nominal interest rate, and determines the controlled part of inflation; higher π_0 means a more expansionary monetary policy. The fiscal authority in country i chooses a policy variable x_i, which can be government spending on goods and services or public investment, a production subsidy, or a cut in distortionary taxation; a larger x_i means a more expansionary fiscal policy.

The GDP levels of the countries are given by

$$y_i = \overline{y}_i + \sum_j a_{ij}\, x_j + b_i\, (\pi - \pi^e) \qquad i = 1, \ldots n, \tag{1}$$

or in vector-matrix form

$$y = \overline{y} + A\, x + (\pi - \pi^e)\, b \tag{2}$$

The common inflation level is given by

$$\pi = \pi_0 + \sum_i c_i x_i = \pi_0 + c' x \tag{3}$$

Dixit and Lambertini (2000 b) construct a micro-founded model with monopolistic competition and nominal rigidities which yield the reduced form (1) and (3).

In the output equation (1), [1] $\overline{y}_i$ is the natural rate of output. [2] Each a_{ii} shows the effect on GPD of that country's own fiscal policy, and the a_{ij} for $j \neq i$ are the spillovers of one country's fiscal policy on others. These can be positive for Keynesian demand effects and negative for crowding out effects; the algebra of the model works perfectly well in either case. [3] In the last term on the right-hand side, π^e is the inflation expected by the private sector, so the term is the usual supply effect of surprise inflation; $b_i > 0$.

In equation (3), inflation is the sum of the component π_0 controlled by the central bank, and a further contribution arising from the fiscal policies of the member countries. This may be because the central bank is in practice forced to accommodate fiscal expansion to some extent, or it may be a change in the equilibrium price of goods depending on the balance between the fiscal injection of demand and its effect on costs due to changes in tax distortions or public investment. Thus c_i can have either sign.

For ease of exposition we will focus on the case where $a_{ii} > 0$ and $c_i > 0$ for all i; other possibilities are examined in detail for the one-country case in Dixit and Lambertini (2000 b).

The vector of the natural rates of output $\overline{y}$, the matrix A summarizing the fiscal policy own and cross effects, the vector b for the supply effects of surprise inflation and the vector c of the effects of fiscal policies on inflation, are all stochastic shocks. We denote the whole vector of these shocks by $z = (\overline{y}, A, b, c)$. The policy variables π_0 and x are implemented after the shocks are observed, and therefore are written as functions $\pi_0(z)$ and $x(z)$ (although the functional form may be fixed before the shocks are observed in regimes where policies are precommitted). The resulting outcomes of GDPs and inflation are then also realization-specific or functions $y(z)$ and $\pi(z)$; to simplify the notation, however, we drop the dependence of output, inflation and the policy variables on z whenever it does not create confusion.

The private sector's expectations are rational, and are formed before any of these shocks are realized and before the policy variables are chosen. Therefore

$$\pi^e = E_z[\pi(z)] \equiv \int \pi(z) \tag{4}$$

where the integral is multi-dimensional, over the joint distribution of z.

Each fiscal authority wants to minimize its loss function defined by

$$L_i^F = \frac{1}{2}\,\theta_i^F\,(y_i - y_i^F)^2 + \frac{1}{2}\,(\pi - \pi_i^F)^2\,, \tag{5}$$

where y_i^F and π_i^F are country-i fiscal authority's ideal levels of output and inflation; $y_i^F > \bar{y}_i$, so extra output is desirable. In a monopolistic competitive setting, for example, output is inefficiently low because the producers price above marginal cost. θ_i^F is weight attached by this authority to output relative to its dislike of inflation.

The common central bank minimizes a similar loss function

$$L^M = \frac{1}{2}\,\sum_i\,\theta_i^M\,(y_i - y_i^M)^2 + \frac{1}{2}\,(\pi - \pi^M)^2\,, \tag{6}$$

or

$$L^M = \frac{1}{2}\,(y(z) - y^M)'\,\Theta^M\,(y(z) - y^M) + \frac{1}{2}\,(\pi(z) - \pi^M)^2\,,$$

where Θ^M is the diagonal matrix with entries θ_i^M and y^M the vector of output goals for the monetary authority.

We consider the case where the central bank is at least as conservative as all fiscal authorities in all respects:

$$y_i^M < y_i^F, \qquad \pi^M < \pi_i^F, \qquad \theta_i^M \leq \frac{\theta_i^F}{n}, \qquad \text{for all } i. \tag{7}$$

The special case where the authorities have common ideal points is discussed in Section 6.

Fiscal policy is discretionary while monetary policy can be committed or discretionary. The timing of events is as follows. [1] If monetary policy is committed, the central bank chooses its policy rule $\pi_0 = \pi_0(z)$; if monetary policy is discretionary, nothing happens. [2] The private sector forms expectations π^e. [3] The stochastic shocks are realized. [4a] If monetary policy is discretionary, the central bank chooses π_0; if monetary policy is committed, the central bank implements the rule $\pi_0(z)$ chosen at step 1. [4b] The country governments choose x_i. When both policies are discretionary, they may be chosen simultaneously or sequentially, corresponding to Nash and leadership equilibria. We consider different possibilities.

4 Discretionary Policies

4.1 Nash Equilibrium

Here the steps 4a and 4b occur simultaneously. The first-order condition with respect to π_0 gives

$$\sum_i \theta_i^M (y_i - y_i^M) b_i + (\pi - \pi^M) = 0, \tag{8}$$

and the first-order condition with respect to x_i is

$$\theta_i^F (y_i - y_i^F)(a_{ii} + b_i c_i) + (\pi - \pi_i^F)\, c_i = 0. \tag{9}$$

Substituting for y_i from the fiscal first-order condition into the monetary first-order condition and solving

$$\pi = \frac{\pi^M - \sum_i k_i \pi_i^F - \sum_i \theta_i^M b_i (y_i^F - y_i^M)}{1 - \sum_i k_i} \tag{10}$$

where

$$k_i = \frac{\theta_i^M}{\theta_i^F} \frac{b_i}{b_i + a_{ii}/c_i},$$

All the k_i are positive under our assumption that the a_{ii} and c_i are all positive. Using our assumption (7) about the relative conservatism of the monetary authority, we have $k_i < 1/n$ and $\sum_i k_i < 1$. Therefore

$$\pi < \frac{\pi^M - \sum_i k_i \pi^M}{1 - \sum_i k_i} = \pi^M < \pi_i^F, \qquad \text{for all } i, \tag{11}$$

and

$$y_i = y_i^F - \frac{c_i}{\theta_i^F (c_i b_i + a_{ii})} (\pi - \pi_i^F) > y_i^F > y_i^M \qquad \text{for all } i. \tag{12}$$

In other words, the outcome is more extreme than the ideal points of all policymakers. This is the result of a non-cooperative "race" between the two sets of authorities – fiscal policies try to achieve output beyond the central bank's ideal, and the monetary policy tries to reduce inflation below the fiscal authorities' ideal. The result – too high output and too low inflation – is undesirable because individuals have little leisure and because of some future consequences such as excessive debt and higher interest rates that are not explicitly modelled. If all the $k_i > 1/n$, which occurs when all a_{ii}/c_i are in the interval $(-1, \theta^M/\theta_i^F - 1)$, the Nash outcome is too little output and too high inflation, which is also undesirable.

4.2 Monetary Leadership

Here monetary policy is chosen at step 4a; fiscal policies are chosen at step 4b. Let H be the diagonal matrix with entries h_i,

$$h_i \equiv \theta_i^F (\frac{a_{ii}}{c_i} + b_i).$$

Hence, the first-order conditions with respect to x can be stacked as follows

$$H[y(z) - y^F] + \pi(z)\, e - \pi^F = 0, \tag{13}$$

where e is the unit vector of dimension $n \times 1$. Substituting for output and inflation, fiscal policy is given by

$$x(z) = J^{-1}[-(Hb + e)\pi_0(z) - H(\bar{y} - b\pi^e - y^F) + \pi^F] \tag{14}$$

where $J \equiv H(A + bc') + ec'$. Inflation and output, as of the beginning of step 2 and taking into account the action of the fiscal authority at step 4b, are

$$\pi(z) = [1 - c'J^{-1}(Hb + e)]\pi_0(z) - c'J^{-1}[H(\bar{y} - b\pi^e - y^F) - \pi^F] \tag{15}$$

and

$$y(z) = y^F - H^{-1}\left\{[1 - c'J^{-1}(Hb + e)]\pi_0(z) - c'J^{-1}[H(\bar{y} - b\pi^e - y^F) - \pi^F]\right\} e + H^{-1}\pi^F. \tag{16}$$

Under discretionary monetary leadership, the central bank chooses $\pi_0(z)$ to minimize her loss function (6), recognizing that the choice of her $\pi_0(z)$ determines $y(z)$ and $\pi(z)$ according to (16) and (15). The first-order condition for the monetary authority is

$$[\ -(y(z) - y^M)'\Theta^M H^{-1} e + \pi(z) - \pi^M\ ]\ [1 - c'J^{-1}(Hb + e)] = 0\,.$$

If $1 - c'J^{-1}(Hb + e) \neq 0$, which is true in almost all states z (that is, with probability 1), this reduces to

$$-(y(z) - y^M)'\Theta^M H^{-1} e + \pi(z) - \pi^M = 0. \tag{17}$$

We can combine this with the fiscal first-order conditions (13) to write

$$\pi = \frac{\pi^M + (\pi^F)'\, H^{-1}\, \Theta^M\, H^{-1}\, e + (y^F - y^M)\, \Theta^M\, H^{-1}\, e}{1 + e'\, H^{-1}\, \Theta^M\, H^{-1}\, e}$$

Under our assumptions, the diagonal matrices H and Θ^M have all positive entries, and $(y^F - y^M)$ is a vector with positive components. Therefore π is larger than a weighted average of the ideal inflation rates of all the authorities, by an amount that depends on the differences in ideal outputs between monetary and fiscal authorities. This need not be an extreme outcome in the way that the Nash equilibrium in the previous section was. In particular, if the common central bank is not conservative with regard to its ideal output levels, so $y^M = y^F$, then π is a weighted average of all the ideal inflation rates.

The case of discretionary fiscal leadership, where step 4b comes before 4a (omitted to save space) can be analyzed similarly. It is found that each component of y is larger than a weighted average of the ideal outputs by an amount that depends on the difference in ideal inflation rates between the monetary and fiscal authority.

5 Monetary Commitment

Consider now the regime where the central bank can commit to a monetary rule. The monetary authority now chooses the whole function $\pi_0(\cdot)$ at step 1, and can also be regarded as choosing π^e subject to the rational expectations constraint (4). The Lagrangean for this choice problem is

$$\mathcal{L}_{\mathcal{M}} = \int \left\{ \frac{1}{2}(y(z) - y^M)'\Theta^M(y(z) - y^M) + \frac{1}{2}(\pi(z) - \pi^M)^2 - \lambda\pi(z) \right\} + \lambda\pi^e, \qquad (18)$$

where λ is the Lagrangean multiplier for the constraint (4), and $y(z)$ and $\pi(z)$ are given as functions of $\pi_0(z)$ by (15) and (16). The first-order condition with respect to $\pi_0(z)$ gives

$$[-(y(z) - y^M)'\Theta^M H^{-1} + \pi(z) - \pi^M - \lambda]\,[1 - c'J^{-1}(Hb + e)] = 0\,,$$

or with probability 1,

$$-(y(z) - y^M)'\Theta^M H^{-1} + \pi(z) - \pi^M - \lambda = 0 \qquad (19)$$

and the first-order condition with respect to π^e gives

$$\lambda + \int \left[-(y(z) - y^M)'\Theta^M H^{-1} + \pi(z) - \pi^M - \lambda\right][c'J^{-1}Hb] = 0 \qquad (20)$$

which, making use of (19), simplifies to

$$\lambda = 0.$$

The constraint is on the border line of not binding. Using $\lambda = 0$, (19) simplifies to

$$-(y(z) - y^M)'\Theta^M H^{-1} e + \pi(z) - \pi^M = 0,$$

which is the same as the first order condition for discretionary monetary leadership, (17). Either, together with (13), gives the solution to the monetary leadership case.

In other words, the existence of fiscal discretion totally negates any value of monetary commitment by the common central bank. Dixit and Lambertini (2000 b) derived and discussed this result in the one-country case. Intuitively, the ex-post reaction functions of the fiscal authorities act as constraints on the monetary rule. In the context of a monetary union, it suggests that "fiscal stability" agreements may serve to shift the fiscal reaction functions – the first-order conditions (13) – and thereby improve the outcome of monetary commitment and leadership.

How do the EMU's specific provisions under the Stability and Growth Pact fare in this respect? They impose upper limits on permissible fiscal deficits in relation to the GDP in each country. In a multi-period model where x_i can be interpreted as the fiscal deficit in country i, a fiscal limit that depends linearly to the actual GDP will take the form

$$x_i \leq \gamma_i + \delta_i \, y_i \,, \qquad \text{or} \qquad x \leq \gamma + \Delta \, y,$$

where γ_i and δ_i are parameters and γ and Δ are respectively the vector and the diagonal matrix formed from them. Using (2), these become

$$(A^{-1} - \Delta) \, y - A^{-1} \, b \, \pi \leq \gamma + A^{-1} \, \bar{y} - A^{-1} \, b \, \pi^e \,.$$

This is a linear restriction in (y, π) space, and the fiscal reaction functions will be modified where the constraints bind. The constraining functions bear no simple relation to the reaction functions; however, the Nash and leadership equilibria must satisfy them. In a one-country model, Dixit and Lambertini (2000 b) consider a fiscal limit that that depends linearly to GDP provided GDP is above a given threshold. There is a good case for examining the issue explicitly in the context of a monetary union and paying closer attention to the design of restrictions on fiscal policies. This seems an important topic for future research.

6 No-Conflict of Objectives

If the ideal points of the monetary authority coincide with those of all fiscal authorities, so

$$y_i^F = y_i^M = y_i^*, \qquad \pi_i^F = \pi^M \qquad \text{for all } i,$$

then all of the above equilibria collapse to

$$y_i(z) = y_i^*, \qquad \pi(z) = \pi^*, \qquad \text{for all } i,\ z.$$

Thus the ideal output and inflation levels are attained irrespective of the weights attached by the different authorities to the two objectives, for all order of moves, and whether or not monetary policy is committed. Dixit and Lambertini (2000 a) consider this case in detail. Intuitively, when the authorities agree on the policy goals, monetary and fiscal policies aim and achieve the same desired outputs and inflation. This result suggests that, in the EMU context, it is more important to achieve a convergence or consensus on the objectives, and less important to achieve commitment or weight conservatism for the ECB.

7 Conclusions

We would like to conclude with some implications of our results for the design of institutions in a monetary union such as the EMU and suggestions for future research.

Central bank independence, given to the ECB by the Maastricht Treaty, implies that different authorities will choose monetary and fiscal policies in a non-cooperative manner. In this setting, making the central bank extra conservative (in the sense of low ideal output and inflation) is likely to make things worse. The non-cooperative interaction between the central bank and the fiscal authorities leads to a race between expansionary fiscal policy that aims to raise output and contractionary monetary policy that aims to reduce inflation. The resulting Nash equilibrium is characterized by both inflation and output that are more extreme than the ideal levels of all authorities in the monetary union.

How to avoid such extreme outcomes? If the authorities' preferences can be chosen in advance and can be made to coincide, the ideal goals for inflation and output can be attained. But if the policy preferences are fixed and in disagreement, then the outcomes can only be influenced by how institutions are designed. Giving either authority a leadership

role produces less extreme and more desirable outcomes. It may not be worth setting up a mechanism of monetary commitment, as the value of precommitment to a monetary rule is completely negated by fiscal discretion. When the fiscal authorities behave strategically, their reaction functions act as constraints on the monetary rule and the outcome is equivalent to discretionary leadership of monetary policy. Constitutional constraints on fiscal policies, such as the fiscal limits stipulated by the Pact for Stability and Growth, may be effective in shifting the fiscal reaction functions and affecting the resulting output-inflation outcome. This seems an important topic for future research.

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