Asymmetric Shocks and Fiscal Federalism in European Union*

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Abstract

The purpose of this paper is to identify the advantages and disadvantages of cooperative behaviour between national states. In particular, the current situation in Europe will be examined by modelling monetary union and European fiscal federalism. The paper will illustrate the inadequacy of European economic policy, especially in the context of asymmetric shocks. The author proposes fiscal federalism as a solution and also gives consideration to the problems that might derive from its introduction. The principal problem, that of moral hazard, is resolved using signalling theory, with an appropriate solution being found in what is known as a threshold contract.

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1 Introduction.

The first goal of this paper is to construct a model that reflects the current situation in the European Union. Specifically, the aim is to examine fiscal policy at local level, i.e. the policies pursued by the governments of the individual member states within the framework of the relevant EU treaties[1], and illustrate how this type of fiscal decentralization can, in some cases, be deleterious to the economic policy of the countries that are party to European Monetary Union. The model will then be used to assess the advantages and disadvantages of a centralised fiscal system in Europe.

A recurring bone of contention amongst economists is the role that economic policy-makers should play with respect to economic interventions. Basically, the experts tend to be either interventionists or non-interventionists. Game theory has played a leading role in this debate in that it offers economists a variety of ways of looking at the problem and provides interpretations of the apparently incomprehensible behaviour of the economic actors based on the nature of the underlying game. The 1960s and 1980s saw the introduction to monetary policy of concepts such as time inconsistency, which are now commonly used, while it has also become possible to quantify the credibility of governments and fiscal policies. A significant contribution is the monetary policy model first introduced in [14] Kydland and Prescott (1977)[2] and presented in [5] Barro and Gordon (1983b), which demonstrates that only the difference between actual and expected inflation has real effects. In another important example, [20] Rogoff (1985) shows that for an economic policy strategy to be really effective, the person appointed governor of the central bank must be a conservative individual.

The discourse between politics and economics is formalised on the basis of these and other reflections[3], which introduce, quantify and rigorously define concepts such as "reputation", "credibility" and "commitment"[4]. These reflections are also at the root of the information

[1]The Maastricht Treaty (February 1992) and the Stability and Growth Pact (Amsterdam, June 1997).

[2]This work also introduces the problem of time inconsistency and explains how it can become the reason why the good intentions of economic policy-makers often have undesired or even catastrophic effects. [17] Persson and Tabellini (1990) is recommended for a general treatment of these models.

[3]For instance, the rational expectations described in [15] Lucas (1976).

[4]On this topic, apart from [5] Barro and Gordon (1983b), [14] Kydland and Prescott (1977), and [15] Lucas (1976), also cf., for example,[12] Dixit and Londregan (2000), [17] Persson and Tabellini (1990), [10] Cukierman and Meltzer (1986), and [2] Alesina and Tabellini (1990).

economy, which is just part of an even larger package: neo-Keynesian economics or the microeconomics of general economic equilibrium.

The problem dealt with in this paper is that posed by asymmetric shocks, i.e. shocks that affect just one country in the EU, in the context of a decentralised fiscal policy and a single monetary policy.

Europe has one central bank and n fiscal authorities, where n is equal to the number of European partners. When asymmetric shocks occur[5], the governments of the countries concerned have no macroeconomic instruments with which they can resolve the resulting disequilibrium, as the example below will show.

A good example of an asymmetric shock is a sudden and dramatic drop in investment demand in an EU country which does not, however, affect the aggregate demand of the other countries. If the first country were not a member of the EU, the natural reaction to this disequilibrium would be monetary or fiscal expansion. But in the current situation the EU's member states cannot set their interest rates independently, indeed they have no room for manoeuvre at all with respect to interest rates and their fiscal policy is blocked by the treaties they have signed. There are other macroeconomic solutions, however: 1. Price and salary variations; 2. Shifts in the factors of production; 3. If there were a centralised fiscal policy, transfers would help to expand demand in the country concerned.

These solutions have been adopted in the USA, but it is difficult to apply the first two to Europe[6], and the third cannot be implemented because Europe does not have a centralised fiscal policy.

A European fiscal policy or, more realistically, a large degree of coordination between the fiscal policies of the individual European countries, would appear to be the most obvious and natural solution of those proposed above. The others would require a degree of mobility in the economic system that would be difficult to achieve in Europe in the short term (suffice to mention the numerous language barriers, a problem that does not exist in the USA).

Let us suppose, therefore, that Europe has a common fund[7], which it activates when one or more countries are affected by an asymmetric

[5]Dixit (2000) [12] distinguishes between two types of shock: There are those that are exogenous to the European Union, such as an oil crisis or a terrorist attack as severe as that of 11 September 2001, and then there are factors that are endogenous to the European Union, such as the fiscal policies of the European governments, which are capable of harming the economies of other member states.

[6]The possibility of implementing price and salary variations or shifts in the factors of production depends on the levels of labour market mobility and flexibility, both of which are extremely weak in Europe.

[7]Persson and Tabellini (1996) [18] and [7] Beetsma and Jensen (1999) present a similar proposal.

shock. The country affected would receive a financial contribution towards lowering taxes or increasing government spending, for example. In the event of a recession, however, the fund would not be activated because the Maastricht Treaty actually provides for the possibility of deviating from the parameters.

We can now analyse the problem of asymmetric information as created by the introduction of a centralised fiscal policy system.

In reality, even without a centralised fiscal system, there are still asymmetries of information in the EU, for example moral hazard[8] and adverse selection.

In the case of moral hazard, national governments can exploit the EU to their own advantage, for example by sharing their national debts with all of the other member states and enjoying low interest rates[9] without, however, actually reducing their debts. In the case of adverse selection, by contrast, a single government might make promises that it cannot maintain and that the other countries cannot assess because they lack information that is available only to the government in question. A system of transfers managed by the EU would introduce new elements of asymmetric information and would invite duplicity on the part of the national governments.

One can make a clear analogy between this type of fiscal system and the insurance system. Just as one pays insurance so as to receive compensation in the event of damages, the national states would contribute to a common fund that they could draw on in the event of shocks so as to help their economies recover again.

2 The model

The players are the governments of two European countries, i=1,2, with homogenous populations and similar socioeconomic characteristics. Monetary policy is considered to be independent and managed by the European Central Bank. Since the two countries are considered ex-ante identical, the phase of acceptance of the treaties can be disregarded - the two governments will accept restrictions that apply to both countries.

[8]Introduced to the literature by [1] Akerlof (1970).

[9]In general, a country with a high national debt produces a deficit each year which is structured as follows: deficit=(interest rate) (national debt)+(government spending)-(taxes)-(inflation)(national debt). Cf., for example, [9] Blanchard (2000). One can deduce from this equality that low interest rates reduce the deficit, but that a high national debt is accompanied by high interest rates and high inflation. Therefore, countries such as Italy and Belgium, which have debts that exceed 100% of their GDP, immediately benefited from their entry into EMU.

We set up a game in two stages in which each country can be harmed in each stage by two types of factor: first, an asymmetric shock and, second, what we call a "total system shock" that affects the whole of Europe. An example of a total system shock might be a severe hike in the price of oil, which would have negative consequences for all the countries in Europe, or an unfavourable economic trend in the USA, which would also influence Europe as a whole.

2.1 Fiscal policy

The first problem to be dealt with is the government's objective function and its microeconomic foundations. We will identify a continuous utility function and this will bring us into a continuous strategy space that will configure problems with different connotations to those posed by discrete strategies.

One solution for the objective function would be electoral models that maximise the probability of re-election for the government[10]. However, a model of this kind probably obscures interactions between the government and private agents.

Another solution, perhaps more common in the literature, is that proposed by [5] Barro and Gordon (1983a), where one assumes that the government is "obliging" and "indulgent" towards the private sector. The assumption is that the government's objective function coincides with that of the agent representing the economy considered. The public goods supplied by the government have a positive weight in the utility function of the private agents.

We introduce the microeconomic foundations of our model proceeding from the idea that the macro economy is the natural continuation of the micro economy. Ideally, the macro economist should begin the specification from the agents, the facilities and the technology and, proceeding on the assumption of individual rationality, work through to the macro variables. Let us consider a population with overlapping generations and N identical individuals. Each agent lives for two periods, works, consumes and leaves no inheritance.

Let us assume further that the technology exhibits constant returns to scale. The representative agent's budget constraint is:

$$C_{t+1}P_{t+1} = P_tO_t \tag{1}$$

where P_t and P_{t+1} are the prices at times t and $t+1$, respectively, O_t is the supply of labour at time t and c_{t+1} is consumption at time $t+1$, under the assumption that one unit of labour produces one unit of

[10] Cf., for example, [3] Alesina (1987), or [18] Persson and Tabellini (1996).

consumer goods. Moving on to the logarithms to exploit their linearity and using the generic notation $x = \lg Z$, (1) then gives us:

$$c_{t+1} = p_t + o_t - p_{t+1} \tag{2}$$

In order to arrive at a linear supply curve, we assume that the utility function has the following functional form[11]:

$$U_{it} = -(1+a)O_{it}o_{it} + O_{it} + aO_{it}c_{i,t+1} + G_{it} + \Pi_{it}O_{it} \tag{3}$$

where i refers to the *i-th* country and t refers to time. G corresponds to government spending, while $\Pi_{it}$is the contribution[12] from the EU in the event of an emergency. The parameter a is defined positively. It is useful to note that (16) should be interpreted as a type of Neumann-Morgenstern utility function

Now we can formalise the shocks, define each element of (16) and solve the optimisation problems. The point of departure is to consider two different types of shock. The first, which is endogenous to the system, can affect just one country at a time. We assume that in period t, omitting the reference to the country i, there are LV_t agents, where L is a scale factor and V_t is a sequence of normal random variables (subject to the usual assumptions), distributed independently and identically with mean 0 and variance σ^2. If $V_t \neq 0$ is a real shock that affects the economy, the contraction of the agents via V_t will have a positive or negative effect on the economy via prices.

The second type of disturbance, the exogenous shock, affects the whole of Europe. For the sake of simplicity, let us assume that this type of shock only has inflationary effects. Thus, the rate of monetary expansion m_t is a sequence of random variables subject to the same assumptions as above.

Let us now define the remaining terms in (16).

Per capita consumption is given by:

[11] [2] Alesina and Tabellini (1990) and [7] Beetsma and Jensen (1999) classify the economic policy of governments into two strategies, F and G. The first, F, is "Europhile", in other words in accordance with the EU treaties and loyal towards the European partners. The second, G, is the strategy of a government concerned only about domestic affairs and that therefore tends to pursue only its own interests (for example, re-election). The two strategies present two different utility functions UFi and UGi.

[12] Chapter 10 of [16] McMillan (1991) is dedicated to transfers, throwing light on their potentially unexpected or even perverse effects. The possibilities range from transfers having no effect at all[13] - in the case of a product that is consumed equally in all countries - to them having negative effects on the recipient and positive effects on the donor country, see also cf. [8] Bhagwati, Brecher and Hatta (1983).

$$C_t = O_{t-1}P_{t-1}/P_t \tag{4}$$

Therefore, assuming that the supply of labour remains constant over time, we obtain:

$$G_t = LO(1 - P_{t-1}/P_t) \tag{5}$$

In other words, the supply of public goods is equal to the difference between per capita output and per capita consumption, all multiplied by the total population.

The possible extraordinary EU intervention Π_t will depend on the difference between $(VL)_{t-1} - (VL)_t$, which expresses the presence or not of a shock and which, when multiplied by current prices P_t, gives us the real quantity of the contribution that the European Union will make to the country concerned (which we assume will be equal to the damage caused by the shock). Thus, we have a sum of two addends with opposite signs:

$$\Pi_{it} = [(VL)_{i,it} - (VL)_{it}]P_t - [(VL)_{-i,it} - (VL)_{-it}]P_t \tag{6}$$

this formula has a positive sign when the *i-th* country experiences a shock, therefore it receives EU aid equal to $[(VL)_{i,it} - (VL)_{it}]P_t$, that is, equal to the entity of the shock. It has a negative sign (of the quantity $[(VL)_{-i,it} - (VL)_{-it}]P_t$) when the *i-th* country is not affected by a shock but the other country has been affected (indicated in the formula as -*i*). Given that we have hypothesised only two countries and asymmetric shocks, it is clear that the shock has to hit either one country or the other. Therefore we have a symmetric and constant-sum game. The construction of (6) is functional to this hypothesis.

Finally, let us look at the problem of optimisation in (16), which is constrained by (2). Calculating and simplifying, we obtain:

$$dU_{it}/dO_{it} = a(p_t - E[p_{t+1}|I_t] + \Pi_{it} \tag{7}$$

$E[p_{t+1}|I_t]$corresponds to the rational expectation of the agents regarding the future price, that is, the price expected by the agents in the period t for the period *t+1*, given the informative set I_t at time t.

Aggregate supply is:

$$Y_t = LV_tO_1 \tag{8}$$

In other words, given (7), in logarithms we have:

$$Y_t = l + a(p_t - E[p_{t+1}|I_t]) + v_t \tag{9}$$

Let us now look at the objective function of the ECB and then set up a game of economic policy where the two European countries will interact within the framework of the ECB's monetary policy.

2.2 Monetary policy

The ECB, which directly controls inflation, must reduce it in view of the national debt of the European partners. Inflation is a function of debts and of monetary expansion, therefore we have:

$$\pi^* = f(\Sigma_i D_i, \Sigma_{it} D_{it}, x_t) \tag{10}$$

where π^* is the ECB's target rate of inflation. The function f depends on: 1) $\Sigma_i D_i$, the sum of the (current) deficits, 2)$\Sigma_{it} D_{it}$, the sum of the deficits over time, i.e. the national debt, and 3) $x_t = m_t - m_t - 1$, monetary expansion.

Following the Taylor rule, we further have:

$$U_{ECB} = a + b(\pi^e - \pi^*) + c(y_t + y^*) \tag{11}$$

where π^e pe is expected inflation[14] and π^* is targeted inflation. In the final member of the equation we consider current and expected GDP growth.

We can then formalise the Lagrangian (of the ECB) to solve the problem of constrained extremes:

$$L_{ECB} = a + b(\pi^e - \pi^*) + c(y_t + y^*) + \lambda(\pi^* - f(\Sigma_i D_i, \Sigma_{it} D_{it}, x_t)) \tag{12}$$

which has the solutions $b + \lambda = 0, c = 0 e \pi^* - f(\Sigma_i D_i, \Sigma_{it} D_{it}, x_t)$. This last term can be approximated as shown in (13) below. In fact, $\Sigma_{it} D_{it}$ can be considered irrelevant for the inflation currently seen in Europe[15]. $\Sigma_{it} D_{it}$, on the other hand (under the hypothesis that aggregate demand for money only derives from the public sector, in other words from the governments), coincides with $)x_t$. Finally, we assume that the ECB's inflation target π^* tends towards zero. This hypothesis, apart from being realistic in the euro zone, which has a very low rate of inflation, also best interprets the approach of the current president of the ECB. It is also to be remembered that price stability is the ECB's foremost priority, as stipulated in the Maastricht Treaty[16] (indeed, the ECB seems to adhere to all the suggestions contained in the model of monetary policy proposed by [20] Rogoff

[14] In the private sector.

[15] As can be easily deduced from the following equality: Deficit=(interest rate)(national debt)+(government spending)-(taxes)-(inflation)(national debt).

[16] Cf. Article 105.1 of the Maastricht Treaty regarding the goal of price stability. In fact, even if the Maastricht Treaty describes other objectives, these are expressed vaguely and are always conditioned by the priority of price stability. Moreover, the ECB has specified that price stability is equivalent to inflation of "less than 2%". For details, cf. [19] Pifferi and Porta (1999). For a critical view, cf. p. 62 in [21] Sen (1997).

(1985)). Therefore, given the assumptions and the simplifications, we can now write:

$$\pi^* - f(\Sigma_i D_i, \Sigma_{it} D_{it}, x_t) \approx m_t - m_{t-1} = x_t \tag{13}$$

that is, the rate of monetary expansion at time t, which we call xt. If we are working under the assumption that aggregate demand for money only comes from the public sector, that is, from governments, then we can plug in another simplification

$x_t) = m_t - m_{t-1} \approx p_t - p_{t-1}$

The equilibrium between demand and aggregate supply is given by the equivalence of (9) and (13)

$$m_t - m_{t-1} = Y_t = l + a(p_t - E[p_{t+1}|I_t]) + v_t \tag{14}$$

2.3 The treaties

The fiscal policy of the national governments is severely constrained by the EU treaties. Therefore, equation (3) is subject to constraints. In particular, we should consider the deficit/GDP constraint, which is one of the most important Maastricht parameters. Let us therefore consider that deficit/GDP may not exceed a constant K=3%. Proceeding with the same symbols as above, we obtain:

$$d_{it}/y_{it} = K \tag{15}$$

Now let us see how the individual national fiscal policies interact within the framework of the ECB's monetary policy.

3 Result

We substitute the government's objective function for the ECB's inflation function. Then we let the two governments interact. We recall (16):

$$U_{it} = -(1+a)O_{it}o_{it} + O_{it} + aO_{it}c_{i,t+1} + G_{it} + \Pi_{it}O_{it} \tag{16}$$

and substitute:

$$u_{it} = o_{it} + (a + o_{it})x_t + l + (w_{it} + 2l_{it})p_t \tag{17}$$

where $xt = mt - mt-1 \approx pt - pt+1, wt = vt - vt-1$. Maximising () with respect to current prices, we obtain that the reaction function[17] of the governments is $w_{it} + 2l_{it}$. If $(VL)_{i,t-1} - (VL)_{it} = 0$, this becomes $2l_{it}$.

Recalling that our game has been constructed so as to allow a shock to affect only one country, let us consider the Nash equilibrium[18]

$$w_{it} + o_{it} + 2l_{it} = w_{jt} + o_{jt} + 2l_{jt} \tag{18}$$

Therefore, depending on the sign of w_{jt}, we will have either a positive or a negative shock to the supply of labour, which will be the opposite to the real sign of the shock. One could imagine a multi-country model where the cost of the contribution made to the country affected by the asymmetric shock is shared between all the countries.

This model gives us full risk sharing as a consequence of asymmetric shocks.

Our result implies moral hazard problems, however, which have been resolved as follows in the literature.

The principal[19] is the EU, while the agent[20] is the *i-th* government. The utility functions are S and U, respectively. The agent's information advantage is his comprehensive knowledge of the economy of his own country. Let us suppose that the *i-th* country has perfect knowledge of circumstances, causes and effects in its own economy. On the basis of this in-depth and complete information, it is therefore able to recognise whether a disturbance to a macro variable is caused by a shock, by distortions of normative policies or by some other factor. Needless to say, this is not always true in the real world. We need only recall the incessant debate being held in both Italy and Spain regarding the high rate of unemployment, i.e. whether it is due to the excessive rigidity of the labour market or to bad economic policy. The principal, who transfers the funds to the countries affected by the shocks, must navigate in uncharted waters both before and after the provision of the contribution. A request for help from a European partner could be based on a shock or might, on the other hand, be due to bad policy, be it in the form of laws, economic interventions or unscrupulous behaviour. And once the funds have been received, they can be used in the appropriate manner or for other purposes. So once

[17]The reaction function is the set of points that represent the best response of a player to every possible move by the other player. Its graphical representation is the reaction curve.

[18]In games with continuous as opposed to discrete strategies, the Nash equilibrium can be defined as the intersection of the reaction curves.

[19]The player with less information.

[20]The player with more information.

again there are information-related problems as to how to assess the efficiency or otherwise of these policies. The principal is not in a position to distinguish between scrupulous and unscrupulous behaviour, or between true and false information.

Let us consider a stochastic parameter $x_i = x(S_{it}, P_{it})$, the associated density function $f(x_i)$ and the function of the results, the state of the world, $p = p(e_i, x_i)$, where e_i defines the more or less Europhile and scrupulous policy of the *i-th* country. In this case, the random variable xi defines the (random) possibility that the country has been affected by an asymmetric shock. The policy e is influenced by x and by $e_i(x_i)$. The state of the world is known only to the agent, i.e. the *i-th* country, which may therefore use hidden information at its will. The principal, the EU, will have information $R(e_i(x_i))$[21] and will not be able to distinguish between the contributions of e_i and (x_i. The inability of the principal to acquire definitive information about the agent is the crux of the moral hazard of this game.

One possible solution is a threshold contract:

$$\Pi_i = a \text{ if } R < R^* \tag{19}$$

$$\Pi_i = b \text{ if } R \geq R^* \tag{20}$$

where $\Pi_i = \Pi_i(R(e_i(x_i)))$ is the EU's contribution to the country affected by the shock. The equilibrium:

$$max_w E[S((R(e_i(x_i)) - \Pi_i(R(e_i(x_i))] \tag{21}$$

is achieved given the constraints:

$$E[U(e_i, \Pi_i(R(e_i, x_i)))] \geq U^* \tag{22}$$

$$e_i^* = argmax E[U(e_i^*, \Pi_i(R(e_i^*, x_i)))] \tag{23}$$

This is only one of the possible solutions. In this case we would have risk sharing that would cancel out the effects of moral hazard and where the only cost would be that of contracting.

4 Conclusion

The principal conclusion of this paper is that for the EU to be able to respond to asymmetric shocks, a coordinated fiscal policy is essential. The paper has identified the problems that can ensue from fiscal

[21]The function $R(e_i(x_i))$ can also be considered the state of the European economy overall, which depends on the policies of the different countries and therefore indirectly on the relative shocks.

policy coordination, specifically that of information asymmetry. The solution proposed is to apply the information economy to the problems of moral hazard. The need for the national states to unite in confederations or organisations in order to control the market must be tied to institutions that, at all levels, enable countries to draw the maximum benefits from the coalition. The real risk is that of imperfect institutions. This simple model was used in an attempt to interpret one of the most significant problems facing the European Union with respect to internal and external stability. The governments of Europe do not appear to be anywhere near applying real fiscal federalism, but at the very least increased coordination of the single fiscal policies would seem imperative.

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