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Strategic Interactions between Monetary and Fiscal Policies:

A Case Study for the European Stability Pact*

By *Jerome Creel*

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I. Introduction

In a recent paper, Leith and Wren-Lewis (2000) – hereafter LWL – examined the interactions between monetary and fiscal policies in a closed economy with sticky prices and non-Ricardian consumers (finitely-lived agents face a higher discount factor than the government). These deviations from the neo-classical framework implied a richer set of interactions between policies than the usual channel of seigniorage revenues or surprise inflation at the core of the Fiscal Theory of the Price Level (FTPL). LWL demonstrated that two stable policy regimes could be identified: in the first one, monetary policy would be 'active' in the sense determined by Leeper (1991), i.e. reacting toughly to inflation deviations from their steady-state value; while fiscal policy would be 'passive', i.e. reacting toughly to public debt deviations from their steady-state value. In the second one, monetary policy's reactions towards inflation would be smoother whereas the government would stabilise public debt very slowly. This case was the closest to Woodford's work (2001) dealing with the FTPL.

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This theory states that the price level can be determined through the fulfilment of the intertemporal government budget constraint. This implies that a government can exogenously fix his real spending and revenue plans, and that the price level will take on the value required to adjust the real value of its contractual nominal debt obligations to ensure government solvency. The mechanism underlying the FTPL is linked to a wealth effect (Woodford 2001): if the sequence of future primary fiscal *deficits* entails an increase in the contractual nominal debt obligations of the government, households will feel wealthier and will consume more, so that the general price level will be increased until the government budget constraint has been satisfied.[1]

The FTPL has already been extended to the case of a monetary union (Woodford 1996; Bergin 2000), but within a neo-classical framework and without nominal inertia in the price setting in the short run. Moreover, net external assets were not included, although they may help the stabilisation process of both economies after a shock.

We thus extend LWL model with sticky prices to the case of two countries engaged in a monetary union and in considering optimal policies as the outcome of a static game between the two fiscal authorities and the European Central Bank (ECB).[2] We also specifically study the possible asymmetric implications of the Stability and Growth Pact (SGP), i.e. the possibility that one country could be unable to react to a shock because it has no fiscal room for manoeuvre, whereas the other country could implement a fiscal policy to stabilise the economy.[3]

The fiscal framework in the model can be justified on two grounds. First, as regards the static-game approach in a dynamic model, justifications can bear on the following argument: it is straightforward to show that, in the Euro area, countries do not abide by strictly to the dispositions of the Broad Economic Policy Guidelines (BEPG) and move back each year the deadline for achieving a 'closed-to-balance' government budget (EC 2001). Governments thus seem to act rather inconsistently, without generally taking full account of their present policies for the future. Second, pragmatism can also be called up to justify the asymmetry in the fiscal framework between the two countries within the monetary union. Such an asymmetry in fiscal policy rules is not unlikely in the Euro area. Though the Maastricht's norm on public debt has been wiped out as regards the entry of some countries in the Euro area, the public finances in these countries (Belgium, Italy and Greece) are still carefully supervised by their EU

[1] Contrary to what *Buiter* (2002) claims about this constraint, it is usually not used as an "equilibrium condition" in the FTPL, and is valid for all possible values of the price level and output.

[2] Extending the model to a dynamic-game framework is beyond the scope of the present paper, though it might well lead to different results.

[3] Indeed, the Stability and Growth Pact prevents countries in the Euro area from increasing public deficits over 3% of their GDP, except in the case of a substantial slump. Countries which would not satisfy the Pact may incur fines (cf. *Beetsma* and *Uhlig* 1999, for a stylised rationale of this Pact). As fines may be long to come (the process under which European countries may order the fine lasts two years), the SGP may not appear 'credible'. In the following, we however consider that the SGP is so credible as to be satisfied by any country over the deficit limit.

partners[4], by the Commission, via the SGP and the implementation of the BEPGs, or by the ECB before it sets the European nominal interest rate. Not to speak, of course, of the recent difficulties of Germany and Portugal (1st quarter of 2002) to dampen the rise in their respective fiscal deficits… This supervision of indebted countries or temporary difficulties to satisfy the BEPGs necessitate that countries under close scrutiny limit their deficit and tend towards a balanced budget at least. Other countries with sound public finances do not, of course, face the same constraints when setting either receipts or expenditures.

Our main objective here is to assess the macroeconomic incidence of this peculiar fiscal setting when countries in the Euro area face symmetric shocks. Though these shocks are more easily circumvented than asymmetric shocks – the ECB should be able to stabilise the economy without fiscal policies –, uncoordinated policies with one government following a balanced-budget rule may be very counter-productive for the ECB and for the government with sound public finances. This thus gives a new argument in favour of coordinated monetary and fiscal policies.

The paper is structured as follows. In section II, we present LWL model briefly. In section III, we outline our analytical framework, stressing its most notable features. Section IV provides an assessment of the consequences of symmetric supply and demand shocks in the monetary union. The shocks are supposed to be permanent. For each shock, we study the Nash equilibrium between the three policy makers and then compare it to a cooperative equilibrium which we computed according to the Nash-bargaining procedure. Section V stresses the most substantial costs emerging from the implementation of the dispositions of the SGP. Section VI brings out some conclusions.

II. Leith and Wren-Lewis Model

LWL (2000) showed that independent central banks cannot ignore what the government is doing with fiscal policy in a closed economy. However, as long as government adjusts its spending or taxes to meet a target for government debt, central bankers can raise the real interest rates by as much as they want in order to hit their inflation targets. The direct implication of this process is that while fiscal policy must react to some extent to variations in government debt, their response needs not be dramatic. Stated briefly, this does not seem to legitimate the tight control of fiscal policy implied by the SGP.

The model of LWL originates in the Blanchard-Yaari (1985) perpetual youth model: since households face a finite life, they consider (a part of) public debt as

[4] Quoted in the FT, June 5 2001: "The performance of Silvio Berlusconi's centre-right government will be watched closely by its European Union partners over the next few months. No aspect will come under closer scrutiny than its management of Italy's public finances. (…) The level of Italy's sovereign debt is still nearly double that permitted by the Maastricht treaty (…). Many Europeans are, therefore, anxiously waiting to see whether Mr Berlusconi (…) can maintain the same level of fiscal rigour (…) as the centre-left did in years gone by." (Italy Survey, p. II).

net wealth. Aggregate demand thus depends positively on public debt and public spending, negatively on taxation:

$Y_t = kB_t - cT_t + G_t$, where B represents public debt, T taxation, G public spending and parameters 'k' and 'c' are positive.

The Phillips curve is such that:

$\dot{\pi}_t = aY_t$, where $\dot{\pi}$ is the inflation rate in time difference.

With parameter 'a' negative (resp. positive), this equation is a forward-looking (resp. backward-looking) Phillips curve.

LWL consider two specifications for fiscal policy. If the government stabilises public debt via public spending, the fiscal framework is of the following form:

[Case 1] $G_t = \overline{G} + f\left[B_t - \overline{B}\right]$, and $T_t = \tau Y_t$,

where τ is the tax rate, a superscript is a target value, and a subscript is time. Government spending responds to public debt deviations from the target and taxation is applied at a constant rate.

The alternative framework is of the form:

[Case 2] $T_t = \overline{T} + f\left[B_t - \overline{B}\right]$ and $G_t = \overline{G}$. The government adjusts taxation to meet its public debt target; and government spending is assumed to be constant.[5]

On empirical grounds, one should favour case 1 for the fiscal framework. Alesina and Perotti (1995) demonstrated that fiscal adjustments were more efficient when expenditures had been reduced, rather than taxation increased. LWL also favour case 1 in their numerical simulations. Reason for this is the little influence of taxation on output and inflation, a situation which denies any substantial fiscal feedbacks on the optimal monetary policy (LWL p. C101).[6] In the model used below, introducing either a modified version of case 1 or a modified version of case 2 gives the same qualitative results.[7]

In their conclusion, LWL state that, if fiscal policy is relatively active in Leeper's sense – debt is stabilised very slowly, whatever the case for fiscal policy is chosen –, then this puts severe constraints on what monetary policy can do. If monetary policy responds to excess inflation by raising real interest rates, this will lead to destabilising movements in output as government debt "explodes". However, as long as fiscal policy is sufficiently passive, central bankers are free to raise real interest rates by as much as they want. The implication is

[5] This fiscal framework owes to the seminal work on fiscal rules by *Sachs* and *Wyplosz* (1984).

[6] Adding a second country automatically increases the fiscal feedbacks on monetary policy, via the fiscal policy of the second country and, thus, tends to limit the above argument by LWL.

[7] In our model, in cases 1 and 2, the tax rate and public spending in each country are set respectively as the outcome of a game between the two governments and the ECB.

that one needs to ensure that fiscal policy responds to some extent to changes in government debt, but this response needs not be as tough as what the SGP seems to generate.

III. Some Extensions to the Previous Model

In the following, we concentrate on the implications of policy rules interactions in the open economy and, more explicitly, in a monetary union. Consumers therefore hold their wealth not only in the form of public debt but also in the form of external assets. In such a situation, within a monetary union, i.e. in the absence of any exchange rate risk, a target for public debt is needed in order to determine the allocation of wealth between net foreign assets and public debt. This is a technical reason for justifying the implementation of fiscal policy rules. Without a target on public debt, wealth could in fact be balanced with unstable and symmetric levels of public debt and external assets.[8]

LWL model is simplified in two respects, with minor consequences on their results: we do not take human wealth nor money into account. The latter exclusion is studied in LWL model. Finally, we extend it in seven respects. Four are linked to the open economy and policy rules: two countries and a common central bank (which we call the ECB) are introduced; we consider an asymmetry in the fiscal framework between the two governments; policy rules are the outcomes of a static game between the two governments and the ECB; and cooperative equilibria are computed. Two other assumptions deal with consumption: a wealth effect which resembles the Pigouvian "real balance" effect and a non-linear effect of the real interest rate on aggregate demand are included. Last, backward-looking inflation expectations are assumed.

1. The General Framework

We study a polar case in the EMU: two countries, identical as far as private behaviours are concerned, form a monetary union.[9] Households in both countries hold their wealth under the form of domestic public debt (D) and net foreign assets (F). The model drops the Blanchard (1985) specification of intertemporal consumption which is at the heart of LWL's model and replaces it with a specification where (still non-Ricardian) consumers consume their current income (including interests received on net financial wealth), plus a proportion of their financial wealth. This specification can be found, for instance, in Creel (2002).

[8] In a flexible exchange rate regime or in a EMS-type regime, the uncertainty regarding the future value of external assets denominated in foreign currencies and/or the risk aversion by households are sufficient conditions for determining the discrepancy between domestic and foreign assets.

[9] Asymmetric private interdependence between the two countries (for instance, different pace of adjustment for prices or wages after a shock, as in *Hughes Hallett*, 1986) are beyond the scope of the present paper.

As in Tobin & Buiter (1976)[10], private agents are assumed to form wealth plans $\dot{W}$ which positively depend on disposable income net of wealth interests $((1-\tau Y))$, but also on the real interest rate (ρ). If actual real wealth differs from planned wealth, households behaviour makes it adjust to its desired level at speed μ. The demand block of the model is therefore given by a somewhat usual IS curve.[11]

$$Y_t = (1-\tau_t)Y_t + \rho_t W_t + \mu\left[W_t - \dot{W}_t\right] + \eta(Y_t^* - Y_t) + \eta\varepsilon(\pi_t^* - \pi_t) + G_t + X_t \quad (1)$$

where: $\dot{W}_t = (\alpha + \beta\rho_t)(1-\tau_t)Y_t$, and α and β are positive parameters.

Aggregate demand increases with disposable income plus interests on wealth (ρW), with the gap between actual and planned wealth, with public spending (*G*) and with a private demand shock (*X*). The additional terms in output and inflation differentials reflect spillovers from the second country through the trade balance. The ε parameter represents the elasticity of the trade balance to the variations of the inflation differential; it is positive; η is the degree of openness.

Aggregate demand depends negatively on the real interest rate in the short run, and positively in the long run. In short, the substitution effect overcomes the wealth effect in the short run while the reverse is true in the long run. The wealth effect is close to the Pigouvian or "real balance" effect: if actual wealth is beneath its planned level, because of an increase in the real interest rate, private consumption will be reduced until savings has reached the desired equilibrium level. In the long run, households will use this savings in order to boost their own consumption.

The existence of a net wealth effect in private consumption has been proven to be a necessary condition for LWL's model to be stable insofar as backward-looking expectations are assumed (see Creel and Sterdyniak 2002). In the following, we will hinge on Fuhrer (1997) or Mankiw (2001) and thus favour adaptive expectations as our specification for inflation dynamics, although some recent results favour rational expectations on empirical grounds (see Gali et al. 2001).[12] Here, we wish to concentrate on the interactions between fiscal and monetary policies only, without any interference with a fourth player, namely households. Assuming adaptive expectations, we can neglect this fourth player while in the meantime being assured that in the long run, inflationary expectations will be met (Blake and Weale 1998). Another way to motivate the adaptive expectations assumption would be to argue that the private sector may act

[10] They stated that savings shall be regarded as a process which adjusts wealth towards some target value relative to income.

[11] Equations in country B are obtained by circular permutation; this country's variables are starred.

[12] *Gali* et al. (2001) claim that they provide evidence that a forward-looking Phillips curve "fits very well Euro data" but, in their study, the expected inflation depends only on past variables. Note that *Benigno* and *Lopez-Salido* (2001), hinging on the methodology developed by *Gali* et al. (2001), show that only Germany out of five European countries support the forward-looking Phillips curve. In the other four countries (France, Italy, Spain, the Netherlands), they find a substantial inertial behaviour in inflation.

adaptively during the early stages of Monetary Union as they learn more about the new policy regime.

Aggregate supply is thus derived according to a standard Phillips curve in the open economy (eq. (2)). Real wages are indexed on the consumer price index (inputs are not imported).

(2) $$\pi_t = \pi_{t-1} + \lambda Y_t + \eta(\pi_t^* - \pi_t) + z_t .,$$

where z is a supply shock and λ is positive.

Wealth (eq. 3) is the sum of public debt and net foreign assets which grow after a trade deficit:

(3) $$W_t = D_t + F_t .$$

Equations (4) and (5) describe the dynamics of these two assets:

(4) $$D_t = (1+\rho_t)D_{t-1} + G_t - \tau_t Y_t ;$$

(5) $$F_t = (1+\rho_t)F_{t-1} + \eta(Y_t^* - Y_t) + \eta\varepsilon(\pi_t^* - \pi_t) .$$

The model is supposed to be quarterly. Shocks occur in the first quarter of 2000 and are permanent.

2. Governments and the ECB

The two countries, named respectively A and B, share a common currency. The ECB implements the monetary policy in the union. The rest of the world is neglected. The fiscal policy framework is asymmetric.

2.1. Government A

Government A uses its tax rate to minimise its loss function (eq. 6) each quarter so that its policies are strategic, rather than *ad hoc* as in LWL.[13] The quadratic loss function depends on the differences between respectively, output, inflation, tax rate and public debt, on the one hand; and their initial steady-state values, on the other. Public debt is expressed in percent of the GDP.

(6) $$LG_t = a_0 \Delta Y_t^2 + a_1 \Delta \pi_t^2 + a_2 \Delta \tau_t^2 + a_3 \Delta (D_t / Y_t)^2$$

Parameters a_0, a_1, a_2 and a_3 are positive weights on respective targets. Targets for output and inflation are uncontroversial. The loss function also includes a term which captures the costs of tax collection (Barro 1979). In country A, the government has to stabilise public debt over GDP, at least in the long run. This

[13] In order to simplify notations, an intertemporal discount rate was not added in the loss functions. We do not intend to compare losses from one period to the other but, rather, at a certain time, from one equilibrium (Nash) to the other (cooperation).

is in line with LWL's conclusions according to which fiscal authorities have to respond somewhat to changes in government debt.

2.2. Government B

Government B implements a fiscal rule which keeps public deficits in line with the stability of its debt to GDP ratio. It is thus assumed that country B has already reached the ceiling of the SGP, considered here as the steady state level of the public deficit ratio. As stated earlier, case 1 for fiscal instruments in LWL (cf. section II) is favoured to case 2. Public spending, rather than taxes, are set in order to stabilise public debt (in GDP share). A lag in government spending is also introduced and represents the relative inertial behaviour of expenditures. Moreover, government B is able to use its tax rate τ to minimise the same loss function as government A:

$$LG^*_t = a_0 \Delta Y_t^{*2} + a_1 \Delta \pi_t^{*2} + a_2 \Delta \tau_t^{*2} + a_3 \Delta (D_t^* / Y_t)^{*2}; \tag{7}$$

$$G_t^* = (1-\chi) G_{t-1}^* + \chi \left[\tau_t^* Y_t^* - \rho_t D_t^* + \mu_g (\Phi - D_t^*) \right]. \tag{8}$$

The Φ letter represents the public debt target of government B; it is exogenous. The $\mu_g \chi$ parameter represents the speed of adjustment of the public deficit to the level required to reach Φ.

This fiscal framework is a bit more complicated than case 1 in LWL, because both fiscal instruments (tax rate and public spending) are endogenous: one is set as the outcome of a game with the other authorities (eqn. 7), whereas the other is set according to a feedback rule which is set such that the fiscal deficit remains under control (eqn. 8), in the spirit of LWL.

The introduction of these two equations in the fiscal framework of government B aims at three objectives, plus that of being as close as possible to LWL formulation. First, we compute Nash-bargaining equilibria to assess the gains from coordination; we thus need a loss function of type (7). Second, the cost of tax collection is not sufficient to limit fiscal policy toughly in the short run, so that we need equation (8) which is more stringent. Third, some macroeconomic models in the EMU adopt equation (8) as the sole strategic behaviour for all governments involved in the model[14] and it is interesting to shed light on the differences between the results obtained via equation (8) with that obtained via the policy design for government A (eq. 6).

Of course, the fact that government B controls two instruments (rather than one for government A[15]) and has the same number of targets as government A should not lead to the conclusion that the "constrained" authority is freer than

[14] See *Barrel* and *Sefton* (1997), *Capoen* and *Villa* (1997), *Jensen* and *Jensen* (1995), *Mitchell* et al. (2000), *van der Ploeg* (1995).

[15] Actual public spending in country A is supposed to be constant and set equal to a target level, G_A.

government A.[16] In our short-run Keynesian framework, a limit on public deficit is a strong constraint for a government as far as the stabilisation of output and inflation to their respective steady states is concerned.

2.3. The ECB

The monetary union is characterised by the uniqueness of the nominal short run interest rate (i) and the independence of the ECB. The ECB is assumed to implement its monetary policy through the setting of this nominal rate. Difficulties regarding the definition and level of money supply in a monetary union and the complications due to the instability of money demand in financial economies are thus avoided. The ECB minimises the respective average and squared deviations of inflation and output from their initial steady states:

$$(9) \qquad LM_t = k_0\Delta\left(\frac{Y_t + Y_t^*}{2}\right)^2 + k_1\Delta\left(\frac{\pi_t + \pi_t^*}{2}\right)^2 + k_2\Delta\rho_{t,M^2} \text{ with } \rho_{t,M} = i_t - \frac{\pi_t + \pi_t^*}{2}$$

The ECB is also supposed to be reluctant to deviate the real interest rate from the steady state. Large deviations of the real interest rate have costly effects on the patrimonial equilibrium: if the real interest rate soars in the short run, this will provoke a steep increase in public debt in both countries, unless government A increases its tax rate dramatically and government B decreases its public spending sharply. Both moves in fiscal policy are costly for the governments, but they are also for the ECB: they reduce the future capacity of governments to stabilise output and inflation, so that the burden of future shocks might fall on the central bank. More generally, the reluctance of the ECB towards large variations in the real interest rate could be justified by the ECB's concern for a stable aggregate private investment. Or, the ECB may want to prevent the banking system from being weakened by frequent and large swings in the Repo rate which they would have to pass on to their customers.

2.4. A Remark

Macroeconomic models usually give the priority to inflation in the central bank loss function, according to the "credibility" argument: the government inflation bias needs a tough reaction by Central bankers (Rogoff 1985). Although our model does not bear on such imperfections as the inflation bias, we have made sure that our specifications for fiscal and monetary policies do not depart on this point from mainstream literature. With no costs for the use of fiscal or monetary instruments, k_1 should have been superior to k_0 and (k_1 / k_0) should have been superior to (a_1 / a_0). In our formulation with costs, this latter condition can be rewritten as:

$$(10) \qquad (k_1 - k_2) / k_0 > a_1 / (a_0 + a_2 - a_3),$$

[16] I thank *Campbell Leith* and *Henri Sterdyniak* for raising this issue.

since the cost for using the interest rate reduces the capacity of the ECB to curb inflation, and the cost for using the tax rate and the cost for increasing public debt reduce the capacity of governments to stabilise output. We will choose parameters which verify this condition.

3. Parameters

Since analytical solutions of the model in the face of shocks are intractable, we set the model in deviation from the steady-state and we adopted a parameter set in order to study the dynamic paths of model variables following the shocks. Our central parameter set is given in table 1. We chose some of them so that fiscal and monetary short-term multipliers match those of the macroeconometric international model MIMOSA (see Le Bihan and Lerais 1998).

Output is normalised at unity, and steady-state government spending is 19.7% of GDP, i.e. the amount of funds for net expenditures in the general budget of France in 1999. Initial steady state public debt is equal to 30% of GDP and corresponds to net public debt in France in 1994, thus before the cyclical rise in public deficits in the early nineties had been converted in public debt. The real equilibrium interest rate is 1% and corresponds to the gap between the interest rate and the GDP growth rate in France in 1999.[17]

Table 1

Parameters and Steady-State Values of Variables

Parameters	α	β	χ	ε	λ	η	μ	μ_g
	0.35	2.50	0.85	0.20	0.25	0.20	0.30	0.30
Loss functions	a_0	a_1	a_2	a_3	k_0	k_1	k_2	
	0.90	0.50	1.00	1.00	0.1	2.50	1.00	
Initial values	D/Y	F/Y	W/Y	ρ	τ	Φ /Y		
	0.30	0.00	0.30	0.01	0.20	0.30		

[17] It has been checked that results were not sensitive to the initial value of the public debt to GDP ratio. The fact that both countries apparently share the same basic parameters and that the model is set in deviations from the initial steady state is not inconsistent with one of them being more constrained (country B) than the other (country A). Stated differently, making both countries explicitly different (one would have a higher debt than the other) would not change the outcomes.

IV. Shocks and Policies

We now analyse the reactions of the two governments and the ECB after a symmetric supply or demand shock. The supply shock consists in a 1 point increase in the inflation rate. The demand shock takes the form of a permanent increase in the planned wealth to GDP ratio which reduces consumption in the short run. We show that most conclusions at Nash equilibrium are robust whatever the specification of the shock, be it a supply or a demand one.

The numerical simulations below are computed under two different specifications for policies. In the first one, we compute non-cooperative Nash equilibrium between the three authorities[18], whereas in the second, we compute cooperative Nash bargaining solutions between the three policy makers. These cooperative solutions are reached after the product of the game earnings for the three players has been maximised. Game earnings for each player are equal to the difference between the loss incurred at the Nash equilibrium and the one incurred at the cooperative equilibrium. It has always been checked that net earnings were positive.

1. A Symmetric Supply Shock

Contrary to the case of a demand shock, the supply shock always creates a tension between the inflation and output targets. The tension is not only between the instruments – which instrument can offset the shock at the least cost? – but also within each authority – which target will be preferred?

1.1. The Dynamics at the Nash Equilibrium

The supply shock provokes a steadily decrease in the output of both countries which is equal to 4% in the long run for each (see table 2). Inflation increases immediately from 3 and 2 percentage points for countries A and B, respectively, and stabilises 4 percentage points higher than in the pre-shock situation.

Since the ECB has been supposed to have a preference for inflation stability over output stability[19], the nominal interest rate is raised so that the real interest rate is increased by almost 200 basis points in the short run, and almost 300 in the long run. This policy has two types of effects in the model: first, it dampens inflationary trends in the short run through its negative effect on the aggregate demand. Second, it raises net interests sharply and is likely to put heavy pressure on fiscal policy.

[18] When implementing its policy, each player considers the others' actions as given.

[19] In the statutes of the ECB (Treaty establishing the European Community, art. 105), it is specified that the primary objective for the Bank is "to maintain price stability" and that output stability might be a second objective as far as it does not jeopardise the primary one.

Table 2

Effects of a Symmetric Private Supply Shock

	Nash equilibrium				Nash bargaining			
	Country A 2001	Country A 2010	Country B 2001	Country B 2010	Country A 2001	Country A 2010	Country B 2001	Country B 2010
Y (%)	-1,90	-4,12	-4,19	-3,87	-2,99	-4,00	-3,07	-4,00
Pi (points)	3,04	3,61	2,06	3,75	2,37	3,09	2,40	3,09
Tau (points)	-0,36	0,98	-0,39	-0,34	-0,01	0,01	0,03	0,02
G (points of GDP	-	-	-0,96	-1,21	-	-	-0,01	0,01
B/Y (points of GDP)	3,92	11,34	0,07	0,00	-0,29	0,14	0,00	0,00
F/Y (points of GDP)	-1,80	-5,92	1,80	5,92	0,16	-0,07	-0,16	0,07
Losses	23,33	151,28	18,07	20,66	10,95	19,20	11,36	19,16
ECB's losses	20,77	43,85			15,17	25,45		
Real interest rate (points)	1,89	2,90			0,11	0,04		

NB1: results are set in deviations from the initial steady state values.

NB2: country B is fettered by the dispositions of the Stability Pact.

Government A tries to focus on the output deviations and to offset the negative shock: the tax rate is reduced in the short run. But the resulting steep growth in public debt (which is also due to the feedbacks of the higher real interest rate on public net interests) leads government A to increase the tax rate sharply in the long run (+1 point). This way, it reduces the inflationary consequences of public debt accumulation. Public debt however stabilises at an unprecedented peak: 11 points of GDP over its initial steady-state value!

The reversal of fiscal policy in country A between the short and the long run is quite enlightening on the effects of public debt on inflation: debt is inflationary, not because of the existence of seigniorage or inflation surprise, but because debt is incorporated into a wealth effect. The existence of non-Ricardian consumers enables government A to be also non-Ricardian: it does not have to satisfy *ex ante* its present value budget constraint because it is well aware that macroeconomic mechanisms at equilibrium will bear the costs of satisfying its constraint *ex post.*

As for government B, it is able to reduce the tax rate in the short and in the long run, because its spending is set in accordance with the satisfaction of a constant public debt to GDP ratio. In the short run, the constraint on its public deficit puts a heavy weigth on its capacity to stabilise the output: it departs in absolute value by more than 4% from its initial steady state level, whereas the deviation of output in country A is below 2%. In the mid-run, however, the stability of the public debt ratio reduces inflationary pressures as well as their negative consequences on competitiveness: the trade balance thus increases and in the long run, country B's net external position has grown by almost 6 points of the GDP. *In fine*, output in country B stabilises slightly closer to the initial steady state in comparison with country A.

Losses for both governments are quite similar in the short run, but at odds in the long run: the difference between both depends quite exclusively on fiscal instruments and public debts. The short term fiscal policy by government A is very costly in the longer run: as stated earlier, public debt soars and necessitates that the tax rate be increased by almost 1 point – in comparison, the tax rate in country B moves by 0.3 point in absolute value. Note also that the more restrictive monetary policy, the costlier fiscal policy in country A.

What could be learned from this equilibrium? First, in our setting, the government with sound public finances, and thus able to make its public deficit depart from the steady state, is more able to stabilise the output the closest to the initial equilibrium in the short run. Second, it is less able to curb inflation. In this strategy, it is outpaced by the government whose hands are tied. In the long run, the government with initial sound public finance incurs a reversal in its fiscal policy: public debt has increased so much that stopping its growth has become the primary objective of the fiscal policy maker.

1.2. The Gains from Coordination

Coordination between the three policy makers make each country face a more equitable share of the burden of the shock in the short run and increases the

homogeneity in their business cycles in the long run. Output decreases more in country A with coordinated policies in comparison with the Nash equilibrium, whereas it decreases less in country B; inflation increases less in country A in comparison with the Nash equilibrium, whereas it increases more in country B (table 2).

Consequently, losses for both governments are now close one to the other in the short and in the long run, quite at odds with the situation at the Nash equilibrium. Coordination is very productive for government A in the short run in that its loss is now lower than the one incurred by government B; this situation was the opposite with uncoordinated policies. This new result depends heavily on fiscal and monetary policies. The latter is very slightly restrictive (the real interest rate rises by 10 basis points, in comparison with 200 when policies were non cooperative), so that fiscal policy is initially restrictive (rather than expansionary in the Nash equilibrium) – between 2000 and 2001, the tax rate increases by 0.3 point from its initial value –, and then neutral (rather than restrictive in the Nash equilibrium). Public debt therefore remains almost stable in proportion to the GDP.

Coordinated policies also give rise to a change in the assignment of instruments – monetary and fiscal – to targets. Whereas government A had a preference for the output target while the ECB had a preference for the inflation target at the Nash equilibrium, they now seem to have switched their preferences: government A tries to offset the inflationary consequences of the shock via a reduction in consumption (the disposable income is reduced) and the ECB does not have to implement a monetary policy restrictive enough to curb inflation as early as in the short run.

Due to the homogeneity of the business cycles in the monetary union, trade balances and the net external positions are stable at their initial steady state values. Whereas a substantial part of the stabilisation process was realised through the real wealth effect at the Nash equilibrium, it is no longer the case when policies are coordinated; the convergence of both economies in the face of a symmetric shock has been thus greatly improved.

2. A Symmetric Demand Shock

A demand shock is easier to stabilise than a supply one thanks to the absence of tension between the inflation and output targets. In the long run, the output comes back to its initial steady state level.

2.1. The Nash Equilibrium

After a negative symmetric private demand shock (table 3), at Nash equilibrium between the three policy-makers, the nominal interest rate decreases in the monetary union and government 1 implements an expansionary fiscal policy. In country B, the lack of fiscal room for manœuvre results in larger decreases in the output level and the inflation rate than in country A.

After this demand shock, government A has decreased immediately its tax rate, so that its public debt has risen up to almost 1 point of GDP. The consequences of this fiscal policy are twofold: they dampen the domestic negative shock but, meanwhile, they raise a trade deficit *vis-à-vis* country B. This latter element provokes an increase in the net external assets of country B (F is negative) and therefore helps to dampen the shock in this country through the 'real wealth effect'. Nonetheless, as government B is unable to implement an expansionary fiscal policy, the economic crises are long to overcome and the ECB has to reduce its interest rate sharply, the real interest cut being up to almost 80 basis points in the long run. This leads finally to a steep reduction in the public debt to GDP ratio (in country A) which comes back to its initial level.

Contrary to the case of a symmetric supply shock, differences between both governments' losses are very small in the long run. In the short run however, the government with sound public finances suffers from the highest losses, in comparison with government B.

2.2. The Nash Bargaining Solutions

Cooperative solutions give rise to more expansionary fiscal and monetary policies in the short run. These thus permit to reduce the scope of the negative shock at the monetary union level.

Consequently, the ECB faces less incentive to implement an expansionary policy in the long run – the decrease in the real interest rate is smaller (in absolute values) than at the Nash equilibrium –, so that public debt is 0.5 point of GDP higher than at the initial steady state. Hence, government A's loss in the long run is only slightly inferior to its loss at the Nash equilibrium.

Moreover, differences between both governments' losses in the long run are still substantial, whereas they were only marginal after a supply shock at the cooperative equilibrium. Contrary to the case with a supply shock, policies here are more expansionary in the short run than at the Nash equilibrium: the subsequent debt rise quite heavily burdens government A.

V. The Costs of the Stability Pact

At the Nash equilibrium, in the case of a symmetric shock, either a supply or a demand one, the fact that one government is constrained by the dispositions of the SGP may force the other, more solvent, government to bear the brunt of shocks – it is this government, and not the constrained one, that bears the major part of these shocks. This appears clearly in graphs 1 and 2. As early as 4 and 3 quarters after the supply or demand shock, respectively, government A faces a higher loss than government B, due notably to the substantial increase in the public debt to GDP ratio.

Table 3

Effects of a Symmetric Private Demand Shock

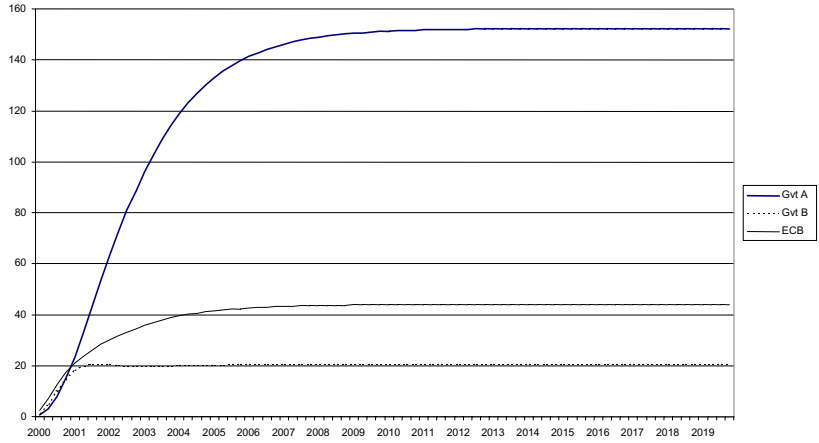
	Nash equilibrium				Nash bargaining			
	Country A 2001	Country A 2010	Country B 2001	Country B 2010	Country A 2001	Country A 2010	Country B 2001	Country B 2010
Y (%)	-0,28	0,00	-0,32	0,00	-0,09	-0,01	-0,16	0,00
Pi (points)	-0,53	-0,80	-0,68	-0,79	-0,23	-0,41	-0,32	-0,,41
Tau (points)	-0,18	-0,22	-0,04	-0,01	-0,22	-0,20	-0,22	-0,23
G (points of GDP	-	-	0,14	0,22	-	-	-0,02	-0,03
B/Y (points of GDP)	0,82	0,07	-0,01	0,00	0,50	0,48	0,00	0,00
F/Y (points of GDP)	-0,41	0,00	0,41	0,00	-0,25	-0,25	0,25	0,25
Losses	0,91	0,37	0,32	0,32	0,33	0,36	0,12	0,14
ECB's losses	1,32	2,15			0,64	0,87		
Real interest rate (points)	-0,63	-0,76			-0,67	-0,67		

NB1: results are set in deviations from the initial steady state values.

NB2: country B is fettered by the dispositions of the Stability Pact.

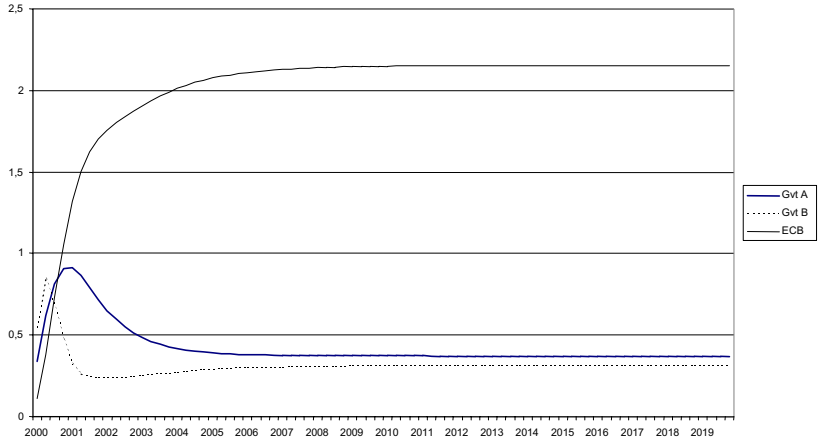
Graph 1

Losses – Symmetric Supply Shock – Nash Equilibrium



Graph 2

Losses – Symmetric Demand Shock – Nash Equilibrium

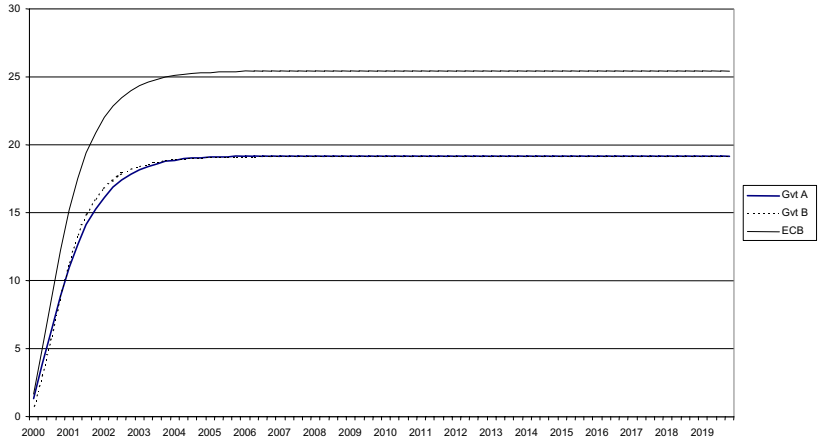


The country with sound public finances thus clearly undergoes feedback effects of the Stability Pact. These are twofold. First, as already mentioned, this country has to participate in the stabilisation of the whole monetary union. The interdependence between the economies increases the strategic interactions between fiscal policies. This interdependence is, of course, more intense as one country lacks fiscal room for manœuvre. Second, these interactions also involve monetary policy. In this peculiar setting, which hinges on an extended version of the macroeconomic model of the FTPL developed by LWL (2000), the government of country A has to stop the public debt to GDP ratio from increasing because monetary policy is active (the nominal interest rate reacts more than one for one with the inflation rate). Government A is therefore fettered in its policy choices by the growth in its debt and by the relative stringency of monetary policy: a higher debt entails more inflationary pressure which the government intends to curb; and a restrictive monetary policy prevents output stabilisation.

Nash bargaining solutions in the case of a supply shock give very interesting results: as already mentioned, coordination totally cancels the costs emerging from the Stability Pact (graph 3): losses for both governments are exactly similar.

Graph 3

Losses – Symmetric Supply Shock – Nash Bargaining

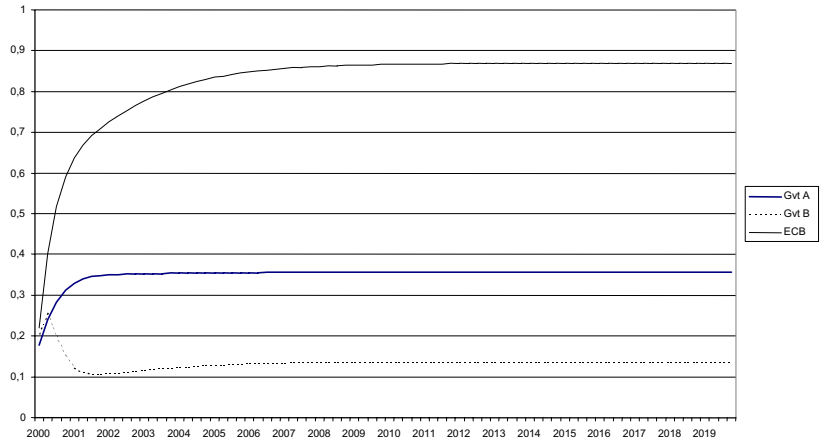


The share of the burden has thus been greatly improved by the coordination of fiscal and monetary policies. This is an important result in our framework. Though the situation of the so-called 'fiscally-constrained' country had appeared more favourable than that of the country with sound public finance (see the loss functions at the Nash equilibrium), it is no longer the case when policies are co-ordinated. Having its fiscal hand tied is beneficial only to the extent that policies are non-cooperative. It becomes detrimental to the constrained country if Nash-bargaining solutions are implemented. Although losses for the government of this country are minimised at the cooperative equilibrium, in comparison with the non-cooperative one, this government would be in a better position if its public deficits had not been limited.

The improvement in the situation of the country with sound public finance does not emerge after a demand shock though (see graph 4). Government A remains in a worse situation than government B (see section IV.2).

Graph 4

Losses – Symmetric Demand Shock – Nash Bargaining



As for the ECB, its losses are higher than both governments', except at the Nash equilibrium after a supply shock (see graphs 1 to 4). Though loss functions differ – the ECB's includes EMU-average output and inflation deviations and deviations of the real interest rate, while governments' incorporate domestic targets, tax rate and public debt deviations –, it is obvious that the costs of using the interest rate are the most prominent one in the losses incurred by the central bank.[20] They show by how much the ECB is being involved in the stabilisation of the Euro-area macroeconomic shocks. Consider no government had been fettered by a balanced-budget rule: the symmetric shock could have been compensated by appropriate fiscal policies without any increase in the public debt to GDP ratio.[21] The ECB would not have been forced into a more stringent policy. In an asymmetric fiscal framework like ours, the ECB has to compensate for the inability of one government to implement the appropriate fiscal policy.

Public debt implications in this model are thus substantial: first, they change the timing of fiscal policy. From 'active' in the short run, they can become 'passive' in the long run, undergoing progressively the "law" of an active monetary policy. Depending on the reactions of governments in the long run, the ECB also is progressively being fettered in the timing as well as the scope of its policy choices, and its ability to smooth economic fluctuations is affected by the constraints of the Pact (see also Hughes Hallett and Vines 1993, and Jensen 1997).

VI. Conclusion

In this paper, we have used an open economy version of Leith and Wren-Lewis (2000) model. This model enables a precise and comprehensive analysis of the interactions between monetary and fiscal policies. The most recent contributions concerning monetary rules, fiscal rules, and the net wealth effect are incorporated and shed light on the possible effects of public debt on the inflation rate, without having to introduce seignoriage or an inflationary tax. We also considered the specific case of an asymmetric fiscal framework in order to illustrate some possible drawbacks of the SGP, namely, that it may reduce the ability of governments and the ECB to implement stabilisation policies in the Euro area.

In fact, an asymmetric fiscal framework between countries forming a monetary union could well have strong feedback policy effects on the implementation of fiscal as well as monetary policies. First, the country whose fiscal policy is aimed at stabilising the economy may suffer from its interdependence with the other country: a negative shock in the latter country may provoke a higher public debt in the first country; and this may impede its future capacities to implement an

[20] EMU-average output and inflation deviations in the mid and long run do not depart much from domestic ones.

[21] The GDP slumps which reduce tax revenues would have been compensated by lower tax rates which would have increased tax revenues either through higher incentives to produce (Laffer argument, see *Canto* et al. 1978) or through rising demand (*Christ* argument, see *Christ* 1968).

active fiscal policy.[22] Hence, the country with initial sound public finances has to intervene in order to stabilise the whole monetary union, but it is more and more fettered in its policy choices as time moves forward if monetary policy is stringent.

Second, the ECB, in its goal of "price stability", may not be immune either against the consequences of fiscal policies. It may have to "substitute" for the absence of fiscal policy in the country under the rule of the Pact. In the long run, if public debt increases in relation to GDP because of the restrictive monetary policy, the ECB has to choose between reducing the interest rate to curb debt's accumulation or increasing it further to prompt "good" governments to accumulate primary surpluses. If monetary policy is very stringent in the long run and the "good" government is unable to reduce its deficit further, the economy of the whole monetary union might well follow an unstable path.

Third, coordination in the case of a symmetric supply shock is productive in that it cancels the costs emerging from the Stability Pact. A more equitable share of the burden of the shock now falls on both governments, the "good" and the "bad". This result does not emerge after a demand shock.

Fourth, after a symmetric supply shock, the coordination of policies give rise to a change in the assignment of instruments – monetary and fiscal – to targets. The government with initial sound public finances dampens the inflationary consequences of the shock and the monetary policy is substantially less restrictive than at the uncoordinated equilibrium. This switch in the assignment of instruments does not occur after a symmetric demand shock.

At last, using a dynamic-game approach might well lead to different conclusions. The huge welfare losses suffered by country A in the wake of a supply shock, for instance, might be avoided if that country could fully take into account the negative consequences of its debt build-up, which in turn would require looking ahead (instead of considering only the current period) when setting taxes. This way, the relative 'gains' from being fettered by the dispositions of the SGP at the Nash equilibrium would be reduced, but overall gains from coordination would not; this time, government B, rather than A, would undoubtedly benefit most from the Nash-bargaining solution. However, introducing this new theoretical setting has been left to future research. Moreover, the short-sighted or time-consistent way to implement fiscal policy is still under debate as French public authorities seem about to renege in mid-2002 on their promise to reach a balanced government budget no later than 2004, a promise they had made in March 2002 in Barcelona!

[22] Note that, contrary to "mainstream literature" (see, for instance, *Chari* and *Kehoe*, 1998), debt monetisation is not part of the story. This is probably on this point that the FTPL is the most attractive.

Summary

We extend the model of Leith and Wren-Lewis (2000) to the case of a two-country monetary union, incorporating adaptive expectations. An asymmetry between the stabilisation properties of the two fiscal policies is introduced: only one country is fiscally-constrained by the dispositions of the Stability Pact. Monetary and fiscal policies are set as the outcomes of a game between the two governments and the common central bank. We show that in case of negative symmetric shocks with a stringent monetary policy, the government with sound public finances is more and more fettered in his policy choices as time moves forward while the reverse is true for the fiscally-constrained government. The costs implied by the Stability Pact for the common central bank are also substantial. Coordinating monetary and fiscal policies after a symmetric supply shock is also shown to be sufficient to cancel the costs emerging from the Pact, but it is not after a demand shock.

References

Alesina, *A*. and *R. Perotti* (1995), Fiscal Expansions and Adjustments in OECD Countries, Economic Policy 21, 205–248.

Barro, *R.J*. (1974), Are Government Bonds Net Wealth?, Journal of Political Economy 82 (November-December).

Barro, *R.J*. (1979), On the Determination of the Public Debt, Journal of Political Economy 87 (5).

Barrell, *R*. and *J*. *Sefton* (1997), Fiscal Policy and the Maastricht Solvency Criteria, The Manchester School 65, 259–279.

Beetsma, *R.M.W.J*. and *H*. *Uhlig* (1999), An Analysis of the Stability and Growth Pact, Economic Journal 109, 546–571.

Benigno, *P*. and *J.D. Lopez-Salido* (2001), Inflation Persistence and Optimal Monetary Policy in Europe, mimeo.

Bergin, *P.R*. (2000), Fiscal Solvency and Price Level Determination in a Monetary Union, Journal of Monetary Economics 45 (1), 37–53.

Blake, *A*. and *M. Weale* (1998), Costs of Separating Budgetary Policy From Control of Inflation: a Neglected Aspect of Central Bank Independence, Oxford Economic Papers 50, 449–467.

Blanchard, *O.J*. (1985), Debt, Deficits, and Finite Horizons, Journal of Political Economy 93 (2).

Buiter, *W.H*. (2002), The Fiscal Theory of the Price Level: a Critique, Economic Journal, forthcoming.

Canto, *V.A*., *D.H. Joines*, and *A.B. Laffer* (1978), Taxation, GNP and Potential GNP, Proceedings of the Business and Economic Statistics Section in San Diego, American Statistical Association.

Capoen, *F*. and *P. Villa* (1997), Internal and External Policy Coordination: a Dynamic Analysis, CEPII Working Paper n°97-15, November.

Chari, *V.V*. and *P.J. Kehoe* (1998), On the Need for Fiscal Constraints in a Monetary Union, Federal Reserve Bank of Minneapolis Working Paper n°589, August.

Christ, *C*. (1968), A Simple Macroeconomic Model with a Government Budget Constraint, Journal of Political Economy 76.

Creel, *J*. (2002), The European Stability Pact and Feedback Policy Effects, Journal of Economic Integration, forthcoming.

Creel, *J*. and *H. Sterdyniak* (2002), The Fiscal Theory of the Price Level and Sluggish Inflation: How Important Shall the Wealth Effect Be?, Ofce Working Paper 2002-01, January.

European Commission (2001), Report on the Implementation of the 2000 BEPGs, European Economy, Reports and Studies, n°2.

Fuhrer, *J.C*. (1997), The (Un)Importance of Forward-Looking Behavior in Price Specifications, Journal of Money, Credit, and Banking 29, 338–350.

Gali, *J.*, *M. Gertler*, and *J.D. Lopez-Salido* (2001), European Inflation Dynamics, European Economic Review 45, 1237–1270.

Hughes Hallett, *A.J*. (1986), Autonomy and the Choice of Policy in Asymmetrically Dependent Economies, Oxford Economic Papers 38, 516–544.

Hughes Hallett, *A.J*. and *D. Vines* (1993), On the Possible Costs of European Monetary Union, The Manchester School 61, 35–64.

Jensen, *S.E.H*. (1997), Wage Rigidity, Monetary Integration and Fiscal Stabilization in Europe, Review of International Economics, Special Supplement 5 (4).

Jensen, *S.E.H*. and *L.G. Jensen* (1995), Debt, Deficits and Transition to EMU: a Small Country Analysis, European Journal of Political Economy 11 (1).

Le Bihan, *H*. and *F. Lerais* (1998), Simulations Properties of MIMOSA, a macroeconometric multinational model, MIMOSA Working Paper, Ofce, n°M-98-01, January.

Leeper, *E*. (1991), Equilibria under 'Active' and 'Passive' Monetary Policies, Journal of Monetary Economics 27, 125–147.

Leith, *C*. and *S. Wren-Lewis* (2000), Interactions between Monetary and Fiscal Policies, Economic Journal 110, March.

Mankiw, *N.G*. (2001), The Inexorable and Mysterious Trade-Off Between Inflation and Unemployment, Economic Journal 111 (May), 45–61.

Mitchell, *P.R*., *J.E. Sault*, and *K.F. Wallis* (2000), Fiscal Policy Rules in Macroeconomic Models: Principles and Practice, Economic Modelling 17 (2), 171–193.

Ploeg, *F*. (*van der*) (1995), Solvency of Counter-Cyclical Policy Rules, Journal of Public Economics 57 (1), 45–65.

Rogoff, *K*. (1985), The Optimal Degree of Commitment to an Intermediate Monetary Target, The Quarterly Journal of Economics, November.

Sachs, *J*. and *C. Wyplosz* (1984), La Politique Budgétaire et le Taux de Change Réel, Annales de l'INSEE 53, January-March.

Tobin, *J*. and *W.H. Buiter* (1976), Long-run Effects of Fiscal and Monetary Policy on Aggregate Demand, in: *J.L. Stein* (ed.), Monetarism, North Holland.

Woodford, *M*. (1996), Control of the Public Debt: a Requirement for Price Stability?, NBER Working Paper n°5684, July.

Woodford, *M.* (2001), Fiscal Requirement for Price Stability, Journal of Money, Credit, and Banking 33, 669–728.