

Together We Are Strong—Divided Still Stronger? Strategic Aspects of a Fiscal Union

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Abstract In this paper we present an application of dynamic tracking games to a monetary union. We use a small stylized nonlinear two-country macroeconomic model of a monetary union for analysing the interactions between two fiscal (governments) and one monetary (common central bank) policy makers. We introduce a negative asymmetric demand side shock describing the macroeconomic dynamics within a monetary union similar to the economic crisis (2007–2010) and the sovereign debt crisis (since 2010) in Europe. We investigate the welfare consequences of three scenarios: fiscal policies by independent governments (the present situation), centralized fiscal policy (a fiscal union) with an independent central bank, and a fully centralized fiscal and monetary union. For the latter two scenarios, we investigate the effects of different assumptions about the weights for the two governments in the cooperative agreement.

1 Introduction

The recent financial and economic crisis has hit the Euro Area (EA) hard, especially because it was followed by a sovereign debt crisis in some member states. This revealed an asymmetry in the EA between a core of financially sound countries and a periphery lacking fiscal sustainability. One possible solution for these problems may be the creation of a fiscal union in addition to the monetary union. In this paper we examine macroeconomic effects of such a fiscal union with a view towards shocks like the recent ones, emphasizing strategic aspects of stabilization policies. We use a dynamic game approach for this purpose.

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2 The Dynamic Game Problem

We consider nonlinear dynamic games in discrete time given in tracking form. The players aim at minimizing quadratic deviations of the equilibrium values from given desired values. Each player minimizes an objective function (loss function) J^i :

$$\min_{u_t^1, \dots, u_t^i} J^i = \min_{u_t^1, \dots, u_t^i} \sum_{t=1}^T L_t^i(x_t, u_t^1, \dots, u_t^N), \quad i = 1, \dots, N, \tag{1}$$

with

$$L_t^i(x_t, u_t^1, \dots, u_t^N) = \frac{1}{2} [X_t - \tilde{X}_t^i]' \Omega_t^i [X_t - \tilde{X}_t^i]. \tag{2}$$

The parameter N denotes the number of players (decision makers). T is the terminal period of the planning horizon. X_t is an aggregated vector

$$X_t = [x_t \ u_t^1 \ u_t^2 \ \dots \ u_t^N]', \tag{3}$$

consisting of an $(n_x \times 1)$ vector of state variables and N $(n_i \times 1)$ vectors of control variables. The desired levels of the state and the control variables enter (1)–(2) via the terms

$$\tilde{X}_t^i = [\tilde{x}_t^i \ \tilde{u}_t^{i1} \ \tilde{u}_t^{i2} \ \dots \ \tilde{u}_t^{iN}]. \tag{4}$$

Finally, (2) contains a penalty matrix Ω_t^i weighting the deviations of states and controls from their desired levels at any period t .

The dynamic system constraining the choices of the decision makers is given in state-space form by a first-order system of nonlinear difference equations:

$$x_t = f(x_{t-1}, x_t, u_t^1, \dots, u_t^N, z_t), \quad x_0 = \bar{x}_0. \tag{5}$$

\bar{x}_0 contains the initial values of the states, z_t contains non-controlled exogenous variables. Equations (1), (2) and (5) define a nonlinear dynamic tracking game problem, which can be solved for different solution concepts. In order to solve this game we use the OPTGAME algorithm as described in [1].

3 Set-Up of the Games

In this study we use a dynamic macroeconomic model of a monetary union consisting of two countries (or two blocs of countries) with a common central bank called MUMOD1. A description of the model is given in [2]. The model is calibrated to deal with the problem of sovereign debt in a situation that resembles the one currently prevailing in the European Union. Mainly based on the public finance situation, the EA is divided into two blocs: a “core” and a “periphery”. The first bloc includes ten

EA countries (Austria, Belgium, Estonia, Finland, France, Germany, Luxembourg, Malta, Netherlands, and Slovakia) with a more solid fiscal situation. The second bloc consists of seven countries with higher public debt and/or deficits and higher interest and inflation rates on average (Cyprus, Greece, Ireland, Italy, Portugal, Slovenia, and Spain).

MUMOD1 is formulated in terms of deviations from a long-run growth path and contains the following state variables: output (y), real interest rate (r), nominal interest rate (I), inflation (π), union-wide inflation and output (π_E, y_E), public debt (D) and interest rate on government bonds (BI). The model includes three decision-makers: the common central bank decides on the prime rate R_{Et} (a nominal rate of interest); the national governments decide on fiscal policy: g_{it} denotes country i 's ($i = 1, 2$) real fiscal surplus (or, if negative, deficit), measured in relation to real GDP.

It is largely agreed upon that the recent sovereign debt crisis in Europe is to a certain extent due to the asymmetry between the core and the periphery in the EA. Several solutions have been proposed for this problem, in particular with respect to the difficulties of Greek governments to achieve sustainable public debt. One such alleged remedy, a "haircut" (partial debt relief) for the periphery, was examined in the context of the MUMOD1 model in [2]. We found that such a "haircut" can be disadvantageous not only for the lending countries (in our model, the government of the core) but also for the indebted country (the periphery). Here we investigate another possible solution often proposed in the political debate, namely the creation of a fiscal union. As in the earlier study, we assume the dichotomy between core and periphery to be strict and immutable and do not differentiate between various core or periphery countries.

We also emphasise that the model of the fiscal union is rather strict in assuming that there is one common policy enacted by the core and the periphery, which are treated together as one player only; hence we consider a coalition (in the sense of cooperative game theory) between the governments of the two countries (or blocs). A pure fiscal union (denoted by PFU) is modelled as a noncooperative (feedback Nash) game with two players, the central bank and the joint fiscal policy maker (the "EA minister of finance" or the "EA government"). The latter has two instruments, the budgetary surpluses of the core and the periphery, which are determined jointly. Alternatively, we also consider Pareto optimal solutions for the game, which are obtained as solutions to optimum control problems with three instruments. They can be interpreted as a centralized monetary cum fiscal union (denoted by MFU), where all decisions about monetary and fiscal policies are made jointly, and may be considered as a benchmark for the advantages of cooperation on the level of the EA.

4 Results of the Games

In the following, we report the results of some numerical game simulations. In all cases, the central bank gets a weight of $1/3$ and the two governments get a joint weight of $2/3$ in the joint objective function. For the fiscal union, we vary the weights

of the core and the periphery from 0.9 and 0.1 respectively (denoted by 09-01 in the figures) to 0.1 and 0.9 respectively (01-09 in the figures). These weights express the relative importance of each government in the fiscal union and can be interpreted as indicators of the relative power of the core and the periphery respectively. We run a baseline game of three independent policy makers for the noncooperative solution, which is the same as in [2]. The baseline Pareto solution from [2] is the 05-05 MFU. In the following figures, we only show the results for the baseline solution, the extreme cases of 09-01 (a “Schäuble fiscal union”) and 01-09 (a “Varoufakis fiscal union”), and the intermediate case of 05-05 (equal weights for both countries).

Figures 1, 2 and 3 display the feedback Nash equilibrium solution trajectories of the fiscal policy instrument variables (fiscal balance) and the two most important target variables, the output gap and public debt. In the baseline, three players play Nash while in the other scenarios (for the PFU), the fiscal union and the central bank are the two Nash players. For lack of space, we do not show the trajectories of the overall Pareto solutions (MFU), as they are qualitatively similar to those of the PFU.

It turns out that the weights of the governments in the fiscal union are important for the distribution of the “burden” of policy making in the fiscal union, while there are no strong differences with respect to monetary policy (not shown here). The larger the weight of the respective player, the more he can shift the task of stabilizing output or debt to the other one. In particular, the 09-01 scenario leads to a very

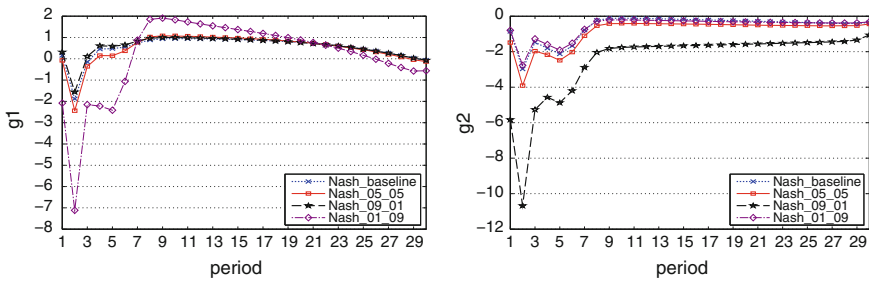


Fig. 1 Country i 's fiscal surplus g_{it} (control variable) for $i = 1$ (core; left) and $i = 2$ (periphery; right); baseline scenario

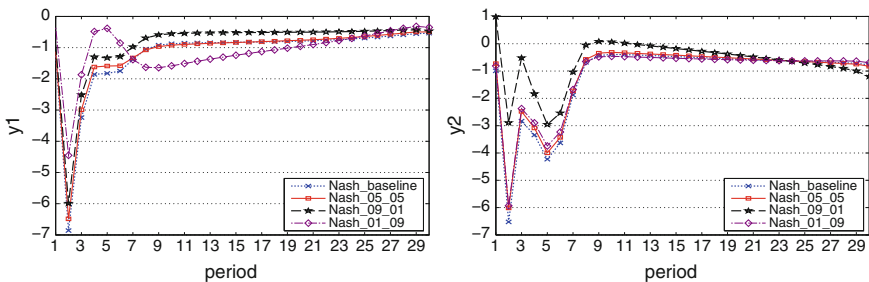


Fig. 2 Country i 's output y_{it} for $i = 1$ (core; left) and $i = 2$ (periphery; right)

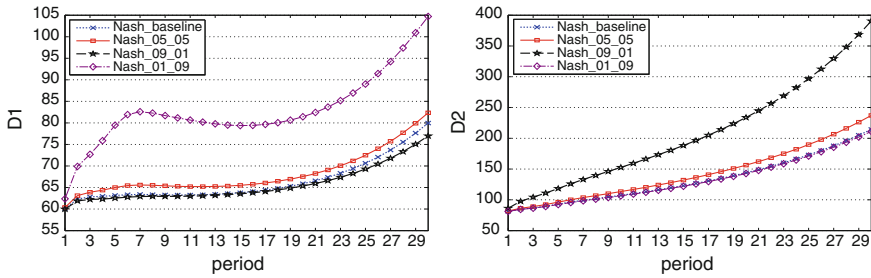


Fig. 3 Country i 's debt level D_{it} for $i = 1$ (core; *left*) and $i = 2$ (periphery; *right*)

cautious use of fiscal policy in the core and a very expansionary one in the periphery, which has to “do all the work” (Fig. 1). In contrast, in the 01-09 solution, the core has to fulfil a locomotive function during the crisis while the periphery may use its instrument in a way close to the noncooperative baseline solution. Note that this enforces an expansionary fiscal policy upon the core in spite of its preference for a more restrictive use of this instrument. Resistance against such a type of fiscal union by the core decision maker is understandable, as is the quest in favour of it by the periphery decision maker.

The different policy mixes result in relatively close developments of the output gap among different scenarios (Fig. 2). However, the development of the government debt is strongly dependent on the weights in the fiscal union (Fig. 3). The weaker country in the fiscal union obtains an enormous increase of its public debt, which leads to a clearly unsustainable level of nearly 400% of GDP in the case of the 09-01 PFU. The intermediate 05-05 fiscal union avoids these extremes and leads to trajectories similar to those in the baseline scenario.

Table 1 shows the values of the objective functions of the players, the central bank (CB), the core (C1) and the periphery (C2) governments, the fiscal union (C1 + C2) and the overall loss (CB + C1 + C2). We can see that the MFU for given weights within the fiscal union always dominates the PFU for the fiscal policy makers, as does the baseline Pareto solution (the 05-05 MFU) over the baseline Nash solution. The same is true for the joint loss of the fiscal union, which is always lower in the MFU than in the PFU. On the other hand, the central bank loses by being part of a full MFU relative to being excluded from an agreement with the fiscal union (PFU); however, this may change when its weight relative to the fiscal union (1/3) increases. This does not imply, however, that joint actions are always better, as can be seen from comparing the Nash baseline solution with the 05-05 PFU scenario. Here the fiscal union is better for the periphery and the central bank but worse for the core and the joint fiscal union. Although the differences are small, this shows that even an intermediate fiscal union with an equal distribution of weights among core and periphery need not be in everybody's interest and may hence be unstable politically.

Table 1 Objective function values of dynamic games for MUMOD1

Scenario	CB	Core (C1)	Periphery (C2)	C1 + C2	CB + C1 + C2
Nash_baseline	41.41	52.55	66.62	119.17	160.58
PFU_0.9-0.1	13.05	36.45	171.27	207.72	220.76
MFU_0.9-0.1	24.75	20.93	146.66	167.59	192.35
PFU_0.8-0.2	23.95	44.43	95.81	140.25	164.19
MFU_0.8-0.2	35.22	24.97	83.24	108.20	143.43
PFU_0.7-0.3	29.53	47.86	78.22	126.08	155.61
MFU_0.7-0.3	40.82	27.25	64.41	91.66	132.48
PFU_0.6-0.4	32.61	49.97	71.61	121.58	154.19
MFU_0.6-0.4	44.06	29.08	56.16	85.24	129.30
PFU_0.5-0.5	34.30	51.76	68.28	120.04	154.34
MFU_0.5-0.5	45.88	31.08	51.61	82.68	128.56
PFU_0.4-0.6	35.00	53.96	66.04	120.03	155.03
MFU_0.4-0.6	46.62	33.98	48.52	82.50	129.12
PFU_0.3-0.7	34.71	57.93	64.00	121.93	156.64
MFU_0.3-0.7	46.23	39.45	45.89	85.34	131.57
PFU_0.2-0.8	32.88	68.57	61.16	129.73	162.60
MFU_0.2-0.8	44.09	53.34	42.82	96.16	140.26
PFU_0.1-0.9	27.08	121.00	54.74	175.75	202.82
MFU_0.1-0.9	37.66	111.07	37.36	148.43	186.09

5 Conclusion

In this paper we used a dynamic game approach to analyse macroeconomic effects of a fiscal union in a model of a monetary union with two countries, the core and the periphery. We showed that a fiscal union in most but by no means all cases gives better results for the fiscal policy makers than noncooperative behaviour. However, the desirability of a fiscal union depends strongly on the weight of the core versus the periphery in the joint objective function of the union, reflecting institutional rules about the decision processes in the union.

References

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