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Keskusteluaiheita – Discussion papers

No. 715

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THE STABILITY PACT AND INEFFICIENCIES IN FISCAL POLICY MAKING IN EMU*

* Forthcoming in Public Finance and Management. An earlier version of the paper was presented at the IAES conference, Munich, March 15-20, 2000. The author thanks participants, especially Volker Clausen, and Ville Kaitila from ETLA for comments. The usual disclaimer applies. Financial support by the Yrjö Jahnsson Foundation is gratefully acknowledged.

ISSN 0781-6847 17.05.2000

ALHO, Kari E.O., **THE STABILITY PACT AND INEFFICIENCIES IN FISCAL POLICY MAKING IN EMU**. Helsinki: ETLA, Elinkeinoelämän Tutkimuslaitos, The Research Institute of the Finnish Economy, 2000, 23 p. (Keskusteluaiheita, Discussion Papers, ISSN 0781-6847; No. 715).

ABSTRACT:. The aim of the paper is to analyse the Stability and Growth Pact of EMU in a two-country model of monetary union with rational expectations and with spillovers of macroeconomic policies between the countries. The paper concentrates on tax policy, and shows that the results on optimal policy crucially depend on whether the demand channel of taxes through aggregate demand, or the supply channel, from taxes through wage formation, dominates in the determination of the rate of inflation and the international spillovers of policy. An optimal stability pact, which corrects the inefficiencies in policy making considered here, i.e., the lack of fiscal policy coordination between the countries and that between fiscal and monetary policies, and political myopia, is derived. Finally, an evaluation of the deterrent power of the existing Stability Pact with respect to deficit spending is derived and found to be quite small in comparison to the short-run gains related to risking the sanctions of the Pact.

Key words: Monetary union, stability pact, fiscal policy, coordination

JEL Classification: E00, E62

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TIIVISTELMÄ: Tämän tutkimuksen tavoitteena on analysoida EU:n vakaus- ja kasvusopimuksen vaikutuksia finanssipolitiikan päätöksentekoon kahden maan rahaunionin mallissa, jossa on rationaaliset odotukset. Tutkimus keskittyy veropolitiikkaan ja osoittaa, että optimaalista politiikkaa koskevat tulokset riippuvat siitä, dominoiko veropolitiikan välittymisessä kysyntäväylä veroista kokonaiskysynnän kautta vaiko tarjontaväylä verotuksesta palkanmuodostuksen kautta inflaatioon ja rahaunionin toiseen maahan. Tutkimuksessa johdetaan "optimaalinen" vakaussopimus, joka määritellään siten, että se korjaa finanssipolitiikan harjoittamiseen liittyviä tehottomuuksia, joita ovat tässä yhteydessä poliittinen likinäköisyys, koordinaation puuttuminen kansallisten finanssipolitiikkojen välillä ja finanssipolitiikkojen ja yhteisen rahapolitiikan välillä. Lopuksi tehdään arvio siitä, onko olemassaolevalla vakaus- ja kasvusopimuksella kylliksi pelotevoimaa estää vastuuton alijäämärahoitus ja päätellään, että lyhyen ajan hyödyt sopimuksen sanktioiden uhmaamisesta ylittävät hyödyn, mitä aiheutuu, jos sanktioita varotaan.

Asiasanat: Rahaliitto, vakaussopimus, finanssipolitiikka, talouspolitiikan koordinaatio

1. Introduction

The Stability and Growth Pact (SGP) of the European Union stipulates an important constraint on public sector finances in the medium run and on the stabilisation aspirations of fiscal policies in the short run in the member countries. The general government budget should be held in balance over the medium run, and with certain exceptions concerning a steep recession, its deficit at less than three per cent of GDP. If not, the country will have to undergo the excessive deficit procedure and even pay penalties in the end. These range from 0.2 to 0.5 per cent of annual GDP, if the budget deficit lies in the range of 3 to 6 per cent or more of GDP.

The basic thinking behind the constraints imposed by the Stability Pact is to guarantee stability in the functioning of EMU and to eliminate a potential conflict between the policy makers, as monetary policy has to obey a tight stance if fiscal policy is loose and inflationary. Another view behind the Stability Pact is adherence to the idea that the prime, or even sole, function of economic policies is to operate in a way that is conducive to medium-run stability and growth, and leave aside the short-run stabilisation of aggregate demand. In this perspective, it is important to put a restraint on the crowding out of private sector expenditures, especially investment, and to limit the possibility to run excessive structural deficits, which the EU countries have typically been prone to.

Another concern behind the Stability Pact is the possibility of adverse international spillovers related to loose fiscal policy, which is more likely and marked under a common currency than earlier. The real interest rate depends on the common monetary policy and the area-wide equilibrium between saving and investment. Therefore, fiscal policy by an individual member country in EMU faces a smaller national crowding out effect than under conditions of an own currency and less mobility of capital. This can lead to too loose fiscal policy from the point of view of the whole euro area.

There are some major weaknesses in the Stability Pact, as has also been pointed out in the literature and economic policy debate. Imposing a limit on the budget deficit may seem to be paradoxical as the EMU countries are likely to face asymmetric shocks, leading to booms and depressions, which the single monetary policy cannot eliminate. Furthermore, if we consider the pressure against the common monetary policy in the short run, then the deficit in the current account, i.e., the excess of national investment over saving, rather than only the government budget deficit, should be the more relevant criterion. However, it has been mentioned in the Pact that the three per cent limit on the budget deficit gives enough room for manoeuvring in a recession, if the pre-recession situation is budget balance or surplus.

On many grounds, public debt, rather than deficit, should be the key variable to which attention should be paid when considering the soundness of public sector finances. The interest rate is determined by the expected path of the deficit to be cumulated over a longer time horizon, and the countries cannot carry out intertemporal adjustment in public finances (e.g., due to a future change in the age structure, run surpluses now and deficits later) in an optimal amount, if only the current budget defi-

cit is controlled and penalised as is done now and no rewards are made on public surpluses, as suggested by Casella (1999). The Stability Pact may also lead to a cumulative downward trend in the ratio of the public debt to GDP, which may cause a demand deficit in a member country with a permanent financial surplus in the private sector, too. The Stability Pact has, however, been mostly criticised from the point of view of imposing a strict constraint on short-run stabilisation policies.

The aim of this paper is, instead, to analyse public finances and the stance of fiscal policies in a medium-run perspective from two angles that do not seem to have been raised previously in connection with EMU. In particular, we want to pay attention to the ambiguity concerning the inflationary vs. deflationary impact of tax policy, including both its national impact on inflation and international spillover to output and inflation in the rest of EMU. This is crucial for the assessment of the properties of the SGP. We build a two-period macroeconomic model with both neoclassical and Keynesian elements in it. The idea is, first, to solve the proper stance of non-cooperative national fiscal policy not constrained by the Stability Pact, and, second, to compare this to the efficient cooperative solution internalising the international spillovers of fiscal policy. On the basis of this comparison, we then study, what kind of a stability pact could correct the various inefficiencies in policy making. These are the possible myopia of political decision makers, lack of coordination between national fiscal policies and lack of coordination between the national fiscal policies and the common monetary policy. In this way we join the recent literature with the aim to study, what an optimal stability pact would look like, as done by Beetsma and Jensen (1999), in contrast to the earlier literature analysing whether the SGP is needed at all and whether it is counterproductive, see, e.g., Eichengreen and Wyploz (1998). In contrast to Beetsma and Jensen (1999), we, however, cast the analysis in a macroeconomic framework. The correction of non-cooperative economic policies with a stability pact is similar to the analysis of monetary policy, where the national loss function is amended so that the first best cooperative solution is reached, see on this Jensen (2000).

As a final item, we want to see whether the existing Stability and Growth Pact has, right or wrong, enough deterrent power to curb myopic deficit spending. The budget for a given period is decided in the beginning of that period, before a shock takes place. The shock has an impact on GDP, thereby also affecting the actual budget balance. The planned budget balance depends on two things: the fiscal stance adopted in the budget proposal and the cycle as forecast at that moment. The actual budget balance, which forms the basis of the possible sanctions in the Stability Pact, depends also on the forecast error made with respect to the actual cyclical position of the economy. The Stability Pact creates a precautionary motive in the fiscal policy towards a smaller deficit, or even a surplus, in the budget, because the higher the planned deficit, the higher the risk that the actual deficit will lead to the sanctions set by the Pact. The gains of a tight fiscal policy are, accordingly, that the expected value of the fines of the Stability Pact is lower. In this sense, the Stability Pact creates an environment where fiscal policy and taxation are tight "just for the sake of certainty".

These gains have to be contrasted to the losses (or gains) of pursuing a somewhat stricter (looser) fiscal policy, by which we mean the following. In the medium-term

outlook, the NAIRU will be lower, and therefore employment, output and aggregate income higher, if the tax wedge can be reduced and a somewhat looser fiscal policy with a higher initial budget deficit could be pursued. The paper will make a quantitative estimate of both these factors, gains and losses, in the Finnish case and will come to the conclusion that the SGP does not seem to be powerful enough so that a myopic government will commit to a tight stance in fiscal policy. Only the pecuniary gains are accounted for here, even though many others, like bad reputation related to sanctions, could also be envisaged.

The structure of the paper is the following. In Section 2 the basic macroeconomic model is introduced for a monetary union. Optimal decision making is introduced and solved in the non-cooperative situation in Section 3 and the interrelationship between the common monetary policy and fiscal policies is illustrated. Section 4 analyses cooperative decision making, and Section 5 turns to the consideration of a stability pact, if this were to be introduced with the goal of correcting the various inefficiencies in national policy making in a monetary union. Section 6 considers the deterrent power of the SGP towards curbing excessive deficit spending, drawing on a numerical illustration. Section 7 briefly concludes.

2. The Macroeconomic Model

As mentioned in the Introduction, we want to cast the Stability Pact within an explicit macroeconomic model, where it properly "belongs", instead of a microeconomic policy selection framework where public sector policy making is solely constrained by its own budget constraint, as in Beetsma and Jensen (1999). We build the following model of structural unemployment and inflation, within an open economy context, in a monetary union, starting from and modifying the basic closed economy model by Layard et al. (1991), and formulated recently by Nickell (1998). We assume that the monetary union is a closed region. For simplicity, let there be a monetary union consisting of two countries, the countries being denoted by subscripts 1 and 2. The countries are not identical, however, and may especially differ in size. We build a two-period model, which we shall first present in a static form and then make an interpretation with a time dimension.

Each economy has an IS curve, which is of the following kind for country 1,

$$y_1 = \sigma_0 - \sigma_1(i - p_{1e}) + \sigma_2 y_2 + \sigma_3(P_2 - P_1) + \sigma_4 g_1 - \sigma_5 \theta_1 + u_1, \qquad (1)$$

where y is output, i the common interest rate, P the producer price level (log), p_{1e} expected inflation, measured by the producer price index in country 1, g is real government expenditure, θ the (aggregate) tax rate and u the demand shock. The right-hand side is conventional with the demand for output being a positive function of foreign output y_2 and competitiveness ($P_2 - P_1$, through exports and investment) and a negative function of the real interest rate. Unemployment U and output y are related to each other by the seminal Okun law:

$$U_1 = \omega_0 - \omega_1 y_1. \quad (2)$$

The core of the model is the following price and wage-setting supply block,

$$P_{C1} = s_1 P_1 + (1-s_1)P_2, \ 0 < s_1 < 1 , \quad (3)$$
$$P_1 = -a_1 + \alpha_1 W_1 + \alpha_2(i-p_{1,e}) + \alpha_3 P_2 + \alpha_4 y_1 + m_{1P} + v_1, \text{ and} \quad (4)$$
$$W_1 = a_1 + P_{C1,e} + \beta_1(P_{C1} - P_{C1,e}) + \beta_2 U_1 + \beta_3 \theta_1 + m_{1W} + z_1, \quad (5)$$

where as new variables, P_C is the (log of the) consumer price index, s_1 is the share of the goods produced in country 1 in the consumption basket of that country, W is the (log of the) nominal wage rate, a is exogenous (total factor) productivity and the m_{1i}s are the rest of the mark-ups in prices and wages. The mark-up factor of prices essentially depends on the demand conditions in the economy, while the mark-up of wages depends on the rate of unemployment and, in a crucial way, on the tax wedge (this kind of wage setting behaviour can be explicitly derived from a monopoly union model, see e.g. Lassila 1998). The v and z are the supply shocks in the setting of prices and wages. The parameter β_1 measures nominal wage flexibility and β_2 the real wage rigidity prevailing in the labour market. If β_1 is equal to unity, we would have full nominal wage flexibility. For the price setting parameters, the homogeneity constraint for the cost components implies that $\alpha_1+\alpha_2+\alpha_3 = 1$. We close the model by the rational expectations hypothesis, $P_{1e} = P_1$, $P_{2e} = P_2$ and, consequently, $P_{Cj,e} = P_{Cj}$, j = 1,2. All the parameters are defined as positive in (1)-(5). They may be country specific, which is not explicitly denoted above.

The financial markets are open for an asset (government debt) between the two periods, 1 and 2, considered in the model. As normal, we assume that the wage and price setting refer to the levels of prices and wages in period 2 only. In period 1 there is a constant price level, normalised to unity so that in (1) we can substitute P by the inflation rate p. Accordingly, we define the real interest rate to refer to the nominal interest rate, which is set in period one, and the change in the price levels between periods 1 and 2. A similar, and somewhat crude, treatment of monetary policy is also incorporated in the (non-structural) model by Beetsma and Jensen (1999). In the second period, the model operates with fixed prices and no interest rate.

The model is fairly large and, as it incorporates rational expectations, is in practice quite impossible to solve analytically all the way down to optimal policy. Hence we also have to take recourse to a numerical calibration, see Appendix 1. The first task is to solve the model into a reduced form of the target variables, i.e., output, unemployment and the rate of inflation as a function of the policy variables. As is self-evident from the set up, each country depends on the other EMU country, so that the model requires a simultaneous solution. We get the following general solution for country 1,

$$y_1 = y^1(i; g_1, \theta_1; g_2, \theta_2), y_1^1 < 0, y_2^1 > 0, y_3^1 < 0, y_4^1 > 0, y_5^1 ?, \quad (6)$$
$$U_1 = U^1(i; g_1, \theta_1; g_2, \theta_2), U_1^1 > 0, U_2^1 < 0, U_3^1 > 0, U_4^1 < 0, U_5^1 ?, \quad (7)$$
$$p_{C1} = p^1(i; g_1, \theta_1; g_2, \theta_2), p_1^1 < 0, p_2^1 > 0, p_3^1 ?, p_4^1 > 0, p_5^1 ?. \quad (8)$$

All the reduced form impact coefficients in (6)-(8) cannot be inferred using only information on the a priori signs of the coefficients in the structural model (1)-(5). In particular, we have to make the following additional assumptions in order to reach the pattern in (6)-(8). To get a negative effect from the common interest rate on inflation, the cost-push impact of the real interest rate in (4), leading further to a lower real interest rate and thereby to a rise in total demand, has to be smaller than its dampening effect running through aggregate demand in (1) and the capacity utilisation variable in the inflation equation (4).

A more crucial assumption concerns the relative importance of the two channels, working in opposite directions, which run from domestic taxes to domestic inflation and to foreign output and inflation. The first of these is the traditional Keynesian effect arising from the reduced demand in the goods market, caused by a tax hike, leading to lower inflation. The second one is the supply channel operating through wage pressure originating in monopolistic trade union behaviour, which leads to a rise in nominal wages as taxes are raised. For simplicity, we use the term "demand view" to denote the situation where the former effect dominates the latter and a rise in taxes is deflationary, and the "supply view" to represent the situation where the latter effect dominates the former and a rise in taxes is inflationary. Similarly, as a tightening of domestic taxation reduces domestic output under both views and, under the demand view, also the domestic wage and price level, it deteriorates price competitiveness of the neighbouring country, cuts foreign output and employment and curbs foreign inflation. If the supply view holds, then, on the contrary, price competitiveness of the neighbouring country improves and so, on balance, it is difficult to fix the foreign effects of tax policy, as the balance is basically an empirical question. In order to remove some of the ambiguity, we shall assume hereafter that, under the supply view, a rise in domestic taxation is expansionary with respect to foreign output, especially if, as the numerical simulations of the two-country model outlined in (1)-(5) show (see Appendix 1), under rational expectations the price effects from a fiscal policy change are marked. With respect to inflation there are definitely clear international spillovers between the countries so that, under the demand view, foreign inflation is also curbed if domestic taxes are raised, while under the supply view, the effect is to accelerate inflation in both countries. The effects of the other domestic policy variables on the real side and inflation are non-controversial.[1]

3. National Non-cooperative Policy Making

The policy maker, the present government, is assumed to have the following objective function in each country. It is based on available resources in the economy and on the fact that in period 2 the present government has the probability π (less than unity) of being re-elected, similarly as in Beetsma and Jensen (1999),

[1] Note that in contrast to the closed economy model by Nickell (1998), in this model also the expected and not only the unexpected changes in the fiscal policy variables affecting aggregate demand have an impact on the real side of the model solution. This difference is basically due to the inclusion of a demand pressure variable and foreign cost-push in the price setting equation as components of the mark up. These also imply that the Phillips curve is not vertical in the national economy.

$$V_j = f(y_{j1}) + \pi_j f(y_{j2}) - (\mu_j/2)p_{Cj}^2 , \quad (9)$$

where f is a concave national utility function and we assume that the marginal social discount factor is a constant and without a loss of generality normalised to zero so that no explicit discounting is present in (9). The weight of inflation μ is of course positive. The first subscript of income y refers to the country concerned and the second to the time period. To be more specific in what follows, we assume that the elasticity of intertemporal substitution is unity and therefore the instantaneous utility function is logarithmic, $f(y_{jt}) = \log(y_{jt})$.

Let us concentrate on the case of a binding constraint on the public debt at the end of the second period and skip the problems related to this assumption and omit the problem of debt default and simply take the level of public debt b_{j2} at the end of the second period to be zero. The public sector borrowing constraint is therefore

$$z_{j2} = -(1+i-p_j)(z_{j1} + b_{j0}) , \quad (10)$$

where b_{j0} is the initial level of public debt and z_{jt} is the real primary deficit in country j in period t,

$$z_{jt} = g_{jt} - \theta_{jt} y_{jt} . \quad (11)$$

We assume that public expenditure g is fixed in both periods in relation to output and not subject to decision making, which only concerns its financing by taxes and borrowing.

The sequence of events in the model is the following. First, the demand and supply shocks are materialised and the stance of fiscal policy is selected in a simultaneous non-cooperative way in both countries for both periods and the monetary policy is set by the common central bank. Then, private sector expectations are formed on inflation and the wage rates set. In this way we exclude the possibility of an inflation bias in policy-making, see e.g. Jensen (2000), and concentrate solely on the inefficiencies in international coordination and on political myopia. In the second period the private sector and fiscal policy decisions are made under certainty. There is no strategic behaviour in the model at this stage.

The model is now solved for the optimal current period tax rate. Insert (11) into (10) and further into (9). National optimal non-cooperative decision making leads to the following condition of intertemporal optimisation for the tax rates in period 1 in country j, [2]

$$\frac{(y_{j1})_{\theta_{j1}}}{y_{j1}} = \pi_j \frac{(y_{j2})_{\theta_{j2}}}{y_{j2}} \left[(1+i-p_{Cj}) + (p_{Cj})_{\theta_{j1}} \left(\frac{g_{j1}}{y_{j1}} - \theta_{j1} + \frac{b_{j0}}{y_{j1}} \right) \right] + \mu_j p_{Cj} (p_{Cj})_{\theta_{j1}} , \quad (12)$$

where output in country j in period t depends negatively on the tax rate in the period concerned and the current output y_{j1} is also affected by the demand and supply shocks. The effects of these is such that the optimal current tax rate is lowered

[2] In the derivation, we have approximated the ratio y_{j2}/y_{j1} to be equal to unity.

in the case of adverse demand and supply shocks, if the effects running trough inflation are omitted. In general, however, the situation is more complex, depending on the weight of inflation aversion in policy making. The only uniform reaction is that the tax rate should be lowered under the supply view in case of an adverse supply shock. The term in square brackets on the right-hand side of (12) has to be positive in order to obtain a positive tax rate for the first period, which we assume to hold. The non-cooperative solution for the tax rates in the two countries forming the monetary union in period 1 can then be found from a nonlinear system of simultaneous equations like (12). In order to reach unambiguous results, we have to assume that the own effects dominate the cross effects, i.e., that the effect of the home tax rate is bigger in absolute value on output at home than abroad. This is not, however, enough under the supply view, as the determinant of the system is not necessarily positive, if the impact $(p_C)_\theta$ of taxes on inflation is large and positive. The optimal tax rate in the second period is solved through the budget constraint (10).

Several important insights can be inferred from equation (12). In contrast to the standard case where there is a fixed endowment of taxes as in Beetsma and Jensen (1999), i.e., when $(p_C)_\theta = 0$ and where only a straightforward intertemporal adjustment takes place, the dependence of current inflation on the current tax rate plays a role of its own and complicates the general solution of (12). As we shall see, we cannot fix a priori the way in which the tax rate depends on a change in some parameter, this depending on whether the demand or supply channel dominates in the total effect of the tax rate on inflation, as already outlined above. To repeat, by the former we mean that the contractionary impulse of taxes on total demand dominates in price formation the supply channel operating through wage determination, see (8) above; and in the latter the case is the reverse.

Let us first analyse the dependence of the optimal tax rate on the parameters of the model. It is not evident how the current tax rate depends on a change in political distortion, i.e., myopia (π_j), of the present government, which is one source of inefficiency in policy-making here, as the reaction depends on many counterveiling effects in the last two terms on the right-hand side of (12). If $(p_C)_\theta$ is zero, which is the traditional case and corresponds to the basic intertemporal optimisation by Beetsma and Jensen (1999), a rise in π definitely leads to a rise in the current tax rate and a smaller current budget deficit. Under the demand view, on the basis of (12), the optimum tax rate rises even more than when taxes have no impact on inflation, since the right-hand side of (12) also rises when the current tax rate is raised. Under the supply view, the result is reversed. It cannot be a priori stated whether the current tax rate is lowered or raised as a result of a rise in π_j. This is because the initial rise in the tax rate leads to a rise in the inflation rate, which already lowers the right-hand side of (12), i.e., the intertemporal burden of deficit financing through a lower national real interest rate, and this spurs more current deficit spending.

With a positive inflation rate, a rise in inflation aversion, i.e. in μ_j, works, of course, in a way, such that, under the demand view, the optimal current tax rate is raised. The reverse holds under the supply channel. So, we see that the reaction of

fiscal policy and also the interplay between fiscal and monetary policies (see on this more below) are determined by the dominance of either of the two channels.[3]

Let us now turn to the common monetary policy. We assume that the common central bank is fully independent and conservative so that it does not care at all about output and employment, but only about the loss L_{ccb} related to the weighted average of the inflation rates, i.e., the aggregate inflation rate in EMU,

$$L_{CCB} = -\frac{1}{2}(S_1 p_{C1}^2 + S_2 p_{C2}^2), \tag{13}$$

where S_j is the relevant size indicator (e.g., output share) of country j in the monetary union. The central bank has at its disposal only the interest rate as its tool in period 1, by which it can dampen the two inflation rates and output levels, thereby also raising, however, equilibrium unemployment. Denoting the solution in (8) for inflation in country j as $p_{Cj} = (p_{Cj})_i i + v_j$, where v_j consists of the linear combination of all other factors other than the interest rate, and where the coefficient $(p_{Cj})_i$ is negative, yields the optimal interest rate,

$$i = -\frac{S_1[(p_{C1})_i]v_1 + S_2[(p_{C2})_i]v_2}{S_1[(p_{C1})_i]^2 + S_2[(p_{C2})_i]^2} \quad . \tag{14}$$

As presented above in connection with (8), the v_js depend positively on the home and foreign fiscal policy variables g_j and either positively or negatively on θ_j. Therefore, according to the demand view, the more expansionary and the less tax financed the budget is, i.e. the bigger the budget deficit, the tighter the monetary policy will be. According to the supply view, on the contrary, the lower the tax rate, the looser the monetary policy aimed at price stability can be. So, before knowing the way the budget deficit emerges and the relative magnitude of the two channels, we cannot immediately state that the deficit as such is in conflict with the task of the common monetary policy by the ECB. The non-cooperative solution for fiscal and monetary policies is determined by (12) for j = 1, 2, and (14).

It is also important to observe that here the common central bank does not completely eliminate the idiosyncratic inflationary pressure arising in one member country, but only a part of it, and the less, the smaller the size (S_j) of country j in the union (measured say by output). But on the other hand, of course, it completely eliminates the common inflationary pressures arising at the union level, i.e., symmetrically in all the member countries. So, we see that the larger the union, i.e., the smaller the average size of its members, the higher the potential conflict between the national desire to stabilise inflation and the task of the common monetary policy to control the average inflation rate in the union, i.e., the less the common central bank alleviates the task of the national policy-makers in their desire to curb idiosyncratic shocks to inflation.[4]

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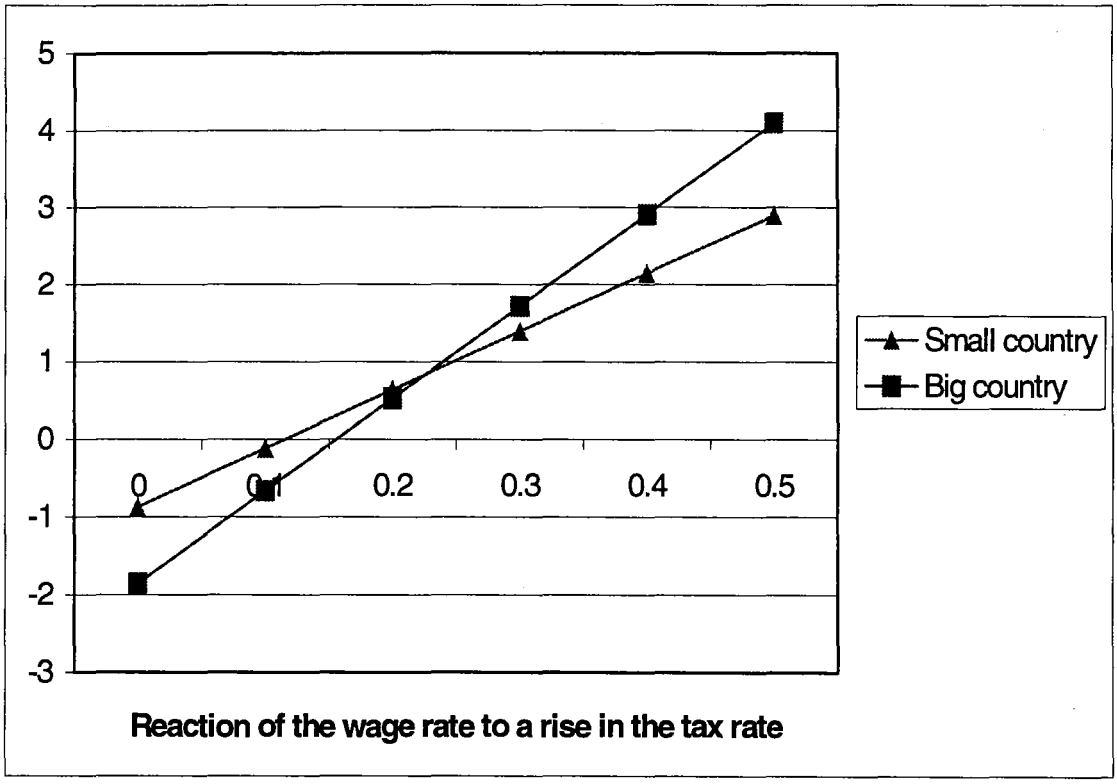
[3] The impacts due to other factors also depend on this dominance. If it is the former, the demand channel, then the higher the interest rate, the higher the current optimal tax rate and the lower the fiscal deficit. The case is, however, indeterminate under the supply view.

[4] If we add the rate of unemployment as one target of the common central bank, the optimal rate of interest would also contain the negative term $S_1(U_1)_i + S_2(U_2)_i$, in the numerator of (14), weighted by the relative weight of unemployment in the decision making of the central bank.

One fear in EMU and behind the reasoning for the Stability Pact is that when the countries operate in financial markets integrated at the union level, and face a common interest rate, which is very little affected by the fiscal laxness in one country, they are tempted to run large budget deficits threatening the stability of EMU. This concern is also valid here because, as we saw above, the common central bank only curbs average inflation and not the national rate of inflation. However, this is not the whole picture, as high taxes are, on the contrary, a threat to reaching price stability in the monetary union under the supply view of tax policy.

We can infer how the international spillovers of fiscal policy are also transmitted via the common interest rate, in addition to those direct effects presented above. Again, they depend on the outcome concerning the effect of taxation on the rate of inflation. First take the demand view of tax policy. The lower the rate of distortionary taxation used to finance government expenditure in one country, i.e., the bigger the budget deficit, the higher the nominal and real interest rate through the reaction of the common monetary policy in the whole monetary union. This will, furthermore, lead to a higher tax rate in the neighbouring country and bigger distortions there. Under the supply view, things are not so clear-cut.

Figure 1. The reaction of the common monetary policy (percentage-point change in the common interest rate) to a rise in the tax rate, as a function of the β_3 parameter



In Figure 1 we present a numerical solution of the model (see Appendix 1) as to the reaction of the optimal monetary policy, i.e., that pursuing price stability, to a rise in the tax rate in one of the member countries of the monetary union. We can clearly discern the marked difference between the demand and supply views. According to the former, a tightening of fiscal policy leads to an accommodative change in monetary policy, even though price stability is its only goal. With values for β_3 being still quite low,[5] the policy rule turns upside down and a rise in taxes, i.e., a cut in the public deficit, leads to a rise in the interest rate, quite contrary to the basic idea behind the Stability Pact of EMU. It is also evident and important to notice that the reaction of the common monetary policy to a policy change in a big country is more vigorous than in the case of a small country (in Figure 1 the shares S_1 and S_2 are 80 and 20 per cent, respectively).

We carried out this analysis also using static expectations for inflation, instead of rational expectations. This change has a marked impact on the reduced form coefficients of the model, which are now in general smaller in absolute size. However, the reaction of the monetary policy is qualitatively similar to that before, which is due to the fact that the effectiveness of monetary policy is also reduced vis-à-vis inflation control. This is intuitively clear, as expectations are not allowed to react endogenously to the change in policy; hence reduced inflation does not lead to a magnified effect through expected inflation back to reduced actual inflation.[6]

4. Coordination vs. Non-cooperation in Fiscal Policies in a Monetary Union

There are several kinds of inefficiencies in policy making captured in the model: first, the governments are typically too short-sighted and do not maximise the "true" national welfare function, and second, the governments may be willing to break their intertemporal budget constraints and borrow more than they can pay back in period 2. There is the problem of time-inconsistent policies, so that when the second period comes, the government may want to change its policies as chosen in the first period. This will be analysed in Section 6. Further, there is no international coordination in fiscal policies, although they create international spillovers to unemployment and inflation in the other countries, and still, there is no coordination between the monetary and fiscal policies, although they should be set in a concerted manner.

We now assume that a social, or rather EU-level planner would, in order to reach a global welfare optimum for the Union, select the policy variables so that the sum of "true" national utilities is maximised, i.e., so that also the myopia at present in (9) is absent, $\pi_j = 1$. We also assume that the EU-level planner wants to obey the constraint, realised by delegating the monetary policy to an independent

[5] The parameter concerned measures how much compensation the trade unions require in nominal wages when the tax rate is raised by one percentage point.

[6] We also get the clear result that the optimal monetary policy as a reaction to a change in fiscal policy in one country does not depend much on the model parameters of the neighbouring country.

common central bank, so that aggregate inflation is maintained equal to the inflation target, denoted by p_C^* (in practice, say, at most 2 per cent per annum). The goal is now to maximise simultaneously with respect to the fiscal policies the sum

$$V_{EU} = V_1 + V_2 , \tag{15}$$

subject to the constraints $\pi_1 = \pi_2 = 1$ and $S_1 p_{C1} + S_2 p_{C2} = p_C^*$, and thereby also subject to the monetary policy reaction function (14). Let simply $p_C^* = 0$. Maximising (15) under these constraints introduces four additional or transformed terms to the optimum presented above in (12). Especially on the left-hand side, a spillover term of tax policy in country 1 to output in country 2 is to be introduced in the optimal condition for the fiscal policy of country 1:

$$\frac{(y_{21})_{\theta_{11}}}{y_{21}}. \tag{16}$$

When the demand channel dominates, we have the case where (16) is negative, while under the supply channel it is positive. The latter is due to the impact of deteriorated competitiveness in the country where the tax hike takes place and the consequent improved competitiveness in the neighbouring country. The myopia of political decision making in a country requires the addition of a term of the form $(1-\pi_1)$ times the term in square brackets on the right-hand side of (12). As a third item, the correction of the coordination failure between fiscal and monetary policies requires addition of the following term to the right-hand side of (12),

$$\frac{(y_{12})_{\theta_{12}}}{y_{12}} \frac{di}{d\theta_{11}} (p_{C1})_{\theta_{11}} \left(\frac{g_{11}}{y_{11}} - \theta_{11} + \frac{b_{10}}{y_{11}}\right) , \tag{17}$$

where the reaction of the monetary policy is that stipulated by (14). At the same time, also the last term on the right-hand side of (12), related to domestic inflation is transformed to be of the following kind, solving first for p_{C2} from the inflation constraint mentioned above,

$$\mu(S_1) p_{C1} (p_{C1})_{\theta_{11}}, \tag{18}$$

where the weight $\mu(S_1) = \mu_1 + \mu_2 (S_1/S_2)^2$. This term rises towards infinity when S_1 approaches unity. As all the other additional terms remain unchanged or bounded, this last term (18) starts to dominate as the share S_1 approaches unity, the deviation of the EU optimum from the solution of national non-cooperative policy-making. We can now infer the following.

Proposition. *If the demand view dominates and inflation in a country is positive (i.e., higher than the EMU target), then there exists a size of the country in the monetary union such that, for bigger countries than this, the non-cooperative tax rate is too low compared to the optimal EMU-level tax rate. If the country is in deflation, i.e., its inflation is less than the EMU target, the reverse holds, i.e., its tax rate is too high. If the supply view dominates, the same holds so that the tax rate is too high from a certain size onwards. For the small partner country, the*

case is reversed under the demand view and the same as that above under the supply view.

The intuition behind the proposition is that the larger the country, the more it is bound in the EMU-level cooperative decision making to the common inflation target to which fiscal policy has to be solely directed in such a country. Under the demand view, this calls for tightening of taxation and the reverse under the supply view. If the country is very small, under the demand domination in the transmission of taxes to inflation, it can gain from an expansion in output created by lower taxation, as the big country controls inflation at the Union level. Under the supply view, when the effect of taxes to inflation runs via wage formation, also the small country should gain from a lowering of its structural unemployment by a reduction in the tax wedge.

In general, the situation is of the kind that it is the instantaneous spillover term (16) that makes it unambiguous to infer how the non-cooperative policies are inefficient. Take the Keynesian demand view, which would normally call for too low taxes and too big a budget deficit when the country size approaches unity in an inflationary country. The negative spillover of a higher tax rate on the output of the neighbour, however, calls for a deviation in the reverse direction. The same applies, mutatis mutandis, to the supply view.

It is also interesting to find that the result behind the proposition basically punishes or rewards national tax policy depending on whether the country concerned is below or above the EU-level norm of the socially optimal inflation rate.

5. The Stability Pact as a Corrective Device of Inefficiencies in EMU

Next, we want to ask two questions: what would an "optimal" stability pact governing fiscal policy making in a monetary union be like, and what are the effects of the present Stability and Growth Pact on policy making. We consider the latter question in the next section. We shall then not only pay attention to the structural deficits, as analysed so far above, but also to the cyclical budgetary positions.

We set out the problem of an optimal stability pact in the following way. We assume that a sanction, i.e., a fine, is only imposed on the basis of the first-period behaviour of the government and will be realised in the second period. The task is to determine the transfer, called a transfer or a fine function, such that imposing it will lead to efficient international cooperation of economic policies within EMU as derived above. To be more precise, we try to find a function h such that when the budget constraint of the public sector is changed from that above in (11) in the following way for country 1 in period 2,

$$z_{12} = g_{12} - \theta_{12}y_{12} + h_1(\theta_{11}) - S_1h_2(\theta_{21}), \tag{19}$$

where the third term on the right-hand side is the fine paid to the budget of the union and the last term the amount of transfers received from the fine paid by the neighbour, the non-cooperative behaviour of the governments will lead to the first-

best cooperative solution. The corresponding change has to be made to the national welfare target in (9), so that the government now values national income, namely production less net transfers paid abroad, i.e. $y_{12}-h_1+S_1h_2$. The situation is analogous to the correction of the non-cooperative monetary policy in an international economy, see Jensen (2000).

In general, under cooperative decision making, side payments have to be introduced for each partner to gain equally from co-operation and to have an incentive to realise the cooperative outcome. Here the problem setting is somewhat different, as we try to change the non-cooperative behaviour to the full cooperative one with fines (transfers through the EU budget) depending on the behaviour of the respective member countries. We should also ask, how the gains from cooperation are distributed, and whether the transfers of the possible stability pact are enough to accomplish that, as side payments are not in practice possible through the Union budget, i.e., under which arrangements are the member countries willing to agree on a stability pact. We leave this question, analysed thoroughly by Beetsma and Jensen (1999), aside and assume that welfare under the stability pact, including fines (or rewards), for each member country, is higher than welfare under the non-cooperative solution, which guarantees that such a stability pact will indeed be signed by the members of the monetary union.

Let us first leave out the national concern for inflation, so that $\mu_j = 0$ in (9), i.e., the national inflation targeting has completely been delegated to the common central bank. Of the factors requiring a correction, myopia is the first, the coordination failure between fiscal and monetary policies is second, and that between the fiscal policies is third. Altogether these lead to the correction $h_{1,1}$, which is in general of the following form, see Appendix 2 for details,

$$h_{1,1} = A_1\theta_1 + B_1\theta_1^2 + C_1 \ , \tag{20}$$

where the parameters A_1 and B_1 are constants and C is the integration constant, i.e., a scale variable that sets the origin on a meaningful point on the horizontal axis, which in turn has to be defined in such a way that the rewards/fines can be handled within the Community budget.[7] Before evaluating (20) in more detail, let us combine with it the penalty function originating from the national inflation target. Adding national inflation aversion introduces a correction, which is, in both cases, a quadratic penalty function centered on that tax rate, which leads to the rate of inflation equal to half of the influence γ_j of factors on inflation other than taxation in the home country (using an analogous presentation as on p. 8 above).[8] We assume this to be positive. We have

$$h_{1,2} = E_1\theta \ + F_1\theta_1^2 \ , \tag{21}$$

where E_1 and F_1 are positive functions of $(S_1/S_2)^2$. Again, as mentioned above in connection with the above proposition, this quadratic function (21) starts to dominate the total h_1 function, which is the sum of (20) and (21), as the size S_1 of the

[7] The EU budget is $(1-S_1)h_1y_{11}+(1-S_2)h_2y_{21}+T_{EU} = G_{EU}$, where the last two items are the given other revenues and expenditure of the Union, respectively.

[8] Note that in this way the h function also depends on the tax rate in the neighbouring country.

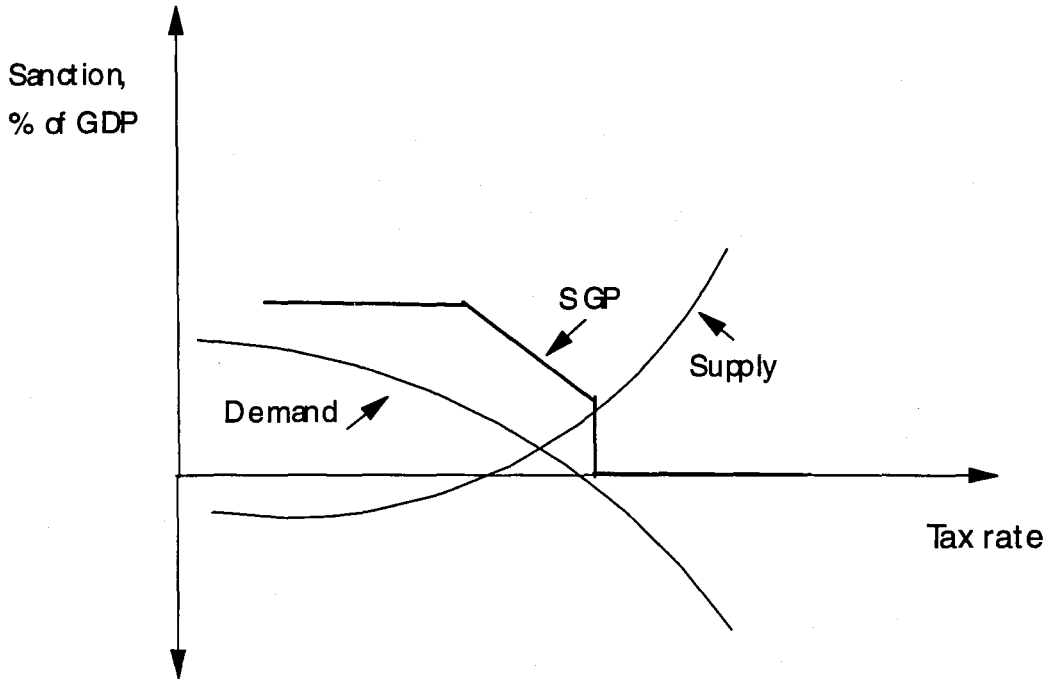
country concerned rises towards unity. In the case of the supply view, the penalty function h is in the end a rising function for all positive tax rates. Under the demand view, the minimum of the penalty function is reached at a positive tax rate, for a proof, see Appendix 2. The optimal stability pact is also dependent through the parameter E_1 on the demand or supply shocks, as they have an effect on the inflation rate. An adverse demand shock, under the demand (supply) view, or a supply shock, under the supply (demand) view, will shift the fine function to the left (to the right).

However, for a small member country (when S_1 approaches zero), component (21) vanishes as the conflict between national inflation targeting and inflation targeting at the EMU level disappears, because the spillover effect from the national to the Union inflation rate vanishes. Therefore, for small S_1, component (20) contributes to the whole of the penalty function. It is noteworthy that it is constant, independent of the demand or supply shocks hitting the economy.

Some straightforward but tedious algebra yields the following pattern, see Appendix 2. In general, it is difficult to give the a priori sign of A_1. The sign of the more interesting B_1 parameter is, however, the following. For a small country, the sign of B_1 is negative under the demand view and positive under the supply view.[9] This is due to the fact that for small countries there is in effect no coordination failure between monetary and fiscal policies (as was presented already in Figure 1). In addition, it is intuitively clear that the current international spillovers of domestic fiscal policy to foreign output and inflation also disappear as the size of the country becomes small. Hence, only a correction of the political myopia is needed. General short-sightedness, i.e., low taxes now and higher taxes tomorrow, should be penalised under the demand view. Under the demand view, this is dampened by the fact that a rise in taxes leads to a rise in the real burden of deficit financing, and this should also be penalised. Under the supply view, things are the reverse. Now, a deferral of the tax reform to reduce structural unemployment should be penalised. We get the following pattern, see Figure 2. In general, more myopia, i.e., a lower value for π gives rise to steeper slopes of the penalty functions.

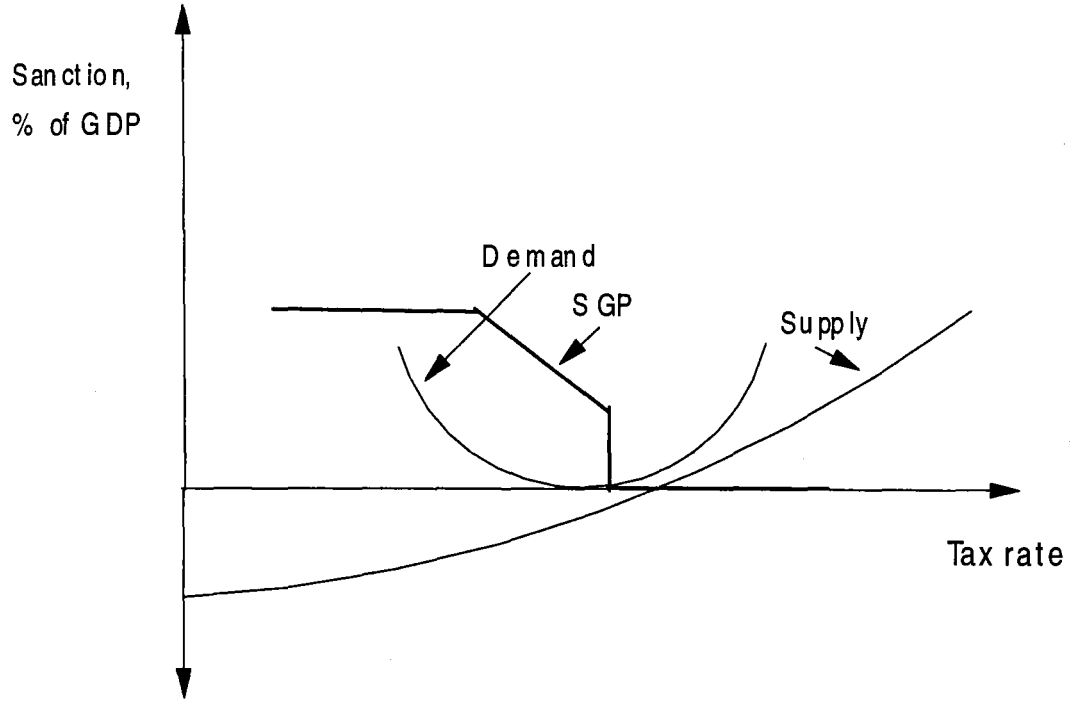
[9] If the size of the country concerned is big enough and under the mild condition that the reaction of the rate of inflation to a unit rise in the interest rate is, however, less than unity in absolute value, then B_1 is positive under the demand view and negative under the supply view.

Figure 2. The sanction of an optimal stability pact for a small country (SGP is the form of the existing Stability and Growth Pact)



For large countries we get the following pattern on the basis of (21).

Figure 3. The optimal stability pact for large countries



The Stability Pact is not redundant here even if the common central bank is fully independent, in contrast to Beetsma and Jensen (1999). Here this depends on the fact that the monetary policy cannot stabilise inflation in each member country at the target with a single policy variable, but can only bring the average rate of inflation back to the target.

As we have seen, the existing SGP seems to be of the wrong technical character, especially under the medium-run of supply side policies, as it is downward sloping as a function of the tax rate. Under the demand view, it matches better with the characteristics of the optimal stability pact for small countries. However, the penalty function should also be symmetrical in not only penalising "bad", but also rewarding "good" behaviour, which the present SGP does not do.

6. Is the Stability Pact an Effective Deterrent to Deficit Spending?

As one element in evaluating the existing Stability Pact, we have to ask whether it, right or wrong, is powerful enough to meet its primary purpose of containing deficit financing. In our framework, we ask whether a completely myopic government with $\pi_j = 0$, is willing to omit the threat of sanctions of the Pact, which now, in contrast to that above, are assumed to be paid simultaneously as the benefits accrue (i.e., within the relevant unit period). To put it differently, we want to ask whether the government entering the second period deviates in a time inconsistent manner from the first-best optimum planned in period 1.[10]

In order to shed light on this issue, we now introduce a new set of shocks, which materialise after the policy has been selected. This will have an effect on the actual budget balance and therefore on how likely the country concerned has to face the sanctions of the Stability Pact.

Let y* be the forecast of output made in connection with the budget proposal, i.e., the deficit z* forecast at that moment being

$$z^* = g - \theta y^* + ib_0 . \tag{22}$$

The actual budget balance z is the following, assuming for simplicity that only output y is uncertain and driven by shocks,

$$z = g - \theta y + ib_0 . \tag{23}$$

Let us now derive the expected cost of sanctions as stipulated by the SGP as a function of the aggregate tax rate θ. These are derived by integrating the penalty function h*, stipulated by the actual SGP mentioned in the Introduction, and al-

[10] There may, of course, be other factors behind the desirability of a stability pact than the ones analysed below. One such factor is the need to safeguard the other EMU partners from the risk of possible overindebtedness and a bail-out of a member country in the monetary union, seriously jeopardising its stability.

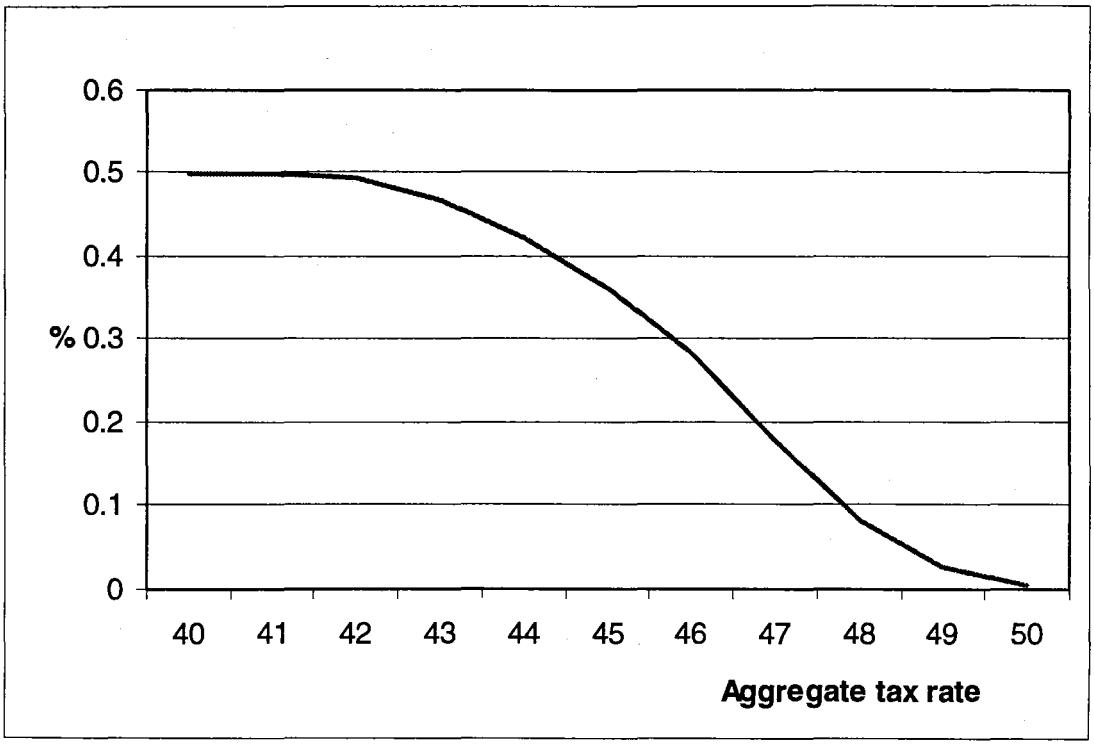
lowing for uncertainty in output. We have proceeded in the following way. We use the Finnish economy as a benchmark and the actual forecasts and their errors as made by ETLA, The Research Institute of the Finnish Economy, in its forecasts carried out in the autumn of each year, i.e., at the same time as the budget for the next year is presented to the Parliament. These GDP forecasts have in the long run been unbiased with a standard deviation of the errors of 2.8 percentage points. In calculating the expected cost of the sanctions, using normality as the distribution of the forecasts errors we have somewhat simplified the numerical integration in ways that are, however, not essential to the results.[11] The outcome is the following function of the expected cost, in relation to GDP, as a function of the tax rate, see Figure 4.

From the figure we can infer that the rise in the expected cost of the Stability Pact is quite, or very small, indeed, if the deficit is permanently increased somewhat starting from balanced budget. At the maximum, the expected cost is, of course, 0.5 per cent in relation to GDP, the same as stipulated by the SGP.

This is the other side of short-run policymaking. As has been argued above, high taxation, as evidenced also by Nickell (1998) and for Finland, e.g., Honkapohja and Koskela (1999) and Kiander and Pehkonen (1999), is a factor behind the high structural unemployment in the EU. It can be estimated, especially based on the empirical estimates of structural unemployment by Kiander and Pehkonen (1999), that if the aggregate tax rate were lowered by one percentage point in relation to GDP and if this lowering were used totally to cut the tax wedge in personal income taxation, the equilibrium unemployment rate could in the Finnish case be lowered by 0.8 percentage points. Using Okun's law inversely, this would lead to an increase in output of roughly two percentage points. We can therefore conclude that the SGP is not an effective deterrent to borrowing for a myopic government interested only in its short-run welfare.

[11] The integration over the linearly rising penalty curve, from a deficit of 3 to 6 per cent in relation to GDP, has been simplified by using the average deficit in this range, i.e., 4.5 per cent in relation to GDP. We have also replaced actual output y with its forecast y*.

Figure 4. The expected cost of the sanctions of the Stability Pact in relation to GDP, per cent, as a function of the planned aggregate tax rate, when public expenditure is 50 per cent of GDP



7. Conclusions

The Stability Pact is an important element in policy making in EMU. Here we have tried to analyse its functioning from a few angles, which, to our knowledge, have not been raised earlier. If the aim of the Pact is to correct the inefficiencies in the policy making, it seems to suffer from some weaknesses. The whole basis of macroeconomic policy making in EMU has been questioned here by introducing the possibility of supply-side dominance in the transmission of fiscal, i.e., tax, policy to inflation. If this holds, many basic issues have to be looked at from a reverse angle than has been the case so far. The link between taxes and wages should be quite strong in continental European labour markets, especially in those where centralised incomes policies are pursued, integrating the tax policy of the government into wage negotiations by the social partners.

The relevance of the supply channel should also be bigger in a longer horizon, and its effect has been found in reality in empirical analyses carried out to explain the high structural unemployment in Europe. What we have done here is to introduce the consequent effect of tax policy on inflation, which contradicts demand-side wisdom and has a reverse interaction with optimal monetary policy in EMU aiming at price stability. It remains to be seen in empirical terms, how important the two channels are in comparison to each other.

It is also important to note some of the limitations of the model used here. We assumed that the monetary union is a closed region, which is in line with the present EMU to a high degree. However, opening it to the rest of the world would, using the basic Mundell-Flemming framework, lead to the outcome that fiscal policy on the aggregate EU is in the short run impotent and fiscal expansion in one country completely crowds out output in the neighbouring country, and only monetary policy is an effective stabiliser of the real economy. This comes in a way close to the supply view presented above. We think that the model here is anyway, in spite of its limitations, a useful tool to analyse possible outcomes of policy co-ordination with spillovers both in the real economy and inflation.

The form of an "optimal" stability pact, transforming the non-cooperative behaviour of the governments into a fully efficient one, also depends on whether the Keynesian demand channel or the supply channel of taxes to inflation dominates, and when the international spillovers are also quite different from each other. The current form of the SGP is not shaped to encourage reform in structural policies that would reduce the mark-ups in wage and price formation. We were able to characterise the situation in the end-points, i.e., when the size of the country in a monetary union approaches zero or unity, but more analysis of the relevant intermediate cases is vitally needed.

Appendix 1. The Parameters Used in the Two-Country Simulation

The parameters used in the calibration were fixed to be the following with some support taken from the simulation properties of the global NiGEM model by the National Institute for Social and Economic Research in London (in parentheses for the big country):

$\sigma_1 = -0.4$, $\sigma_2 = 0.2$ (0.02), $\sigma_3 = 1.3$ (1.0), $\sigma_4 = 0.25$ (0.3), $\sigma_5 = -0.3$ (−0.2);

$\omega_1 = -0.4$; $s_1 = 0.7$; $\alpha_1 = 0.5$ (0.7), $\alpha_2 = 0.1$, $\alpha_3 = 0.4$ (0.2), $\alpha_4 = 0.2$;

$\beta_1 = 0.3$, $\beta_2 = -0.4$, and β_3 ranging, as in Figure 1, from 0 to 0.5.

These would lead to the following pattern of the reduced form impact coefficients of the policy variables under rational expectations, where the value of the reaction parameter β_3 of the wage rate to a rise in the tax rate appears in parentheses. The shares of the countries 1 and 2 are 20 and 80 per cent, respectively.

Endogenous variable	Tax 1 (0.0)	Tax1 (0.5)	Tax 2 (0.0)	Tax 2 (0.5)	Interest rate
y_1	−0.252	−0.035	−0.263	0.436	−0.057
U_1	0.109	0.014	0.105	−0.174	0.227
p_1	−0.170	0.572	−0.293	0.611	−0.176
pe_1	−0.186	0.627	−0.321	0.671	−0.192
pc_1	−0.160	0.536	−0.304	0.654	−0.173
W_1	−0.167	0.921	−0.280	0.580	−0.228
y_2	−0.107	0.346	−0.421	−0.088	−0.500
U_2	0.043	−0.138	0.169	0.035	0.200
p_2	−0.136	0.453	−0.331	0.754	−0.169
pe_2	−0.171	0.569	−0.385	0.864	−0.203
pc_2	−0.146	0.488	−0.320	0.711	−0.171
W_2	−0.140	0.466	−0.324	1.050	−0.220

Appendix 2. The Properties of the Optimal Stability Pact

Under a stability pact with sanctions $h(\theta_{11})$ the budget constraint is transformed in the way mentioned on pages 12 and 13 so that national income $\tilde{y}_{12}$ in period 2, which is the basis of the welfare of the government in that period, is transformed into the following $\tilde{y}_{12} = y_{12} - h_1 + S_1 h_2$ and the tax rate $\tilde{\theta}_{12}$ in period 2 is $\tilde{\theta}_{12} = \theta_{12} + (h_1 - S_1 h_2)/y_{12}$. Now the derivative of the national welfare function in period 2 with respect to the current tax rate, i.e, the first term on the right-hand side of (12), is transformed into the following (when keeping the tax revenue from the neighbour's penalty again under noncooperation as a fixed parameter and using the logarithmic instantaneous welfare function f in (9)),

$$\pi \frac{\partial f(y_{12})}{\partial \theta_{11}} = \pi \frac{1}{y_{12}} \left[-\frac{\partial h_1}{\partial \theta_{11}} + (y_{12})_{\theta_{12}} (-(1+i-p_{C1}) - (p_{C1})_{\theta_{11}} (\frac{g_{11}+b_{10}}{y_{11}} - \theta_{11}) + \frac{\partial h_1}{\partial \theta_{11}} \frac{1}{y_{12}}) \right]. \tag{A1}$$

Imposing this change the national non-cooperative solution is now compared to the full cooperative EU level solution, which is solved from the following condition

$$\frac{1}{y_{11}}(y_{11})_{\theta_{11}} + \frac{1}{y_{21}}(y_{21})_{\theta_{11}} + \frac{1}{y_{12}}(y_{12})_{\theta_{12}} \left[-(1+i-p_{C1}) + (i_{\theta_{11}} - (p_{C1})_{\theta_{11}})(\frac{g_{11}+b_{i0}}{y_{11}} - \theta_{11}) \right]$$

$$-\mu(S_1)(p_{C1})_{\theta_{11}} = 0, \tag{A2}$$

where as above $\mu(S_1) = \mu_1 + \mu_2 S_1^2 / S_2^2$. Next, we transform, with a proper specification of the h function, the necessary and sufficient condition of non-cooperative behaviour under the stability pact from (A1) so that it is identical to that under full cooperation (A2). This leads to the following differential equation for h_1,

$$D_1 \frac{\partial h_1}{\partial \theta_{11}} + D_2 + D_3 \theta_{11} + D_4 p_{C1} = 0, \tag{A3}$$

where the D_is are constant parameters. As in the text, first leave out the last term in (A3). Integration produces the outcome expressed in (20) above. In general, the parameters in (A3) are the following. For D_1 we have,

$$D_1 = \frac{\pi_1}{y_{12}} (-1 + \frac{(y_{12})_{\theta_{12}}}{y_{12}}) < 0. \tag{A4}$$

Let us omit for a while the term D_2, which is in general ambiguous, and turn to D_3, which is the following

$$D_3 = \frac{\pi_1}{y_{12}} (y_{12})_{\theta_{12}} (p_{C1})_{\theta_{11}} + \frac{1}{y_{12}} (y_{12})_{\theta_{12}} (i_{\theta_{11}} - (p_{C1})_{\theta_{11}}). \tag{A5}$$

For very small S_1, by (14), i_θ goes to zero, and we can now infer that under the demand view, D_3 is negative and under the supply view it is positive. Therefore we get the pattern mentioned in the text that, for small size of the country concerned, the optimal stability pact is concave under the demand view and convex under the supply view. For a small EMU country, also the current international spillover to foreign output becomes small and we are left with the following D_2 term,

$$D_2 = (\pi_1 - 1)\frac{1}{y_{12}}(y_{12})_{\theta_{12}}\left[-(1+i-p_{C1})-(p_{C1})_{\theta_{11}}(\frac{g_{11}+b_{10}}{y_{11}})\right], \qquad \text{(A6)}$$

where we assume that the term in square brackets is always negative, which is quite likely, making D_2 negative. For small S_1, also the parameter $D_4 = \mu_2(S_1/S_2)^2$ goes to zero. Now we have all the elements to infer the properties of a suitable stability pact under both views, mentioned in the text and presented in Figure 2.

Now turn to the case of a large country in the monetary union, the share of its size approaching the other extreme, i.e., unity. In this case, the D_4 term starts to increasingly dominate equation (A3). By splitting the inflation rate, analogously as in connection with (14), $p_{C1} = (p_{C1})_{\theta_{11}}\theta_{11} + \gamma_1$, we come to the result that the penalty function is for large S_1 of the following form,

$$h_1 = -\frac{\mu_2}{D_1}\frac{S_1^2}{S_2^2}\left[(p_{C1})^2_{\theta_{11}}\theta_{11}^2 + (p_{C1})_{\theta_{11}}\gamma_1\theta_{11} + C_1\right], \qquad \text{(A7)}$$

where again the C_1 is the integration constant term. Now we can infer the properties of the penalty function as in Figure 3, if γ_1 is positive.

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