DEPARTMENT OF ECONOMICS

Working Paper

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Robert Dogonowski

Working Paper No. 1998-10

ISSN 1396-2426

UNIVERSITY OF AARHUS • DENMARK

INSTITUT FOR ØKONOMI

AFDELING FOR NATIONALØKONOMI - AARHUS UNIVERSITET - BYGNING 322
8000 AARHUS C - ☎ 89 42 11 33 - TELEFAX 86 13 63 34

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8000 AARHUS C - DENMARK ☎ +45 89 42 11 33 - TELEFAX +45 86 13 63 34

Fiscal Policy Design, Imperfect Competition and Productivity Shocks

ROBERT RENE DOGONOWSKI   DEPARTMENT OF ECONOMICS
UNIVERSITY OF AARHUS   DENMARK

May 1998

ABSTRACT. In this paper we study the role of fiscal policy in a macroeconomic model with imperfect competition in the product market. We find that fiscal spending per se and a less competitive industry reduce the responsiveness of income to productivity shocks. The government should follow a counter-cyclical fiscal policy if it wants to stabilize income (against productivity shocks), but this policy is not in the interest of the households which prefer pro-cyclical fiscal spending. We also analyse the cost of following a non-conditional fiscal policy rule, and find that it is more costly to do so, when the degree of competition in the product market is low.

JEL Classification Number: E39, E61, E63

Keywords: Stabilization policy, fiscal rules, productivity shocks.

1. INTRODUCTION.

In this paper we study the role of fiscal policy in economies with imperfect competition in the product market and productivity shocks. Can fiscal expenditure stabilize income and if it is the case how does the market structure matter? How should fiscal expenditure be related to the business cycle if a policy is chosen in order to minimize the sensitivity of output to productivity shocks? Since stabilization of income is not necessarily the optimal fiscal policy, the second part of the paper sheds light on the design of fiscal policy when the objective is to maximize the welfare in the economy. We will solve for the optimal conditional and non-conditional fiscal policy rules and we will focus on how the welfare loss of following the non-conditional fiscal rule is related to the degree of market power in the economy.

The raised issues are important for economic policy making and the use of fiscal policy as an instrument to reduce fluctuations in output[1] has long been a theme of (Keynesian) macroeconomics. Our analysis is a part of the research field The New Macroeconomics[2] where the implications of market imperfections for macroeconomic policies are in the center. Within this field the question of stabilization policies has not attracted much attention with Andersen & Holden (1997) and Hairault et al. (1995) as interesting exceptions. Andersen & Holden consider a two-sector open economy with an imperfection in the labour market and show that fiscal policy can be used to stabilize the economy and that the optimal (welfare maximizing) fiscal policy is pro-cyclical. Hairault et al. (1995) present different automatic stabilizers and evaluate their effectiveness in two economies, one with perfect competition and one with market power. When evaluating the effectiveness of automatic stabilizers they find no constant relation to the degree of competition in the economy.

We restrict our focus to an economy where the only imperfection is in the product market and we then know that fiscal policy can have effects through at least two different mechanisms. One is based on the effect of fiscal policy on the elasticity of the demand curve faced by the firms[3], and the other which we will use in our analysis, is due to the income effects on the labour supply (see Dixon (1987), Mankiw(1988) and Startz (1989)). This income effect arises since the financing of fiscal spending and the increase in profit affect the disposable income of households which react by

[1]With the implicit purpose of increasing welfare.

[2]See Dixon & Rankin (1995) for a description of the research field called "The New Macroeconomics". This field is sometimes better known as "The New Keynesian Macroeconomics".

[3]Fiscal policy can affect the elasticity and thereby the firms' market power which influence the optimal price setting and through that the equilibrium of the economy. See d'Aspremont et al. (1994), Pagano (1990) and Jacobsen & Schultz (1990).

changing their labour supply[4].

We show that fiscal spending per se and less competitive industry can reduce the sensitivity of output and employment to productivity shocks. In spite of our different model structure we find support for the conclusions of Andersen & Holden (1997) that the government can stabilize income by a counter-cyclical fiscal policy but this is not in the interest of the households which prefer a pro-cyclical fiscal spending rule.

The other central theme of the paper is related to the cost of requiring that fiscal policy should not be conditional on productivity shocks, i.e. that the government should pre-commit itself . There are various reasons for pre-commitment, it could be the time lags or inefficiencies due to the political process (see Persson and Tabellini (1990)), incomplete information or strategic actions by economic decision makers[5]. We do not model any of these reasons, but focus on the cost of not following the optimal fiscal policy (the conditional fiscal rule) and our contribution is to analyse how the cost (welfare loss) is related to the degree of competition in the product market. We find it more harmful to pre-commit on a fiscal spending level when the degree of competition is low in the product market.

This analysis can also be related to the current debate about the Maastricht fiscal criteria for the EMU[6] where we will interpret the potential binding constraints which the Maastricht fiscal criteria will create (see Buti et al. (1997)) *as if* fiscal policy has to be non-conditional on productivity shocks. We therefore find it more harmful to put constraints on fiscal policy for members states where the degree of competition is low in the product market.

The paper is organized in the following way. We present the model in the second

[4]Fiscal policy works also through this supply side effect in the dynamic models of Baxter & King (1993), Christiano & Eichenbaum (1992) and Braun (1994).

[5]An example is Calmfors and Horn (1985) who argue that accomodation policies by the government in a strategic game with trade unions may cause wage inflation and reduce employment.

[6]For a discussion of the fiscal criteria, see Buiter et al. (1993) and Inman (1996).

section, and analyse the responsiveness of output to productivity shocks and the possibility of output stabilization in the third section. The fourth section contains the identification and comparison of the conditional and non-conditional fiscal policy rules. The fifth section contains some concluding remarks.

2. THE MODEL.

The model follows the structure of Mankiw(1988). It is a static general equilibrium macroeconomic model with imperfect competition in the product market and a perfect labour market. The economy has three different types of agents, i.e. households, an industry with more than one firm and a public sector. We will next describe these agents in more detail.

2.1. Households. We will make use of the representative agent approach by letting all households be described in form of a single representative household. The household is assumed to have preferences over real consumption C, leisure $(\overline{L} - L)$ and real public expenditure G. $\overline{L}$ is the endowment of time. The utility function is quasi linear and takes the form

$$U(C, \overline{L} - L, G) = \Lambda C^{(\alpha)}(\overline{L} - L)^{1-\alpha} + G^{(\sigma)} \tag{1}$$

where $0 < \alpha < 1$, $0 < \sigma < 1$ and $\Lambda = \alpha^{-\alpha}(1-\alpha)^{\alpha-1}$. That households get utility from public expenditures is different from Mankiw(1988), where government expenditure represent pure waste[7]. By this assumption we avoid that the welfare maximizing fiscal policy is to shut down the public sector. The representative household regards public

[7] Any provision of public goods is not optimal in Mankiw (1988) although the presence of imperfect competition but can be ensured by letting households having preferences for fiscal spending as it is the case in Molana & Moutos (1990), Bénassy (1991a) and Startz (1995). Molana & Moutos (1990) use a utility function where the welfare maximizing fiscal policy rule says that we should either have no private or no public consumption depending on the parameters of the model. They analyse when a fiscal expansion is welfare increasing for any initial level of fiscal expenditures. Startz (1995)

expenditure G as fixed, and wishes to maximize his utility by choice of consumption C and hours of work L. He is furthermore restricted by the following budget constraint

$$C \leq (\frac{\Pi}{P} + \frac{W}{P}L) - \frac{T}{P} \tag{2}$$

This constraint tells us that it is not possible to spend more on goods C than total net income $\frac{\Pi}{P} + \frac{W}{P}L - \frac{T}{P}$. $\frac{\Pi}{P}$ is real profit from firms, all entirely owned by the households, $\frac{W}{P}L$ is the real wage income and $\frac{T}{P}$is the lump sum tax collected by the public sector. Since the household will spend all its income the budget constraint may be rewritten as

$$PC + (\overline{L} - L)W = \Pi + \overline{L}W - T \tag{3}$$

From the maximization problem it follows that the consumer will have the following standard demand functions from Cobb-Douglas preferences:

$$C = \alpha(\frac{\Pi}{P} + \overline{L}\frac{W}{P} - \frac{T}{P}) \tag{4}$$

$$(\overline{L} - L) = \frac{1-\alpha}{\frac{W}{P}}(\frac{\Pi}{P} + \overline{L}\frac{W}{P} - \frac{T}{P}) \tag{5}$$

The indirect utility function may then be written as

$$V(G, a) = \frac{(\frac{\Pi}{P} + \overline{L}\frac{W}{P} - \frac{T}{P})}{\left(\frac{W}{P}\right)^{1-\alpha}} + G^{(\sigma)} \tag{6}$$

We see from the first term that disposable income determines the household's utility level in the model of Mankiw (1988).

---

uses a Cobb-Douglas utility function in the consumption good, leisure and fiscal expenditures. He shows that when fiscal expenditures have been set to maximize welfare, an increase in these may be effective (output rises), but will obviously reduce welfare. Bénassy (1991a) provides a normative analysis of fiscal policy where he in an OLG model shows that when fiscal policy has positive effects on equilibrium employment - government should push its spending beyond the level chosen under perfect competition (the first best level).

2.2. The Industry. The economy has one industry with N firms operating under a constant returns to scale production technology, such that $Y_i = aL_i$. Y_i is firm i's real production, a is an indicator for the industry wide level of technology and L_i is labour, the only input factor employed by firm i. The number of firms N is fixed and is assumed to be strictly greater than one $(N > 1)$. The level of technology is uniformly distributed on $[1-\lambda, 1+\lambda]$, i.e. a has density function $f(a) = \frac{1}{2\lambda}$ for all $a \in [1-\lambda, 1+\lambda]$, where $\lambda < |1|$. This distribution is chosen for ease of exposition. In Mankiw(1988) the level of technology is non-stochastic and set to one.

There are no fixed costs of running a firm, but since we are only concerned about the short-run we do not allow for entry and exit into the industry. As an implication of the objective demand curve approach[8] the industry takes real demand as given and will face a unit elastic demand curve. The competition of the N firms is described by Cournot-Nash behavior[9]. This is a simple way to describe competition, and it captures the property that the profit margin depends on the number of firms. We will let all firms observe the productivity level and after that they choose their real production level Y_i. This assumption ensures that information problems are not essential for the following conclusions. Each firm maximizes its own profit - taking the production of the other firms as given. The profit maximization problem reads

$$\max_{Y_i} \ \Pi_i = P \cdot Y_i - W \cdot L_i(Y_i) \tag{7}$$

By combining the first order condition to the problem above with the symmetry condition that all firms produce $\overline{Y}$ in the equilibrium, i.e.e $Y_i = \overline{Y}$ for all $i = 1...N$

[8]See the seminal paper of Gabszewicz & Vial (1972). For a discussion of the objective (and subjective) demand curve approach see Bénassy (1991) and Hart (1985).

[9]There are few general arguments for prefering one market power model over another one. See Sutton (1990) for a discussion of this issue and Bénassy (1991b) for a survey on monopolistic competition.

we get the well-known markup condition:

$$\frac{W}{P} = a(1 - \frac{1}{N}) \tag{8}$$

The industry creates a distortion by setting the real wage lower than the marginal product of labour. The size of the distortion is decreasing in the number of firms in the product market. We will in the following use N as an ordinal measure for the degree of competition, and say that the degree of competition is high when the number of firms is high. Additionally this condition represents the factor demand function, which tells us that labour demand is perfectly elastic with respect to the real wage.

For later use we need to express the real value of the industry profit as a function of aggregate real output $Y = \sum_{i=1}^{N} Y_i$

$$\frac{\Pi}{P} = \frac{Y}{N} \tag{9}$$

As a property of Cournot-Nash competition real industry profit is a fraction $\frac{1}{N}$ of aggregate real output Y.

2.3. The Public Sector. The government controls the size of real public expenditures G. This is a restrictive assumption since the government could otherwise influence the elasticity of the aggregate demand curve, e.g. by choosing the size of nominal public expenditures instead. We have by this assumption chosen to avoid fiscal policy effects merely due to changes in the elasticity of the industry demand curve.[10]

Since the analysis is carried out in a static model it is only reasonable to consider a balanced budget for the government. The financing of public expenditure G will take

[10]The industry faces nominal demand $Q(P) = C(P) + G(P)$. $C(P)$ and $G(P)$ are nominal demand by the private and public sector. In the case of Cournot-Nash competition among firms the markup is given as $(1 + \frac{\epsilon}{N})$ where ϵ is the elasticity of demand Q with respect to the price P. The elasticty

place by collecting a lump sum tax $\frac{T}{P} = G$ from the household. By this assumption we keep the analysis simple and avoid distortions and other complications from tax collection[11].

The government buys the products from the same industry which produces C. For simplicity we assume that they pay the same price P as charged to the household. This is consistent with the property that the industry faces unit elastic demand.

The government takes into account that the financing of the public expenditures affects the disposable income of the household. A direct effect is through the lump sum tax, and an indirect effect is through an increase in the industry profit. Two (cost related) effects working in opposite directions.

Different objectives of the government will be discussed later on in this paper.

2.4. The Fiscal Multipliers. We know how real profit is related to income Y, and we will next show how the aggregate production Y and fiscal expenditure G are related. From the equilibrium condition Y=C+G, the consumption function equation (4) and the condition of a balanced budget, we get

$$Y = \frac{\alpha \overline{L} \frac{W}{P}}{1 - \frac{\alpha}{N}} + \frac{(1-\alpha)G}{1 - \frac{\alpha}{N}} \tag{10}$$

The fiscal multiplier is

$$\frac{\partial Y}{\partial G} = \frac{1-\alpha}{1-\alpha/N} > 0 \tag{11}$$

ϵ is the weighted sum of the elasticity of private and public demand. The elasticity is

$$\epsilon = \left(\frac{C}{C+G}\right)\frac{C'(P)P}{C} + \left(\frac{G}{C+G}\right)\frac{G'(P)P}{G}$$

Our assumption about the public sector ensures that the elasticity $\epsilon = -1$ in this analysis. For a further discussion of the elasticity effect, see Dixon & Rankin (1995) p 52.

[11]This class of models are sensitive to tax collection. As shown in Dogonowski (1998) the sign of the fiscal multiplier in the Cobb-Douglas case depends on whether the tax system is progressive(-), proportional(0) or regressive(+).

An increase in fiscal spending has a direct effect on demand but also crowds out private consumption due to the lump sum tax. The net effect is positive and is represented by the term $(1-\alpha)$ in the numerator. Higher demand will increase the income of the household through the profit term and the initial increase in income is strengthen by this profit multiplier, represented by the term $(1-\alpha/N)$ in the denominator. The multiplier is decreasing in the number of firms since an intensified competition dampen the profit multiplier as can be seen from the next expression

$$\frac{\partial\left(\frac{\Pi}{P}\right)}{\partial G}=\frac{1-\alpha}{N-\alpha} \tag{12}$$

3. RESPONSIVENESS OF INCOME TO PRODUCTIVITY SHOCKS AND STABILIZATION POLICIES

In this section we will analyse the responsiveness of output to productivity shocks and focus on the issue of stabilization. We will present two different measures of output responsiveness to productivity shocks. To alleviate the difference in magnitudes and measurement units we will use the elasticity of income with respect to the level of productivity as the first measure and the coefficient of variation in income as the other measure. We expect these measures to inform us to what extend fiscal spending and competition matters for the stability of income.

By use of equation (10) we are able to write the relevant elasticity of income as

$$\frac{\partial Y}{\partial a}\frac{a}{Y}=\frac{1}{1+\frac{(1-\alpha)G}{\alpha L(1-\frac{1}{N})a}} \tag{13}$$

and the coefficient of variation in income CV_Y as

$$CV_Y=\frac{\sqrt{Var[Y]}}{E[Y]}=\frac{\sqrt{Var[a]}}{1+\frac{(1-\alpha)G}{\alpha L(1-\frac{1}{N})}}$$

These measures are almost identical and will provide the same predictions. We will therefore in the following only refer to the elasticity measure. We see that if there is no fiscal spending (G=0) income equals private consumption which is linear in a and the elasticity is therefore one and independent of the degree of competition. When we have fiscal spending (G>0) the elasticity is the weighted sum of the elasticities of the private consumption term and the public consumption term (including its crowding out of private consumption due to the lump sum tax). Since public consumption is independent of the productivity level a, the elasticity will decrease. If the degree of competition increases then for a given level of public spending, more resources are available for private consumption and the consumption term gets relatively more important, why the elasticity gets larger (but it is always smaller than one).

These observations tell us that fiscal policy per se and a less competitive industry stabilize income. As in Hairault et al. (1995) we also find that increasing government size reduce output variability.

The result above could also be explained by focusing on the labour market. It is useful to write aggregate production as Y = a L, where L is aggregate employment. The elasticity of equation(13) then reads

$$\frac{\partial Y}{\partial a}\frac{a}{Y} = 1 + \frac{\partial L}{\partial a}\frac{a}{L} \tag{14}$$

We see that to achieve stability of income we need to reduce the sensitivity of employment to changes in the productivity level. We already know from equation(13) that the equilibrium employment elasticity is negative and we will next explain how it can get smaller. The employment elasticity arises from the interplay of the household and firms in the labour market. A productivity increase of 1 percent will given a constant real wage increase the profit. The household receives this higher profit and chooses to supply less labour. This profit effect on labour supply is less pronounced the more competitive the industry. On the other side firms will find it profitable to attract (hire) more labour by increasing the real wage by 1 percent. This effect is independent of the number of firms in the industry. The net effect on employment of an increase in productivity will be negative but less pronounced the more competitive the industry is, and we conclude that a more competitive economy is more sensitive to productivity shocks.

Gali (1994) provides an empirical analysis which shows that economic stability is increasing in the size of government expenditure. This can be interpreted as a large public sector serves a stabilizing role per se but potentially also via the workings of automatic stabilizers. Our model predicts this finding and we will next see how we can build in stabilizers by letting the level of fiscal expenditure be related to the business cycle.

Which kind of fiscal policy rule should the government implement if it wishes to reduce fluctuations in income?

When we allow fiscal spending to depend on productivity, i.e.e $G(a)$, then the elasticity of income with respect to productivity is

$$\frac{\partial Y}{\partial a}\frac{a}{Y} = \frac{1 + \frac{G'(a)(1-\alpha)a}{\alpha L(1-\frac{1}{N})a}}{1 + \frac{(1-\alpha)G}{\alpha L(1-\frac{1}{N})a}}$$

and it is obvious that a counter-cyclical fiscal policy $G'(a) < 0$ will have a stabilizing effect on income. When the economy is affected by a positive productivity shock, output will increase. If the government decrease fiscal expenditure and therefore collects less taxes, the household becomes richer and chooses to supply less labour at the given wage rate; production will decrease (gets closer to its initial level). While the traditional Keynesian stabilization policy worked through demand management the counter-cyclical stabilization in this model works through the supply side on the labour market.

There also exists a counter-cyclical fiscal policy rule which stabilize income perfectly against productivity shocks, i.e. $\frac{\partial Y}{\partial a}\frac{a}{Y} = 0$. This policy rule may be written as

$$G(a) = k - \frac{\alpha \overline{L}(1 - 1/N)a}{1 - \alpha}$$

where k is a constant which ensures that $G(a)$ is positive for all possible productivity shocks a. This fiscal policy rule is counter-cyclical and the level of fiscal spending is decreasing in the degree of competition.

4. FISCAL POLICY

The counter-cyclical fiscal policy rules of the previous section are not necessarily consistent with the maximization of the representative household's utility. In this section we will characterize two different fiscal policy rules which are based on such a maximization. It is here assumed that the representative agents utility function is identical to the welfare function of the government.

First we will let the government implement a fiscal rule which may depend on the realization of the productivity level. This is what economists usually call the conditional fiscal policy rule. Afterwards we restrict the behavior of the government and demand that fiscal expenditures are independent of the productivity level (a non-conditional fiscal rule). The reasons for this requirement can be that time lags or inefficiencies due to the political process (see Persson & Tabellini (1990)), incomplete information or strategic aspects of economic decision making make it favorable.

What is of particular interest is to measure the welfare loss of the household when following the non-conditional fiscal policy and show whether imperfect competition makes it even more costly.

4.1. The Conditional Fiscal Policy Rule. We will first find the conditional fiscal policy rule G^* by solving the following problem of the public sector. The problem reads

$$\max_G \; V(G, a) = \frac{\left(\frac{\Pi}{P} + \overline{L}\frac{W}{P} - \frac{T}{P}\right)}{\left(\frac{W}{P}\right)^{1-\alpha}} + (G)^{(\sigma)} \tag{15}$$

s.t

$$G = \frac{T}{P} \tag{16}$$

$$\frac{\Pi}{P} = \frac{\alpha \overline{L}\frac{W}{P}}{N-\alpha} + \frac{(1-\alpha)G}{N-\alpha} \tag{17}$$

The first order condition may be written as

$$\frac{1-\left(\frac{1-\alpha}{N-\alpha}\right)}{\left(\frac{W}{P}\right)^{1-\alpha}} = \sigma\left(G^{*}\right)^{\sigma-1} \tag{18}$$

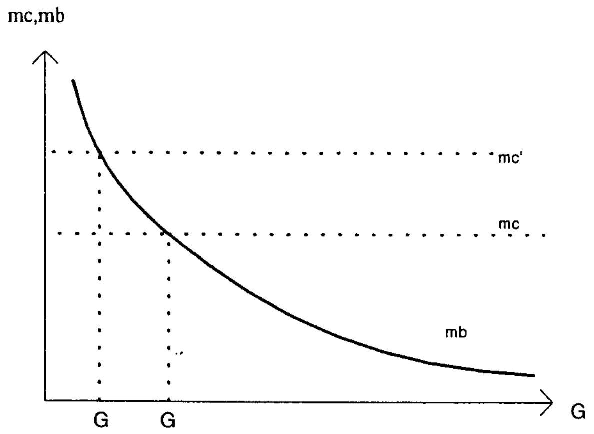
and this is a standard condition where the marginal cost (mc) of providing the public good should equal the marginal benefit (mb). Both the marginal cost and the marginal benefit are measured in terms of utility. Real public expenditures have two different effects on disposable income which together generate the cost side. There is a positive effect on income since profit is increasing in G and a negative effect through the lump sum tax. Only the first mentioned effect depends on the number of firms (see the numerator on the left hand side of equation (18)). Since marginal cost is measured in terms of utility the appropriate adjustment of the pecuniary effect takes place through the wage term in the denominator. This adjustment factor also depends on the number of firms. The marginal benefit is simply a function of G, due to the quasi linearity of the utility function. The (optimality) condition may be summarized as

$$mc(N,a) = mb(G)$$

where marginal cost is related to the number of firms and the productivity shock. This first order condition is illustrated in Figure 1.

The mc is independent of the level of fiscal expenditures, and is therefore a horizontal line. The marginal benefit mb is decreasing in G since $0 < \sigma < 1$. At the intersections of the mb and mc lines we find the optimal values of G (denoted G^{*} in equation(18)).

Figure 1: Illustration of mc and mb



The marginal cost depends positively on the number of firms. This is the case since a higher degree of competition will decrease the profit multiplier of fiscal expenditures and the negative effect on disposable income of a fiscal expansion will therefore be larger. When we increase the number of firms the *mc* curve moves upwards and we call the new marginal cost line *mc'* (and *mc* is related to the initial number of firms). The effect from the adjustment factor works in the opposite direction and is less important.

Since the marginal benefit of supplying the public good is independent of the number of firms we see that the optimal supply of the public good is decreasing in the degree of competition[12].

If we solve for the conditional fiscal policy rule we get

$$G^{*} = \left(\frac{\sigma \left(\frac{W}{P} \right)^{1-\alpha}}{1 - \left(\frac{1-\alpha}{N-\alpha} \right)} \right)^{\frac{1}{1-\sigma}} \tag{19}$$

[12]This depends crucially on the specification of the utility function.

We will next see how this rule is related to the business cycle (the technology parameter a). The positive sign of the elasticity of G* with respect to a

$$\frac{\partial G^*}{\partial a}\frac{a}{G^*} = \frac{1-\alpha}{1-\sigma} > 0 \; for \; all \; a \in [0;1); \; \sigma \in [0,1) \tag{20}$$

tells us that we should increase fiscal spending if productivity increases (pro-cyclical fiscal spending). The reason is that the adjustment factor transferring income to utility (the term $\left(\frac{W}{P}\right)^{\alpha-1}$ in equation(18)) decreases as a gets larger and the marginal cost of public consumption gets smaller. The smaller α the more sensitive is the adjustment factor to changes in productivity. When mc falls the government wishes to increase G. Most if σ is large since then the marginal benefit of public consumption is less sensitive to changes in G. We conclude that this spending rule is more sensitive to changes in productivity when α is smaller and σ is larger[13].

That a pro-cyclical rule is maximizing welfare is different from the traditional Keynesian ideas of counter-cyclical spending. The reason is that, the Keynesian result is based on the premise that welfare improves as a result of stabilizing income[14]. The variables of interest here are private agents' consumption and leisure, not output per se. [15]

We will end this section by explaining how the degree of competition influences the relation between the conditional fiscal policy rule and the productivity shock. A positive productivity shock makes the household better off in terms of utility and

[13] In the limit where $\alpha \to 1$, labour supply turns out to be inelastic, and the government will choose not to supply the public good at all.

[14] Silvestre (1993) presents a complete set of premises of the Keynesian Cross. i) No direct crowding out ii) No crowding out via prices iii) The presence of higher rounds effects iv) Welfare improves as a result of the increase in output. Our point is the departure of (a modified version) the fourth premise.

[15] In a different setup Miller (1984) shows that volatility of consumption can increase even if volatility of output is decreasing.

the marginal cost of public consumption therefore gets smaller. If the industry is more competitive the allocation of labour will be more efficient and the household will be even better of. Then the productivity shock will be better utilized and the fall in the marginal cost due to the productivity shock gets even larger. If marginal benefit is constantly decreasing for all levels of public consumption the fall in the marginal costs induced by the productivity shock will have worked in the direction of increasing public spending most in the economy with intensive competition. But since we have a convex marginal benefit curve, the fall in marginal costs after all work in the opposite direction, which means that it will be optimal when hit by a positive productivity shock to increase fiscal spending more in a less competitive economy.

4.2. The Non-Conditional Fiscal Policy Rule. We will next derive the non-conditional fiscal policy rule. The government chooses a level of fiscal expenditures which have to be realized independent of the productivity which may prevail in the economy. This rule will be derived by solving the following problem

$$\max_{G} \; E[V(G,a)]$$

s.t

$$G = \frac{T}{P} \tag{21}$$

$$\frac{\Pi}{P} = \frac{\alpha \overline{L}\frac{W}{P}}{N-\alpha} + \frac{(1-\alpha)G}{N-\alpha} \tag{22}$$

where E is the mathematical expectation operator. We have assumed that a follows a uniform distribution, and by use of the density function it is possible to solve for $E[V(G,a)]$ analytically. Afterwards we choose the level of fiscal spending which maximizes the expected indirect utility.

These calculations are carried out in appendix (ii) and the non-conditional optimal fiscal policy G^{NC} should be set at the following level

$$G^{NC} = \left(\frac{(1-\frac{1}{n})^{\alpha}((1+\lambda)^{(\alpha)} - (1-\lambda)^{(\alpha)})}{2\alpha\sigma\lambda(1-\frac{1}{\alpha/n})} \right)^{\frac{1}{\sigma-1}} \tag{23}$$

We may write G^{NC} as a function of G^* and get

$$G^{NC} = G^* \left(\frac{((1+\lambda)^{(\alpha)} - (1-\lambda)^{(\alpha)})a^{1-\alpha}}{2\lambda\alpha} \right)^{\frac{1}{\sigma-1}}$$

From this equation we know that there exists a level of technology $\hat{a}$ independent of the degree of competition for which $G^{NC} = G^*$.

$$\hat{a} = \left(\frac{2\lambda\alpha}{(1+\lambda)^{(\alpha)} - (1-\lambda)^{(\alpha)}}\right)^{\frac{1}{1-\alpha}}$$

Since $\hat{a} < 1$ the most frequent scenario will be that fiscal spending when non-conditional is set at a lower level than the conditional level. Even when the fiscal policy choice is non-conditional we find that the level of fiscal spending is decreasing in the degree of competition.

4.3. The Welfare Loss of Following the Non-Conditional Fiscal Policy Rule. As a contribution to the debate of the cost of implementing conditional or non-conditional (which also is related to the rule vs discretion literature, see e.g. Kydland & Prescott (1977)) we will end this analysis by comparing the welfare between the case where fiscal policy may vary with economic activity and the case where fiscal policy has to be non-conditional. We will use the obtained utility as a measure of welfare. Since our focus is on the question whether the degree of competition matters for the welfare loss of restricting fiscal policy it is not trivial to construct the loss function. In spite of this two unsophisticated measures exist. We may measure the absolute or relative welfare loss and relate it to the degree of competition. Since both measures provides the same results we will only focus on the absolute measure. We construct a loss function which measures the difference in utility by using the non-conditional fiscal rule instead of the conditional fiscal rule. This loss function L is defined as

$$L \equiv V(G^*) - V(G^{NC})$$

When using a second order Taylor approximation around the point G^* the loss function may be written as

$$L \approx -\frac{1}{2}\frac{\partial^2 V}{\partial G^2}(G^*)(G^{NC} - G^*)^2$$

This derivation makes use of the envelope theorem and may be found in appendix (iii). When we substitute parameters for this specific model we find that the loss function can be written as

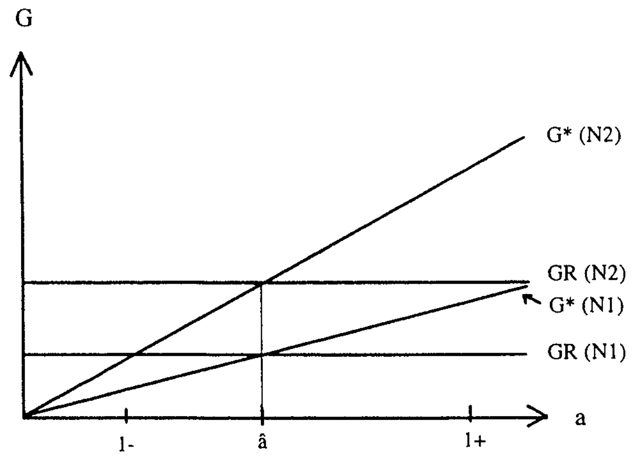
$$L \approx \frac{1}{2}\sigma(1-\sigma)\left[1 - \left(\frac{((1+\lambda)^{(\alpha)} - (1-\lambda)^{(\alpha)})a^{1-\alpha}}{2\lambda\alpha}\right)^{\frac{1}{\sigma-1}}\right]^2 (G^*)^{(\sigma)} \tag{24}$$

The loss function is defined for all possible values of technology and may be written as a function of the conditional fiscal rule. We know that G^* is decreasing in the degree of competition and therefore the size of the loss is also decreasing in the degree of competition. This result is illustrated in Figure 2 where G^{NC} is denoted GR.

Graphically the conditional fiscal rule $G^*$is steeper the less competitive the product market is. When a productivity shock occurs the government in a less competitive economy (with N_2 firms) wishes to change the level of public spending more than the government in a more competitive economy (with N_1 firms), where $N_1 > N_2$. A government which chooses (or is forced) to follow the non-conditional fiscal rule will therefore always be further away from its optimal spending the less competitive the product market.

The result of this section can also be related to the current discussion of the Maastricht Treaty for the European Monetary Union. According to the fiscal criteria of the treaty, the general government deficit should not exceed 3 percent of GDP and

Figure 2: Restricted and Unrestricted Fiscal Policy



the government gross debt should not exceed 60 percent of GDP (For a discussion of the Maastricht fiscal criteria, see Buiter et al. (1993) and Inman (1996)). In the 1997 Annual Economic Report presented by the Commission of the EC it was shown that the cyclical fluctuations in economic activity significantly affect government budget balances and exert a stabilizing influence on economic activity. For most countries in the EC, an acceptance of the Maastricht Treaty will restrict the workings of the automatic stabilizers (see Buti et al. (1997)), and we should expect this to have a negative effect on welfare in the economy. In our analysis the economy is affected by a productivity shock which the government observe and therefore wish to adjust its supply of the public good in accordance with the conditional fiscal policy rule. We can call this rule an automatically build in budget component on the spending side[16]. A participation in the EMU will restrict the workings of the automatic (stabilizers) components in the public budget due to the restrictions on budget deficits. Budget deficits are of course not sensible in static models, but we believe that requiring that

[16]Typically fiscal spending is pro-cyclical. See OECD (1993).

fiscal spending should be independent of economic activity is an appropriate way to model the implications of budget norms in a static framework. Our conclusion is therefore that fiscal restriction due to the Maastricht treaty will have negative welfare consequences, and we find that it will be more harmful to put constraints on fiscal policy for member states where the degree of competition is low in the product market.

5. CONCLUDING REMARKS

This paper contained a simple model constructed to highlight some important points on stabilization policies and on the cost of following a non-conditional fiscal policy rules in economies with imperfect competition and productivity shocks. We found the interesting results that fiscal spending per se and a less competitive industry stabilize income. Furthermore increasing government size is also reducing output variability. The possibility of perfect income stabilization exists and was identified as a counter-cyclical fiscal policy rule, but this rule was inconsistent with the policy of maximizing welfare, which calls for a pro-cyclical rule.

The cost of following a non-conditional fiscal policy rule was found to be decreasing in the degree of competition. In a more competitive economy the government wishes to adjust public spending less when a productivity shock occur, and therefore the loss of flexibility is less harmful. This result is interesting as a contribution to the debate on conditional vs non-conditional rules in policy making, but can also be related to the present discussion of the consequences of the Maastricht fiscal criteria. In that context we conclude that it is more harmful to put constraints on fiscal policy for those members of the EMU with a low degree of competition in the product market.

Future work should be about the robustness of these results and emphasis should be laid on constructing a more general micro-foundation incorporating dynamic aspects, risk averse agents and also include different kinds of shocks to the economy.

The issue of taxation should be given more priority in this class of models.

6. APPENDIX

(i) The utility maximizing objective for the public sector is

$$\max_{G} \Lambda C^{(\alpha)}(\overline{L}-L)^{1-\alpha}+G^{(\sigma)},\ \Lambda=\alpha^{-\alpha}(1-\alpha)^{\alpha-1} \tag{25}$$

s.t

$$C=\alpha(\frac{\Pi}{P}+\overline{L}\frac{W}{P}-\frac{T}{P}) \tag{26}$$

$$(\overline{L}-L)=\frac{1-\alpha}{\frac{W}{P}}(\frac{\Pi}{P}+\overline{L}\frac{W}{P}-\frac{T}{P}) \tag{27}$$

$$G=\frac{T}{P} \tag{28}$$

$$\frac{\Pi}{P}=\frac{\alpha\overline{L}\frac{W}{P}+(1-\alpha)G}{N-\alpha}$$

This may be rewritten as

$$\max_{G} \frac{\left(\frac{\Pi}{P}+\overline{L}\frac{W}{P}-G\right)}{\left(\frac{W}{P}\right)^{1-\alpha}}+G^{(\sigma)} \tag{29}$$

We may derive the first order condition and get

$$\frac{\left(1-\frac{\partial(\frac{\Pi}{P})}{\partial G}\right)}{\left(\frac{W}{P}\right)^{1-\alpha}}=\sigma G^{\sigma-1} \tag{30}$$

The left hand side is what we call marginal cost (mc) in the paper. When we use $\frac{W}{P}=a(1-\frac{1}{N})$ the marginal cost may be written as

$$mc=a^{\alpha-1}\frac{(1-\frac{1}{N})^{(\alpha)}}{1-\frac{\alpha}{N}} \tag{31}$$

and we see that

$$\frac{\partial mc}{\partial N}>0\ ;\ \frac{\partial mc}{\partial a}<0 \tag{32}$$

We may next solve for G^*

$$G^*=\left(\frac{\sigma\left(1-\frac{1}{N}\right)^{1-\alpha}}{1-\left(\frac{1-\alpha}{N-\alpha}\right)}\right)^{\frac{1}{1-\sigma}} a^{\frac{1-\alpha}{1-\sigma}} \tag{33}$$

and rewrite it as

$$G^* = \left(\frac{\left(1 - \frac{\alpha}{N}\right)\sigma}{\left(1 - \frac{1}{N}\right)^{(\alpha)}} \right)^{\frac{1}{1-\sigma}} a^{\frac{1-\alpha}{1-\sigma}}$$

Since

$$\frac{\partial \left(\frac{1-\frac{\alpha}{N}}{(1-\frac{1}{N})^{(\alpha)}} \right)}{\partial N} = \frac{\alpha(\alpha - 1)}{(1 - \frac{1}{N})^{(\alpha)}(N-1)N^2} < 0 \tag{34}$$

we conclude that

$$\frac{\partial G^*}{\partial N} < 0$$

(ii) We will here derive the non-conditional fiscal policy rule (G^{NC}). We may write the indirect utility function $V(G, a)$ as

$$V(G,a) = \frac{\left(\frac{\alpha \overline{L}(1-\frac{1}{N})a}{N-\alpha} + \frac{(1-\alpha)G}{N-\alpha} + \overline{L}a(1 - \frac{1}{N}) - G \right)}{a^{1-\alpha}(1 - \frac{1}{N})^{1-\alpha}} + G^{(\sigma)} \tag{35}$$

and simplify it further as

$$V(G,a) = \frac{\left(\frac{1-\frac{1}{N}}{1-\frac{\alpha}{N}} \right) \left(a\overline{L} - G \right)}{a^{1-\alpha}(1 - \frac{1}{N})^{1-\alpha}} + G^{(\sigma)}$$

The problem is

$$\max_G \int_{1-\lambda}^{1+\lambda} V(G,a) f(x) dx \tag{36}$$

By assumption we know that $f(x) = \frac{1}{2\lambda}$. The first order condition may be written as

$$\frac{\frac{N-1}{N-\alpha}}{2\lambda(1 - \frac{1}{N})^{(1-\alpha)}} \left[\frac{1}{\alpha} a^{(\alpha)} \right]_{1-\lambda}^{1+\lambda} = \frac{\sigma \left(G^{NC} \right)^{(\sigma-1)} [a]_{1-\lambda}^{1+\lambda}}{2\lambda} \tag{37}$$

We may then solve for the non-conditional fiscal policy rule

$$\begin{aligned} G^{NC} &= \left(\frac{(1 - \frac{1}{N})^{(\alpha)} \left((1+\lambda)^{(\alpha)} - (1-\lambda)^{(\alpha)} \right)}{2\lambda\alpha\sigma(1 - \frac{\alpha}{n})} \right)^{\frac{1}{\sigma-1}} \\ &= \left(\frac{((1+\lambda)^{(\alpha)} - (1-\lambda)^{(\alpha)})a^{1-\alpha}}{2\lambda\alpha} \right)^{\frac{1}{\sigma-1}} G^* \end{aligned} \tag{38}$$

If $\alpha \to 1$ then $G^* = G^{NC}$. Fiscal expenditure in the non-conditional case is decreasing in the degree of competition. There exists a level of a where $G^* = G^{NC}$. We will call this level for $\hat{a} = (\frac{2\lambda\alpha}{(1+\lambda)^\alpha - (1-\lambda)^\alpha})^{\frac{1}{1-\alpha}}$.

(iii) We will next only focus on the part of the indirect utility function which depends on G.

$$V(G^*, a) = (G^*)^{(\sigma)} - \frac{\frac{(1-\frac{1}{N})^{(\alpha)}}{1-\frac{\alpha}{N}} G^*}{a^{1-\alpha}} + f(a) \tag{39}$$

$$V(G^{NC}, a) = (G^{NC})^{(\sigma)} - \frac{\frac{(1-\frac{1}{N})^{(\alpha)}}{1-\frac{\alpha}{N}} G^{NC}}{a^{1-\alpha}} + f(a) \tag{40}$$

and the terms $f(a)$ contains all the terms independent of G. We will define L as the loss function when the fiscal policy choice is restricted to be non-conditional

$$L \equiv V(G^*) - V(G^R) \tag{41}$$

By a second order Taylor approximation evaluated at G^* the indirect utility function $V(G^{NC}, a)$ may be written as

$$V(G^{NC}) = V(G^*) + \frac{\partial V}{\partial G}(G^*)(G^{NC} - G^*) + \frac{1}{2}\frac{\partial^2 V}{\partial G^2}(G^*)(G^{NC} - G^*)^2$$

The loss function then reads

$$L \approx -\frac{\partial V}{\partial G}(G^*)(G^{NC} - G^*) - \frac{1}{2}\frac{\partial^2 V}{\partial G^2}(G^*)(G^{NC} - G^*)^2 \tag{42}$$

and by the envelope theorem we know that $V'(G^*) = 0$. Furthermore we find that

$$\frac{\partial^2 V}{\partial G^2}(G^*) = \sigma(\sigma - 1)(G^*)^{\sigma-2} \tag{43}$$

$$\left(G^{NC} - G^*\right)^2 = \left[1 - \left(\frac{((1+\lambda)^\alpha - (1-\lambda)^\alpha)a^{1-\alpha}}{2\lambda\alpha}\right)^{\frac{1}{\sigma-1}}\right]^2 (G^*)^2 \tag{44}$$

We are now able to rewrite the loss function and we see that it is decreasing in G^* which is decreasing in the degree of competition.

$$L \approx \frac{1}{2}\sigma(1-\sigma)\left[1 - \left(\frac{((1+\lambda)^{(\alpha)} - (1-\lambda)^{(\alpha)})a^{1-\alpha}}{2\lambda\alpha}\right)^{\frac{1}{\sigma-1}}\right]^2 (G^*)^\sigma \tag{45}$$

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