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Fiscal Reconstruction Policy

and Free Riding Behavior of Interest Groups

Toshihiro Ihori[a]
& Jun-ichi Itaya[b]

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a:Department of Economics,University of Tokyo
b:Department of Economics,Otaru University of Commerce

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Abstract

This paper investigates dynamic properties of fiscal reconstruction process by analyzing the infinite duration dynamic game among various interest groups with a framework of voluntary acceptance of tax burden. By comparing the first best solution, the open-loop solution under enforceable commitments, and the feedback solution without commitment, we explore the free riding behavior of interest groups during fiscal reconstruction process and investigate the normative role of taxes and transfers to internalize the free riding problem.

Key words: fiscal reconstruction, free riding, consumption taxes
JEL classification numbers: H41, F13, D62

*a: Corresponding author: Department of Economics, University of Tokyo, Hongo, Tokyo 113, Japan, (phone) 03-3812-2111, (fax) 03-3818-7082, E-mail: ihori@e.u-tokyo.ac.jp
b: Department of Economics, Otaru University of Commerce, 3-5-21 Midori, Otaru, Hokkaido 047, Japan, (phone) 0134-27-5200, (fax) 0134-27-5213, E-mail: itaya@res.otaru.ac.jp

1. Introduction

Most developed countries are suffering from huge government deficits. This is partly due to a slowdown of economic growth in recent years. When national income does not grow much, tax revenue will not increase either. On the contrary, public spending and transfer payments have been gradually raised due to political pressures of interest groups, resulting in large budget deficits. Many governments are attempting to return to the balanced budget by raising taxes and/or reducing public spending. One of the most common measures is to impose a ceiling constraint on the total public spending. Then taxes are raised and government spending is reduced so as to attain the target level of government debt-to-GDP ratio. This is called the fiscal stabilization or reconstruction movement. Since fiscal reconstruction usually takes much time and public asset balances change over time, it is important to explore dynamic properties of fiscal reconstruction process.

Alesina and Drazen (1991) presented a simple model of delayed stabilization defined as a change of policy that stabilizes the debt-to-GDP ratio, due to a war of attrition among various interest groups and derived the expected time of stabilization as a function of characteristics of those groups.[1] According to their analysis, the delay of stabilization is caused not only by heterogeneity in terms of the cost of waiting associated with the distortions resulting from distortionary financing (which are borne by the interest groups), but also by uncertainty about such a cost which leads each interest group to believe the possibility that other groups concede earlier to accept a larger share of the burden for stabilization.

[1] . Futagami (1989) explored a dynamic game between the government and the public by using a two-person noncooperative differential game and investigated the properties of consumption taxes which are used to overcome government deficits. He found that there is an optimal upper bound of consumption tax rate in order to minimize the terminal stock of government debts.

While they focused mainly on the costs associated with unsuccessful fiscal reconstruction, this paper explores the gains from successful fiscal reconstruction. After fiscal reconstruction is successfully completed, the government (or the fiscal authorities) can obtain greater freedom on how to spend its budget instead of spending more on interest payments on outstanding government bonds, so that it can spend more on the provision of public goods and social welfare spending. These expenditures in turn contribute to improving the welfare of all interest groups. In order to obtain such benefits, therefore, those interest groups may be willing to voluntarily accept tax increases or give up their group-specific privileges to some extent.

We do not investigate when fiscal reconstruction would begin, which is the main question of the war-of attrition model. The main purpose of the present paper is to highlight the free riding behavior of interest groups in the fiscal reconstruction process, and so this paper is intended as a complement to the war-of-attrition model of Alesina and Drazen[2]. More specifically, instead of the war-of-attrition model we shall develop a dynamic game among several influential interest groups which would accept voluntarily increases in their net tax burden (or abandon voluntarily some of group-specific privileges) in order to gain the benefits resulting from a reduction in government debts. The fiscal authorities are assumed to be strong enough to impose a ceiling rule of total public spending. This is a starting point of fiscal reconstruction. However, they are so weak that each of the interest groups can set a group-specific privilege voluntarily. In the real economy when facing fiscal crises, every interest group generally agrees with the implementation of fiscal reconstruction (such as imposing a ceiling constraint on total public spending). But it would not necessarily

[2] . There are several papers including Chari and Coles (1993) and Velasco (1997) which analyze the free rider problem of fiscal policy. However, there have been no theoretical analyses to investigate the free rider problem of fiscal reconstruction.

imply that each interest group is willing to accept cuts in its own privilege. This phenomenon may be called 'acceptance with the overall goal but objection to more specific arrangements'.

We believe that when formulating the process of fiscal reconstruction it is critical to clarify how the existing privileges of interest groups such as preferential treatments of taxes and/or subsidies are to be abandoned[3]. The marginal benefit of doing so is an increase in public spending (for instance, national public good or social welfare spending) since an increase in net tax payments borne by each group can curtail the size of deficits and thus interest payments on public debt in the long run. The marginal cost of that is a decrease in private consumption since an increase in its net tax payments reduces disposable income of each interest group. They are therefore willing to abandon some of their privileges only if the marginal benefit would outweigh the marginal cost. However, if one of the interest groups gives up its privileges or accepts cuts in group-specific subsidies, all other groups would benefit from its concession. In other words, there always exists a free rider incentive for every interest group to defer their concession.

Under such highly likely circumstances we investigate the relationship between the convergent level of government debt and the degree of enforceable commitment. We also explore the normative role of taxes and transfers to attain the Pareto-efficient fiscal reconstruction process by internalizing the free riding problem. We shall praise a consumption tax as an effective means of attaining the fiscal reconstruction process closer to a Pareto efficient one. However, it turns out that the

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[3]. For example, in Japan the bureaucracy, politicians, and agricultural cooperatives (*nokyo*) form the ruling triad of the agricultural sector. Some politicians (*zoku*) have acquired experience and influence in sectoral economic management, and the role of party *zoku* is crucial in creating the consensus and in determining how the cuts are to be distributed among related but conflicting interest groups.

sole use of consumption tax policy is not sufficient to accomplish this task. It is only the combination of consumption taxes and transfers to the interest groups that internalizes the free riding problem. This desirable outcome of consumption taxes in conjunction with appropriate transfer policy has a new policy implication, which has not been addressed in the conventional literature on fiscal stabilization policy.

Section 2 presents the model. Section 3 characterizes the Pareto efficient path of fiscal reconstruction. Section 4 considers the open-loop solution under enforceable commitments. Section 5 considers the feedback solution without commitment. Section 6 investigates normative roles of taxes and transfers to attain the Pareto-efficient fiscal reconstruction in the long run. Finally, section 7 concludes the paper. Mathematical derivations are found in the Appendix.

2. The model

There are many ($n \geq 2$) interest groups in a small open economy. Each of them enjoys a group-specific privilege of smaller taxes and/or higher subsidies which may be used for private consumption. For analytical simplicity, the instantaneous utility of group i (or the representative agent of group i) is assumed to be separable in consumption c_i and the benefit of public spending $Gn^{-\delta}$, which is common to all groups and may be viewed as a pure public good. The variable G is public spending and the parameter δ represents the degree of congestion; namely, $\delta = 0$ indicates pure public and $\delta = 1$ indicates pure private. Moreover, in order to be able to obtain explicitly analytical solutions, a second-order Taylor-series approximation of the utility function is employed. That is,

$$U^i(c_i, G) = \alpha^i + \beta_1^i c_i - \frac{\gamma_1^i}{2} c_i^2 + \beta_2^i n^{-\delta} G - \frac{\gamma_2^i}{2} n^{-2\delta} G^2 \qquad (1)$$

$$\alpha^i, \ \beta_1^i, \beta_2^i, \gamma_1^i, \gamma_2^i > 0, \ \ 0 \le \delta \le 1$$

Subscript (or superscript) i means group i. Given the instantaneous utility function (1), the intertemporal utility function of group i over an infinite-horizon starting at time 0 is given by

$$\int_0^\infty U^i(c_i(t), G(t)) e^{-\rho t} dt \tag{2}$$

where ρ (>0) is the constant discount rate, which is common to all groups.

Public spending G at each point in time is determined by

$$G(t) = G^* - rB(t) \tag{3}$$

where G^* is an exogenously given ceiling level, r is the exogenously given world interest rate, and B is external government debt. Equation (3) means that the total government spending including interest payments is fixed at the level of G^* through time, so that higher public spending G is possible only by reducing the external debt outstanding B. This ceiling constraint reflects an agreement to reconstruct the fiscal system towards balanced budget. During the fiscal reconstruction process many countries have actually imposed the ceiling constraint on total government spending in order to prevent a further deterioration in budget deficits. Equation (3) formulates such a ceiling rule. The strict ceiling rule of (3) (i.e., constancy of G^*) is adopted only for simplicity.[4]

The pubic debt, B, will change over time, following the government budget constraint. Hence, the dynamic evolution of B is given by

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[4]. A more general ceiling rule could be employed with the analytical results intact. When interest payments on public debt rB increase, the fiscal authorities have three choices; increasing taxes, reducing spending, or issuing more debt. Since we consider the situation where fiscal reconstruction is needed, the last choice is unsustainable. It would not be optimal to employ the first choice alone if taxes are distortionary. Hence, an increase in rB corresponds to a decrease in G as well as an increase in taxes. This is a typical movement we would like to investigate. All we need below is the negative relation between G and rB.

$$\dot{B} = G + rB - \sum_{j=1}^{n} g_j \tag{4}$$

where g_i is net payment of taxes provided by group *i*. More precisely, g_i is defined by the income tax payment applied to all groups ωY_i minus group-specific privileges (e.g., subsidies or rents to group *i* and public spending that benefits only group *i*) z_i.

$$g_i \equiv \omega Y_i - z_i \tag{5}$$

where Y_i is exogenously given income of interest group *i* and ω is the common income tax rate.

The government (more precisely, fiscal authorities) is assumed to be 'strong' enough to impose the ceiling constraint (3). However, they are 'weak' in that fiscal reconstruction can be thought of as a voluntary one on how the increases in net taxes g_i are to be apportioned between various interest groups. Namely, each interest group can voluntarily set cuts in group-specific subsidies or rents to accomplish fiscal reconstruction, given some hypothesis about the time path of others' contributions g_i. We further assume that each interest group has enough information to exactly know the structure of the government budget constraint (4). In other words, there is *no budgetary illusion*. This assumption implies that the number of interest groups is relatively small so that they can recognize the effect of changes in their contributions on public spending or its accumulation path.

From (3) and (4) we have

$$\dot{G} = r\sum_{j=1}^{n} g_j - rG^* \tag{4'}$$

Group *i*'s flow budget constraint is given by

$$(1-\omega)Y_i = c_i - z_i$$

Or considering (5) we have

$$c_i + g_i = Y_i \tag{6}$$

where the relative price of private consumption and public spending is set to be unity for simplicity. To focus on the problem at hand, Y_i is assumed to be fixed over time[5]. Although this assumption may appear to be extremely strong within a dynamic setting, it would be defended by the following reasons. First, based on the experiences of many countries facing large budget deficits, it turns out that the balanced budget movement takes place in the economy where the growth rate of GDP is close to zero and so GDP is nearly fixed over time.

Secondly, it is well recognized that the fully intertemporal optimization of private agents with perfect foresight within an infinite horizon framework would lead to the debt neutrality proposition of alternative financing of government spending. In order to discuss the meaningful problem of government deficit, we assume the perfect liquidity constraint in addition to the zero ceiling constraint (3). As a result, private savings as well as private bequests are absent due to such a constraint and hence disposable income is exogenously fixed. Alternatively, if we allow for private lending or borrowing in the small open economy, the interest groups would be willing to borrow as much as possible when $r < \rho$, and vice versa. Suppose there exists an exogenous limit of lending or borrowing; in other words, capital markets are imperfect. Then the absence of private savings in (6) would be justified by redefining income in a way to include interest payments from external borrowing.

3. Cooperative behavior: Pareto efficient outcome

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[5]. If the economy does not grow, the growth in government deficit may not be consistent in the long run. However, it is not difficult to extend the present model to the economy which is growing at a constant rate.

We first investigate the Pareto efficient outcome as a reference scenario. Pareto efficient outcomes for the economy just described are found from solving the following problem:

$$Max \sum_{j=1}^{n} \int_0^\infty U^j(c_j(t), G(t)) e^{-\rho t} dt \tag{7}$$

subject to (4)', (6) and the initial level of public spending $G(0)$. Before solving this problem, substitute (6) into (1). The utility function (1) of group i may be rewritten as follows:

$$U^i(Y - g_i, G) = \tilde{\alpha}^i + \tilde{\beta}_1^i g_i - \frac{\gamma_1^i}{2} g_i^2 + \beta_2^i n^{-\delta} G - \frac{\gamma_2^i}{2} n^{-2\delta} G^2 \tag{8}$$

where

$$\tilde{\alpha}^i \equiv \alpha^i + \beta_1^i Y_i - \frac{\gamma_1^i}{2} Y_i^2 .$$

$$\tilde{\beta}_1^i \equiv -\beta_1^i + \gamma_1^i Y_i \ (<0)$$

We assume that $\tilde{\beta}_1^i < 0$, which implies that the marginal utility of consumption is positive even if all income of group i were devoted to private consumption. In what follows, we assume for simplicity that interest groups are identical with respect to preferences as well as income. The subscript (or superscript) i will be dropped hereafter unless it is necessary.

From the condition (4)' = 0 and using symmetry in the long run,

$$ng = G^* \tag{9}$$

From (6) we have as the feasibility condition for the whole economy

$$nY = nc + ng \tag{10}$$

Equation (10) together with (9) implies that the steady state level of c is constant regardless of any values of G. As shown in Appendix 1, we also have in the steady state

$$n\frac{U_G}{U_c}=\frac{\rho}{r} \tag{11}$$

where U_k stands for the partial derivative of U with respect to argument k. Equation (11) can be viewed as the dynamic version of familiar Samuelson's rule for the optimal provision of public goods. Equations (10) and (11) together determine the steady state Pareto-efficient levels of G and c.

Alternatively, substituting (A5) in Appendix 1 into g in (9) and solving explicitly for the steady state Pareto efficient level of G yields

$$\overline{G}^P=\frac{n\kappa_1^p-G^*}{-n\kappa_2^p} \tag{12}$$

where

$$\kappa_1^p\equiv Y-\frac{\beta_1}{\gamma_1}+\frac{\beta_2}{\gamma_1}\frac{n^{1-\delta}r}{\rho}>0$$

$$\kappa_2^p\equiv-\frac{\gamma_2}{\gamma_1}\frac{n^{1-2\delta}r}{\rho}<0$$

From (3) the steady state level of external debt is given by

$$\overline{B}^P=\frac{1}{r}(G^*-\overline{G}^P) \tag{3'}$$

An increase in G^* will reduce $\overline{G}^P$ via (12) and hence raise $\overline{B}^P$ via (3)'. Since the steady state level of c remains constant, higher $\overline{G}^P$ implies lower steady state welfare. Intuitively, higher G^* implies higher tax payments by every group, thereby reducing its disposable income. The decreased disposable income depresses the demand for public spending. If the fiscal authorities are strong enough, they can impose a severe ceiling constraint and the resulting level of G^* becomes low. Thus, the above comparative static result has an interesting policy implication in that when the fiscal authorities are 'weak' and hence the ceiling constraint is mild, the steady state welfare is low. In contrast, an increase in Y will raise $\overline{G}^{p}$ via (12) and hence reduce $\overline{B}^{p}$. This is clearly due to the positive income effect. Therefore, a reduction in G^{*} has the same effect as an increase in Y in that it actually benefits every interest group. On the contrary, if Y declines due to a negative exogenous shock, it is desirable to reduce public spending and to accept a larger amount of government debt.

Equation (11) [or (12)] means that $\overline{G}^{p}$ is increasing with r/ρ and n but decreasing with δ, while the steady state levels of private consumption, c, and of voluntary tax payments, g, both remain constant by virtue of (9) and (10). Since a higher rate of interest raises the cost of per-capita public debt thus reducing its steady state level, the resulting decrease in B causes the steady state level of G to fall so as to satisfy (3). An increase in ρ implies a higher rate of discounting the future utilities from G and thus an increase in the marginal cost of G. An increase in the number of groups has two effects. Since it directly increases the number of those who receive the benefits of G and thus the total marginal utility of G, the provision level of G should be higher. It also increases private consumption by reducing g, thus raising the marginal rate of substitution of G with respect to c. Both effects cause the optimal level of G to rise. A higher value of δ implies a higher degree of congestion from public spending thus reducing the marginal benefit of fiscal reconstruction. Hence, an increase in δ will lead to lower public spending and thus higher government debt.

4. The open-loop strategies

Let us investigate the open-loop strategies. This type of Nash equilibrium concept presumes that the contribution to tax revenue made by each group in the fiscal reconstruction process at each point in time is only conditioned on the initial stock of public debt and hence the initial level of public spending, $G(0)$, and that each group precommits itself to the entire path of contribution chosen at the outset of fiscal reconstruction.

The optimization problem of group i is formulated as follows: Maximize (2) subject to (4)', (6) and the exogenously given $G(0)$ and $g_j(t)$ $j \neq i$ at time 0.

The first order conditions are as follows

$$U_c(-1) + \mu r = 0 \tag{13-1}$$

$$\dot{\mu} - \rho\mu = -U_G \tag{13-2}$$

From (13-1) and (13-2) at the steady state we have in addition to (10)

$$\frac{U_G}{U_c} = \frac{\rho}{r} \tag{14}$$

Alternatively, we now have the following decision rule for group i' s contribution:

$$g^o(G) = \kappa_1^o + \kappa_2^o G \tag{15}$$

where

$$\kappa_1^o \equiv Y - \frac{\beta_1}{\gamma_1} + \frac{\beta_2 n^{-\delta}}{\gamma_1}\frac{r}{\rho} > 0$$

$$\kappa_2^o \equiv -\frac{\gamma_2 n^{-2\delta}}{\gamma_1}\frac{r}{\rho} < 0$$

The steady-state level of $\overline{G}^o$ is given as

$$\overline{G}^o = \frac{n\kappa_1^o - G^*}{-n\kappa_2^o} \tag{16}$$

From (16) it is clear that the steady state effects of a change in either ρ, r, n or δ on *c*, *g* and *G* at the open-loop solution are qualitatively the same as those at the Pareto efficient solution. In particular, an increase in *r* would force each interest group to cooperate more willingly with fiscal reconstruction since the marginal return on doing so is *r*. This may explain rapid improvements of government budgets in some of European countries where *r* is high and slow fiscal reforms in Japan where *r* is low[6].

Compare between the steady-state level of public spending under the Pareto efficient solution $\overline{G}^P$ and that under the open-loop Nash equilibrium $\overline{G}^O$. Figure 1 shows the feasibility condition (10) at the steady state as vertical line AB. The Pareto efficient solution at the steady state is given by point P, where condition (11) is satisfied on line AB. On the other hand, the steady state open-loop equilibrium is given by point O, which satisfies (14) on line AB. U_G / U_c given by (14) is greater than U_G / U_c given by (11). Equation (14) means that the *per-group* marginal benefit of *G* is equal to the marginal cost of *G*, while (11) means that the *total* marginal benefit of *G* is equal to the marginal cost of *G*. Since the marginal rate of substitution of G with respect to c is greater at point O than at point P, G is too little, c is too much, and B is too much at point O compared with the Pareto efficient allocation. If one group cooperates with fiscal reconstruction by accepting more cuts in subsidies or more tax increases, it would benefit all other interest groups in the economy. That is, the main reason for such under-provision is that each group disregards a positive externality of cooperation with fiscal reconstruction which spills over into all other groups in choosing its own contribution [Bliss and Nalebuff (1984), Bergstrom et.al. (1986), and Boadway et.al

[6]. To be precise, we have to investigate the effect of an increase in *r* on the adjustment speed of fiscal reconstruction (i.e., the adjustment speed of *G* towards its steady state level). Ihori and Itaya (1997) demonstrated that higher *r* accelerates the adjustment speed of *G* at the open-loop solution.

(1989)].

5. The feedback strategies

When the fiscal authorities are 'weak' in that each interest group can set its own privilege voluntarily, the most likely outcome would be described by the feedback strategies rather than the open-loop strategies. The feedback Nash equilibrium allows each interest group to condition its contribution to tax revenues on the current stock of public debt and level of public spending at each point in time. Thus, the feedback Nash equilibrium is subgame perfect equilibrium, but the open-loop equilibrium is not.

Let $V^i(G)$ be the value function of group i of the game that starts at G. Using the value function approach the feedback Nash equilibrium strategies must satisfy the following Hamiltonian-Jacobi-Bellman condition:

$$\rho V^i(G) = \underset{g_i}{Max}[\tilde{\alpha} + \tilde{\beta}_1 g_i - \frac{\gamma_1}{2} g_i^2 + \beta_2 n^{-\delta} G - \frac{\gamma_2}{2} n^{-2\delta} G^2 + V_G^i \{\sum_{j=1}^{n} r g_j - rG^*\}] \quad (17)$$

Since the right hand side of (17) is concave with respect to g_i, the function g_i that maximizes it is given by

$$g_i = \frac{1}{\gamma_1}(\tilde{\beta}_1 + V_G^i r) \quad (18)$$

In what follows, we focus on the linear strategies to avoid analytical complexities. In this case equation (18) can be rewritten as

$$U_c = V_G r \equiv (\theta_1 \gamma_1 + \theta_2 \gamma_1 G) r \quad (19)$$

where the second equality follows from (A6) in Appendix 2.

As shown in Appendix 2, we have

$$g^s(G) \equiv \kappa_1^s + \kappa_2^s G \quad (20)$$

where

$$\kappa_1^s \equiv \frac{\widetilde{\beta}_1}{\gamma_1} + \theta_1 r = Y - \frac{\beta_1}{\gamma_1} + r\frac{\lambda_1 n r \widetilde{\beta}_1 + \beta_2 n^{-\delta} - \gamma_1 \lambda_1 r G^*}{\gamma_1 \rho - (2n-1)\gamma_1 \lambda_1 r^2} > 0$$

$$\kappa_2^s \equiv r\lambda_1 = \frac{\frac{\rho}{2} - \sqrt{(\frac{\rho}{2})^2 + \frac{\gamma_2}{\gamma_1} n^{-2\delta} r^2 (2n-1)}}{r(2n-1)} < 0$$

At the steady state we have

$$\overline{G}^S = \frac{n\kappa_1^s - G^*}{-n\kappa_2^s} \tag{21}$$

It is important to note from (21) that although $\overline{G}^S$ is positively related to ρ, the effects of *n*, δ or *r* on $\overline{G}^S$ are ambiguous. This result stands in contrast to the one that both $\overline{G}^P$ and $\overline{G}^O$ are unambiguously increasing with r/ρ, $1/\delta$ and *n*. The reason for these ambiguities is that the higher, say *r*, the more willing every group is to abandon its privileges; such less aggressive behavior in turn leads the other groups to abandon less due to the property of *strategic substitutes*, thereby offsetting the original effect.

Using (19), Appendix 3 shows that[7]

$$\pi \equiv \frac{\rho V_G}{U_G} < 1 \text{ and } \frac{U_G}{U_c} > \frac{\rho}{r} \tag{22}$$

at the feedback solution. As shown in Figure 1, the feedback solution is given by point S, which satisfies the second inequality in (22). Since the marginal rate of substitution of G at point S is greater than that at point O, G is too little, c is too

7 . In this paper we focus only on the linear feedback strategy which is unique. However, Ihori and Itaya (1997) show that there are an infinite number of nonlinear feedback strategies. According to their result, the steady state level of *G* which is supported by the best nonlinear feedback strategy coincides with that at the open-loop solution. Therefore, even if the nonlinear feedback strategies were allowed, the strict inequalities in (22) are replaced with the weak ones and thus our conclusions still remain valid with minor modifications.

much, and hence B is too much at point S, compared with point O. The free riding behavior of interest groups is further aggravated when players' contributions are conditional on the observable current collective contributions compared with that at the open-loop solution. It also turns out from (3) that without commitment the resulting public debt is higher than that with the enforceable commitment (i.e. open-loop) case. The contributions of the groups to tax revenues are strategic substitutes and thus aggressive behavior (lower contribution to tax revenues) by one group leads to less aggressive behavior (higher contribution to tax revenues) by the other groups. The economic insight behind the result is similar to that of Fershtman and Nitzan (1991) and Tornell and Velasco (1992).

In conjunction with the comparative steady state results of the open-loop solution in the previous section, moreover, we also have the following welfare ranking:

$$U(\bar{c},\overline{G}^{S}) < U(\bar{c},\overline{G}^{O}) < U(\bar{c},\overline{G}^{P})$$

where $\bar{c}$ is the steady state level of private consumption.

6. Normative tax and transfer policy

6.1 Neutrality results

We now investigate a normative role of tax and transfer policy which internalizes the free riding problem. First of all, (5) means that the income tax rate ω can affect the real equilibrium only through changes in g_i. Any changes in ω would completely be offset by appropriate changes in z_i to keep g_i intact in any of the noncooperative equilibria just described in the previous sections. Since each interest group exactly knows the government budget constraint, it is concerned with g_i, the net payment of taxes, which is only the relevant choice variable in this model. Since all g_i's remain constant, so does the government budget constraint. Therefore the income tax policy cannot affect the real equilibrium. The whole results obtained in sections 3-5 will be independent of the income tax rate ω. The economic mechanism behind this neutrality result is essentially the same as that behind the neutrality result in terms of income redistribution through lump-sum transfers [e.g., Warr (1983) and Bergstrom et. al. (1986)].

Suppose then that the fiscal authorities can tax group-specific privileges, z_i and that the tax revenue from this is used for redeeming government debts. How would the result be altered? We now have as group i's budget constraint

$$(1-\omega)(Y+z_i)=c_i \tag{23}$$

By substituting (5) into z_i in (23), (6) can be amended as follows

$$(1-\omega)g_i+c_i=(1-\omega^2)Y \tag{6'}$$

Since z_i is also included in the tax base, the government budget constraint (4) is now rewritten as

$$\dot{B}=G+rB-\sum_{j=1}^{n}g_j-\omega\sum_{j=1}^{n}z_j$$

By substituting (5) into z_i in the above equation and the resulting expression into (4)', the dynamic evolution of public spending may be written as

$$\dot{G}=r\sum_{j=1}^{n}(1-\omega)g_j+r\omega^2nY-rG^* \tag{24}$$

If we define $\widetilde{g}_i\equiv(1-\omega)g_i$, all the relevant optimality conditions may be expressed using $\widetilde{g}_i$ instead of g_i, resulting in the same real equilibrium as in the basic case where group-specific privileges are not taxed. Therefore, the income tax policy has no real effects even if the group-specific privilege were taxed.

Next, let us consider a consumption tax, τ, instead of the income tax. In this case group i' s budget constraint is

$$Y + z_i = (1+\tau)c_i$$

or equivalently,

$$Y = \hat{g}_i + c_i \tag{23)'$$

where $\hat{g}_i \equiv \tau c_i - z_i$. The government budget constraint (4) is now rewritten as

$$\dot{B} = G + rB - \sum_{j=1}^{n} \hat{g}_j$$

From (3) and the above constraint, the dynamic evolution of public spending is

$$\dot{G} = r\sum_{j=1}^{n} \hat{g}_j - rG^* \qquad (25)$$

Equations (23)' and (25) together mean that the consumption tax τ can again affect the real equilibrium only through changes in $\hat{g}$. As may be expected, the consumption tax τ would also have no real effects. An increase in the consumption tax will lead to an increase in privileges z by the same amount, so that private consumption and the demand for public spending both remain intact.

The intuition behind these neutrality results concerning income and consumption taxes is essentially the same as in Bernheim (1986) and Boadway et. al. (1989), although their results are static ones. As pointed by them, the key assumption for these neutrality results is that every interest group can 'see through' the government budget constraint in the sense that they recognize that the policy parameters must be chosen so as to satisfy this constraint whatever decisions may be taken by the interest groups. As stated before, the assumption of 'no budgetary illusion' may be justified in a situation where the number of interest groups is small.

6.2 Lump-sum transfer policy

Let us then consider the lump-sum transfer policy. Suppose that the fiscal authorities transfer some portion ε (>0) of the total (net) tax revenue $\sum_{j=1}^{n} g_j$ to the interest groups. The government budget constraint is now given as

$$\dot{B} = G + rB - \sum_{j=1}^{n} g_j + \varepsilon \sum_{j=1}^{n} g_j \tag{26}$$

From (3) and (26) the dynamic evolution of public spending is

$$\dot{G} = r(1-\varepsilon)\sum_{j=1}^{n} g_j - rG^* \tag{27}$$

And group i 's budget constraint is now given as

$$Y + \frac{\varepsilon}{n}\sum_{j=1}^{n} g_j = g_i + c_i \tag{28}$$

We assume that every interest group receives the same amount of transfer and that it knows precisely this transfer scheme. Then, (28) can be rewritten as

$$Y + \frac{\varepsilon}{n}\sum_{j \neq i} g_j = (1-\frac{\varepsilon}{n})g_i + c_i \tag{28'}$$

Note that under the Nash conjecture (which is actually fulfilled) the interest groups would regard the left hand side of (28)' as fixed.

In what follows, our analysis is focused on the steady state equilibrium. Considering (27) and (28)', in the case of open-loop solutions we now have in place of (13-1)

$$-U_c(1-\frac{\varepsilon}{n}) + \mu r(1-\varepsilon) = 0 \tag{13-1'}$$

Thus, at the steady-state open-loop solution in place of (14)

$$\frac{U_G}{U_c} = \frac{1-\frac{\varepsilon}{n}}{1-\varepsilon}\frac{\rho}{r} \tag{29}$$

which means that the transfer policy parameterized by ε has clearly real effects.

Since the right hand side of (29) is increasing with ε, any positive value of ε cannot realize the Pareto efficient solution given by (11). Intuition is as follows. An increase in ε reduces the effective relative price of g in terms of c, thus stimulating G due to the substitution effect. However, it also reduces net revenue for redemption of public debt, lowering the effective rate of return on raising g_i (or the marginal benefit of cooperating with fiscal reconstruction) from r to $r(1-\varepsilon)$ so that the steady state level of B rises but that of G falls. The former effect is welfare improving, whereas the latter effect is welfare reducing. Since $n>1$, the latter effect always dominates the former effect and thus the long-run welfare falls with the amount of net revenue for redemption of public debt.

At the feedback solution we now have in place of (19)

$$-U_c\left(1-\frac{\varepsilon}{n}\right)+V_G r(1-\varepsilon)=0 \tag{19'}$$

Further elaboration of (19)' gives

$$\frac{U_G}{U_c}=\frac{1}{\pi}\frac{1-\frac{\varepsilon}{n}}{1-\varepsilon}\frac{\rho}{r} \tag{30}$$

The transfer policy has real effects in the case of feedback strategies too. Since $1/\pi \equiv U_G/\rho V_G > 1$, neither any positive value of ε nor $\varepsilon = 0$ can realize the Pareto efficient solution. The exercise here suggests to us that the sole use of transfer policy is not an effective means in achieving the Pareto-efficient fiscal reconstruction path.

6.3 Income tax policy with positive transfers

When $\varepsilon>0$, is it possible to attain the Pareto efficient solution by changing income taxes? The subsection 6.2 has already shown that the income tax scheme (5) is not effective even with the transfer policy. Instead, in this subsection we consider the combination of the transfer policy and the income tax scheme (23). Then the government budget equation is now given as

$$\dot{B} = G + rB - \sum_{j=1}^{n} g_j - \omega \sum_{j=1}^{n} z_j + \varepsilon \sum_{j=1}^{n} g_j \tag{31}$$

Then from (3) (5) and (31) we have

$$\dot{G} = r\sum_{j=1}^{n}[(1-\omega)-\varepsilon]g_j + r\omega^2 nY - rG^* \tag{32}$$

Combining (6)' and (28)' we have the following budget constraint of group i

$$(1-\omega)^2 Y + \frac{\varepsilon}{n}\sum_{j=i} g_j = (1-\omega-\frac{\varepsilon}{n})g_i + c_i \tag{33}$$

Therefore considering (32) and (33) in the steady state we have

$$\frac{U_G}{U_c} = \frac{1-\omega-\dfrac{\varepsilon}{n}}{1-\omega-\varepsilon}\frac{\rho}{r} \tag{34}$$

It is immediately seen from (34) that so long as ε is positive, the income tax policy has real effects. We also know that unless

$$\omega = 1 \tag{35}$$

we cannot attain the Pareto efficient outcome (11) in the open-loop case. However, raising ω closer to 1 is desirable from the viewpoint of society. Intuition is as follows. When $1-\varepsilon < \omega < 1$, an increase in ω would not raise the government tax revenue much since z is 100ω% deductible. Due to the positive transfer ε, the government effective (net of transfer) revenue for redemption of public debt would actually decline. In other words, the effective rate of return on cooperating with fiscal reconstruction is reduced from r to $(1-\omega-\varepsilon)r$. On the other hand, the effective relative price of g in terms of c declines to $(1-\omega-\varepsilon/n)$ stimulating the demand for G whenever the positive transfer policy is present. The former effect is welfare reducing, while the latter effect is welfare improving as a result of increased G. The overall effect is welfare improving so long as $1-\varepsilon<\omega<1$.

On the other hand, in the case of feedback strategies we obtain the following first order condition

$$\frac{U_G}{U_c}=\frac{1}{\pi}\frac{1-\omega-\dfrac{\varepsilon}{n}}{1-\omega-\varepsilon}\frac{\rho}{r} \tag{36}$$

Since $1/\pi>1$, we cannot obtain the Pareto efficient solution by setting $\omega=1$ unlike the case of open-loop strategies. This is because the positive income effect resulting from lower income taxes causes the interest groups to increase the demand for G and then to abandon their privileges more.

6.4 Consumption tax policy with positive transfers

We finally investigate the normative role of consumption tax policy with positive transfers. When the fiscal authorities transfer some portion of $\sum_{j=1}^{n} g_j$ as before, the resulting real equilibrium is the same as in the income tax policy just described in the previous section. Alternatively, we here consider the case where the fiscal authorities transfer some portion of consumption taxes, $\sum_{j=1}^{n}\tau c_j$, to the interest groups.

With a consumption tax rate τ and a positive transfer parameterized by ε group i's budget constraint is written as

$$Y+\frac{\varepsilon}{n}\tau\sum_{j\neq i}c_j=g_i+(1+\tau-\frac{\varepsilon\tau}{n})c_i \tag{37}$$

The government budget constraint can now be expressed by

$$\dot{B}=G+rB-\sum_{j=1}^{n}g_j-(1-\varepsilon)\sum_{j=1}^{n}\tau c_j \tag{38}$$

The evolution equation of G is given by

$$\dot{G} = r\sum_{j=1}^{n} g_j + r(1-\varepsilon)\sum_{j=1}^{n} \tau c_j - rG^* \tag{39}$$

Thus, at the steady-state open-loop solution we have

$$\frac{U_G}{U_c} = \frac{\dfrac{1}{1+\tau-\dfrac{\varepsilon\tau}{n}}}{1-\dfrac{(1-\varepsilon)\tau}{1+\tau-\dfrac{\varepsilon\tau}{n}}}\frac{\rho}{r} = \frac{1}{[1+\varepsilon\tau(1-\dfrac{1}{n})]}\frac{\rho}{r} \tag{40}$$

The consumption tax policy has real effects so long as ε is positive. In order to realize the Pareto efficient allocation at the steady-state open-loop solution, by equating (40) with (11), we obtain the optimal consumption tax rate, τ^O:

$$\tau^O = \frac{n}{\varepsilon} \qquad (n>1) \tag{41}$$

which is increasing with the number of interest groups and decreasing with the portion of consumption taxes to be used for lump-sum transfers. The positive externality of g_i is spread over more groups as the number of groups increases. To internalize it the higher consumption tax rate is required.

On the other hand, at the feedback solution we have

$$\frac{U_G}{U_c} = \frac{1}{\pi}\frac{1}{1+\varepsilon\tau(1-\dfrac{1}{n})}\frac{\rho}{r} \tag{42}$$

In order to realize the Pareto efficient allocation, we have to equate (42) with (11) thus resulting in

$$\tau^s = \frac{n}{\varepsilon}\frac{n-\pi}{n\pi-\pi} \tag{43}$$

Since $(n-\pi)/(n\pi-\pi)>1$ (recalling that $\pi<1$), the optimal consumption tax rate should be greater than that at the open-loop solution. This is quite intuitive. Since the free-riding behavior of each interest group is more severe at the feedback solution than that at the open-loop solution, a higher rate of the consumption tax is required to rectify it by reducing more the marginal benefit of enjoying group-specific privileges.

Consumption taxes are usually regarded as the most powerful measure to raise a large amount of tax revenue since the tax base is very broad. This is the revenue effect. The consumption tax also changes the relative price of private consumption in terms of voluntary taxes, thereby making private consumption less attractive and thus inducing substitution from c to G. This is the substitution effect. When ε is low, the government deficit is likely to be offset by revenues from consumption taxes. It follows that the marginal benefit of fiscal reconstruction for each interest group is low and hence it would not be likely to make each interest group abandon its privileges easily. The revenue effect is mostly offset by an increase in group-specific privileges. Hence, the lower ε, the higher τ^O is needed to reduce the marginal cost of abandoning the existing privileges due to the substitution effect. The consumption tax policy works well only if some of consumption taxes are returned to the interest groups involved.

6.5 Remarks

There are several important remarks. First of all, we may introduce distortionary effects of income taxes. Suppose that income taxes are distortionary in the following simple way. A tax revenue ωY reduces private consumption by $x(\omega Y)$ where a distortionary cost is an increasing, convex function with $x(0)=0$ and $x'(.) > 1$. Then, the budget constraint of group i is now

$$Y + z_i = \omega Y + x(\omega Y) + c_i \tag{44}$$

If we then define g_i in place of (5) as

$$g_i = \omega Y + x(\omega Y) - z_i \tag{45}$$

we may formulate exactly the same model as before. The income tax rate ω and the distortionary cost x can affect the equilibrium only through changes in g. Hence, we can obtain the same analytical results as in sections 3-6 even if income taxes are distortionary. This result again coincides with the general neutrality proposition established by Bernheim (1986).

Second, we have elsewhere shown that the adjustment speed of the Pareto efficient path is greater than that of the open-loop equilibrium path, and moreover the adjustment speed of the open-loop equilibrium path is greater than that of the feedback equilibrium path [See Ihori and Itaya (1997)]. An increase in the consumption tax will raise the adjustment speed of fiscal reconstruction in either noncooperative equilibrium and hence it is desirable in terms of the adjustment speed as well. An increase in consumption taxes combined with positive transfers raises the relative price of consumption in terms of privileges, inducing earlier concession to give up the privileges of interest groups. This is another desirable effect of the consumption tax on fiscal reconstruction.

7. Conclusion

Although every interest group agrees with imposing the ceiling constraint on total public spending for fiscal reconstruction, there exist a lot of freedom on how to stabilize the debt-to-GDP ratio. In formulating the process of fiscal reconstruction it is critical to clarify how the existing privileges of interest groups such as preferential treatments of taxes and/or subsidies are to be abandoned. We have shown that the target level of government debt after fiscal reconstruction is completed is increasing with the rate of time preference and the degree of congestion of public spending, but is decreasing with the rate of interest and the number of interest groups.

We have then shown that the free riding behavior of interest groups in the fiscal reconstruction process is aggravated when their cooperation is conditional on the observable collective cooperation. Put differently, without commitment lower cooperation, higher existing privileges, and higher government debt are made relative to the enforceable commitment case. The most important policy's lesson from the present analysis is that if the program of fiscal reconstruction is too flexible in the sense that it allows each interest group to reconsider the predetermined strategies about subsidy cuts at each point in time when the outcome of fiscal reconstruction is revealed, it is highly likely that fiscal reconstruction ends finally in much failure. Our result indicates that allowing such possibility would strengthen an incentive of each group to free ride. In order to realize successful fiscal reconstruction, therefore, we have to stick to the long-term program for fiscal reconstruction that has been agreed at the beginning of planning period. In practice, one of effective means is to enact legislation for fiscal reconstruction which does not permit much room for reconsidering or revising the fiscal reconstruction plan later on.

We have finally shown that some combination of tax and transfer policy may attain the Pareto-efficient outcome in the long run. The consumption tax can be used for attaining the Pareto-efficient target of fiscal reconstruction not because it produces much revenue but because it reduces the marginal benefit of enjoying group-specific privileges thereby inducing each interest group to abandon its privileges easily. In order to make the consumption tax policy effective as an instrument for fiscal reconstruction, the portion of tax revenue which is returned to the interest groups involved should be raised so as to induce their voluntary acceptance of subsidy cuts or tax increases more easily. The optimal consumption tax rate at the open-loop solution is increasing with the number of groups and decreasing with the portion of consumption taxes to be used for lump-sum transfers. This desirable outcome of consumption taxes has a new policy implication, which has not been addressed in the conventional literature on fiscal reconstruction [see, e.g., Futagami (1989)].

The present model could be extended in several directions. The most important extension is to allow heterogeneity across interest groups as in Alesina and Drazen (1991) and Bulow and Klemperer (1997). Recently, Grossman and Helpman (1996) focuses on campaign contributions by heterogeneous interest groups as a vehicle for influencing public policy. The extension to include heterogeneous interest groups in terms of incomes, preferences, or discount factors may add further insights to our results despite the analytic complexity. Another interesting extension of the model is to treat the governing party as simply another interest group with ability to vary its actions through time (possibly also facing elections) and to investigate how the ability to precommit to a tax system improves things. This could lead to an interesting international comparison of fiscal stabilization policy in the real world to cope with fiscal deficits. Finally, it might be interesting to move beyond the traditional deficit finance issues in this analysis and to investigate the dynamic aspects of social security reform.

Appendix 1: Pareto efficient outcome

After substituting (6) into (8), the current value Hamiltonian is given by

$$H \equiv \sum_{i=1}^{n} U(Y - g_i, G) + \mu[\sum_{i=1}^{n} rg_i - rG^*] \tag{A1}$$

where μ is the shadow price associated with the accumulation of public spending. Hence, the first order conditions are given as

$$\frac{\partial H}{\partial g_i} = U_c(-1) + \mu r = 0 \tag{A2}$$

$$\dot{\mu} - \rho\mu = -\frac{\partial H}{\partial G} = -\sum_{i=1}^{n} U_G \tag{A3}$$

$$\lim_{s \to \infty} \mu(s)G(s)e^{-\rho s} = 0$$

Recalling that

$$U_c \equiv \beta_1 - \gamma_1 c$$

(A2) reduces to

$$g_i = Y - \frac{1}{\gamma_1}(\beta_1 - \mu r) \tag{A2)'}$$

and (A3) also reduces to

$$\dot{\mu} = \rho\mu - nU_G \tag{A3)'}$$

where $U_G \equiv \beta_2 n^{-\delta} - \gamma_2 n^{-2\delta} G$.

At the steady state from the condition (A3)' = 0 we have

$$\mu = \frac{n(\beta_2 n^{-\delta} - \gamma_2 n^{-2\delta} G)}{\rho} \tag{A4}$$

Substituting (A4) into (A2)' and rearranging, we also have

$$g_i = \kappa_1^p + \kappa_2^p G \tag{A5}$$

where

$$\kappa_1^p \equiv Y - \frac{\beta_1}{\gamma_1} + \frac{\beta_2}{\gamma_1}\frac{n^{1-\delta}r}{\rho} > 0$$

$$\kappa_2^p \equiv -\frac{\gamma_2}{\gamma_1}\frac{n^{1-2\delta}r}{\rho} < 0$$

Appendix 2: Feedback solution

Consider the quadratic value function

$$V^i(G) = \theta_0 + \theta_1\gamma_1 G + \frac{\theta_2}{2}\gamma_1 G^2$$

Differentiating this value function yields

$$V_G^i = \theta_1\gamma_1 + \theta_2\gamma_1 G \tag{A6}$$

Substituting this into (18), we have

$$g^s(G) = \kappa_1^s + \kappa_2^s G \tag{A7}$$

where

$$\kappa_1^s \equiv \frac{\widetilde{\beta}_1}{\gamma_1} + \theta_1 r$$

$$\kappa_2^s \equiv r\theta_2$$

Substitute $g^s(G)$, $V^i(G)$, and V_G^i into the functional equation (17). Then, we have

$$\begin{aligned}0 = &-\rho[\theta_0 + \gamma_1\theta_1 G + \frac{1}{2}\gamma_1\theta_2 G^2] + \widetilde{\alpha} + \frac{\widetilde{\beta}_1^2}{\gamma_1} + \widetilde{\beta}_1(\theta_1 + \theta_2 G)r + \beta_2 n^{-\delta}G - \\ &\frac{\gamma_1}{2}\{(\frac{\widetilde{\beta}_1}{\gamma_1})^2 + \frac{2\widetilde{\beta}_1}{\gamma_1}(\theta_1 + \theta_2 G)r + (\theta_1^2 + 2\theta_1\theta_2 G + \theta_2^2 G^2)r^2\} - \frac{\gamma_2}{2}n^{-2\delta}G^2 + \\ &(\gamma_1\theta_1 + \gamma_1\theta_2 G)[nr\frac{\widetilde{\beta}_1}{\gamma_1} + n(\theta_1 + \theta_2 G)r^2 - rG^*]\end{aligned} \tag{A8}$$

Since this equation must be satisfied for every possible G, the constant term and each of the coefficients of the G-terms on the right hand side of this equation must be zero.

The equation corresponding to the coefficient of the G^2-term is given by

$$\gamma_1 r^2 (\frac{2n-1}{2})\theta_2^2 - \gamma_1 \frac{r}{2}\theta_2 - \frac{\gamma_2}{2} n^{-2\delta} = 0 \tag{A9}$$

Applying the quadratic formula, we have

$$\theta_2 = \frac{\frac{\rho}{2} \pm \sqrt{(\frac{\rho}{2})^2 + \frac{\gamma_2}{\gamma_1} n^{-2\delta} r^2 (2n-1)}}{r^2(2n-1)} \tag{A10}$$

Let denote these two roots λ_1 and λ_2, respectively. They are real and distinct, because

$$(\frac{\rho}{2})^2 + \frac{\gamma_2}{\gamma_1} n^{-2\delta} r^2 (2n-1) > 0$$

Moreover, it is clear that one root is positive and the other root is negative, i.e.,

$$\lambda_1 < 0 < \lambda_2$$

λ_1 is the only root for θ_2 from the stability viewpoint.

The equation corresponding to the coefficient of the G-term is given by

$$-\rho\gamma_1\theta_1 + \beta_2 n^{-\delta} + (2n-1)\gamma_1\theta_1\theta_2 r^2 + \theta_2 nr\tilde{\beta}_1 - \gamma_1\theta_2 rG^* = 0 \tag{A11}$$

Substituting λ_1 into θ_2 in (A11) yields

$$\theta_1 = \frac{\beta_2 n^{-\delta} + \lambda_1 nr\tilde{\beta}_1 - \gamma_1\lambda_1 rG^*}{\rho\gamma_1 - (2n-1)\gamma_1\lambda_1 r^2} \tag{A12}$$

Since $\tilde{\beta}_1 \equiv -\beta_1 + \gamma_1 Y < 0$, we can show that $\lambda_1 nr\tilde{\beta}_1 - \gamma_1\lambda_1 rG^* > 0$ and hence $\theta_1 > 0$.

Appendix 3: Derivation of (22)

Let us compare U_G / ρ and V_G. We investigate the sign of:

$$Q \equiv V_G - \frac{U_G}{\rho} = \theta_1\gamma_1 + \theta_2\gamma_2 n^{-2\delta}G - [\frac{\beta_2 n^{-\delta}}{\rho} - \frac{\gamma_2 n^{-2\delta}}{\rho}G]$$

From (A11)

$$\begin{aligned} \rho\gamma_1\theta_1 - \beta_2 n^{-\delta} &= \theta_2\theta_1\gamma_1 r^2(2n-1) + \theta_2 nr\widetilde{\beta}_1 - \gamma_1\theta_2 rG^* \\ &= \theta_2[\theta_1\gamma_1 r^2(n-1) + \theta_1\gamma_1 r^2 n + nr\widetilde{\beta}_1 - \gamma_1 rG^*] \end{aligned} \quad \text{(A13)}$$

From κ_1^s, κ_2^s we also know

$$\theta_1\gamma_1 r^2 n + nr\widetilde{\beta}_1 - \gamma_1 rG^* = \gamma_1(-nr^2\theta_2)G \quad \text{(A14)}$$

Substituting (A14) into (A13), Q reduces to

$$Q = \frac{\theta_2}{\rho}[\theta_1\gamma_1 r^2(n-1) + \gamma_1(-nr^2\theta_2)G] + [\theta_2\gamma_1 + \frac{\gamma_2 n^{-2\delta}}{\rho}]G \quad \text{(A15)}$$

Note that from (A9) we have

$$r^2(2n-1)\theta_2^2 = \rho\theta_2 + \frac{\gamma_2}{\gamma_1}n^{-2\delta} \quad \text{(A16)}$$

Substituting (A16) into (A15), we have

$$\begin{aligned} Q &= \frac{\theta_2\gamma_1 r^2(n-1)}{\rho}[\theta_1 + \frac{1}{r^2(n-1)}(-nr^2\theta_2 + \rho + \frac{\gamma_2 n^{-2\delta}}{\gamma_1\theta_2})G] \\ &= \frac{\theta_2\gamma_1 r^2(n-1)}{\rho}[\theta_1 + \theta_2 G] \end{aligned} \quad \text{(A17)}$$

which is negative since $V_G \equiv \gamma_1[\theta_1 + \theta_2 G] > 0$.

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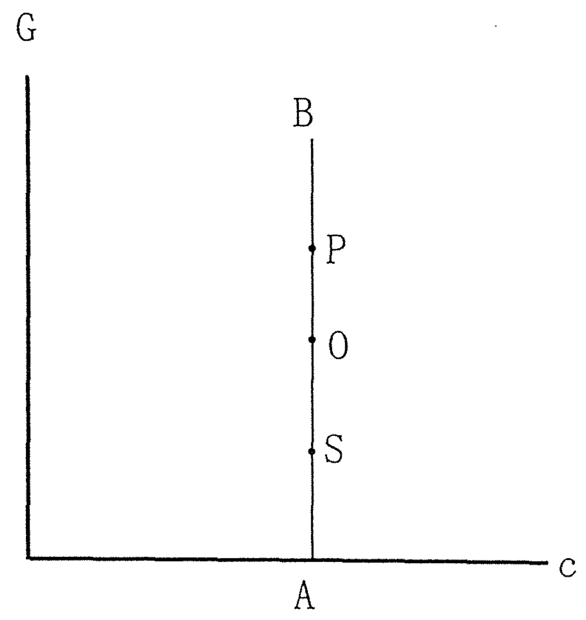

Figure 1

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Institute of Economic Researchi, Otaru University of Commerce
3-5-21, Midori, Otaru, Hokkaido 047-8501, Japan Tel.0134-27-5289 Fax.0134-27-5293

小樽商科大学経済研究所
〒047-8501 北海道小樽市緑3丁目5番21号 Tel.0134-27-5289 Fax.0134-27-5293