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Policy Cooperation Among Benevolent Governments May Be Undesirable

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This paper presents a simple counterexample to the belief that policy cooperation among benevolent governments is desirable. It also explains circumstances under which such counterexamples are possible and relates them to the literature on time inconsistency.

Since the work of Hamada (1976), investigating the effects of increasing policy cooperation among countries has been a major topic in international economics. A standard conclusion of this work is that increasing policy cooperation among countries is desirable. In a seminal paper, Rogoff (1985) has challenged this view. Using a simple monetary model, Rogoff shows that cooperation among policy makers can lead to a lower level of welfare than noncooperation does.

Rogoff's result has caused much consternation among those who advocate policy cooperation, and his work has been criticized along several dimensions. For example, some authors, including Canzoneri and Henderson (1988), have noted that a key assumption in Rogoff's model is that the objective function of each country's policy maker does not coincide with the objective function of its residents. Indeed, if in his model policy makers maximize the welfare of their country's residents, the counterexample is overturned and cooperation strictly dominates noncooperation. This feature leads some to interpret Rogoff's result as simply saying that if policy makers form a coalition against the private sector, they may be worse off than if they do not. Others, such as Neck and Dockner (1988), have claimed that Rogoff's result depends on private agents acting strategically. Under this interpretation, Rogoff's result is relevant to, say, economies with a large trade union, but not to economies with a large number of competitive private agents. In a somewhat different vein, Persson (1988) and, especially, Devereux (1986*a*,*b*) have questioned the significance of welfare comparisons across different institutional regimes in a model without a solid foundation for the behavioural relationships.

This paper presents a simple model in which governments are benevolent, but cooperation is still undesirable. The model is a two-country version of Fischer's (1980) optimal tax model. In it, private agents are competitive (in that each agent takes both prices and government policies as uninfluenced by his actions) and each government maximizes the welfare of its country's residents.

In the paper, the two different regimes—cooperative and noncooperative—correspond to alternative institutional arrangements. Neither regime has a technology for committing to a specific set of policy rules at the beginning of time. This feature is modelled by having policy makers move sequentially with private agents. In the noncooperative regime, policies are set separately and sequentially by policy makers to maximize their country's welfare. The institutional arrangement defines an extensive form game. In the cooperative regime, policies are set sequentially by a single decision-making body to maximize world welfare. This institutional arrangement defines another extensive form game. The subgame perfect equilibria of these two games are used to compare welfare across regimes.

The approach used to characterize equilibria of the cooperative and noncooperative regimes is of some analytical interest. Each regime is shown to impose different dynamic incentive constraints on the set of tax policies. This lets the equilibrium allocations of the regimes be characterized as solutions to optimal tax problems subject to these constraints. This technique ranks welfare levels in the two regimes without the use of a specific numerical example (as was necessary in Kehoe (1986)).

Finally, note that Van der Ploeg (1987) explored the possibility of undesirable cooperation in a two-country version of Calvo's (1978) inflation tax model using a somewhat different notion of equilibrium than the one used here.

1. THE WORLD ECONOMY

Consider a two-period symmetric world economy consisting of a home country and a foreign country, denoted by $i=h$ and f. Each country is populated by a large number of identical consumers and a government. Each country has access to the same linear production function for which the marginal products of labour and capital are denoted by the constants w and R. For simplicity, assume (somewhat as Fischer (1980) does) that consumers have consumption-savings-investment decisions in the first period and consumption/labour supply decisions in the second. In the first period, consumers in country i are each endowed with y units of the consumption good out of which they each consume c_1^i and save s^i. The consumer then invests some savings, k_h^i, in the home country and the rest, k_f^i, in the foreign country. In the second period, the individual consumes c_2^i units of the consumption good and $\bar{n}-n^i$ units of leisure out of a total income of $(1-\theta_h)Rk_h^i+(1-\theta_f)Rk_f^i+(1-\tau_i)wn^i$, where $\bar{n}$ is the endowment of labour, θ_h and θ_f are the tax rates on capital in the home and foreign countries, and τ_i is the tax rate on labour in country i. Assume that savings are completely and costlessly mobile between countries and that labour is immobile.

A consumer in country i chooses $\{c_1^i, s^i, k_h^i, k_f^i; c_2^i, n^i\}$ to solve the following problem:

$$\max\,[U(c_1^i)+\beta U(c_2^i, \bar{n}-n^i)] \tag{1.1}$$

subject to

$$c_1^i \leqq y - s^i$$
$$k_h^i + k_f^i \leqq s^i$$
$$c_2^i \leqq (1-\theta_h)Rk_h^i+(1-\theta_f)Rk_f^i+(1-\tau_i)wn^i$$

where $U(c_1^i)$ and $U(c_2^i, \bar{n}-n^i)$ are both strictly monotone, concave, and smooth and satisfy the usual Inada conditions.

The government of country i sets proportional tax rates on capital income, θ_i, and labour income, τ_i, in order to finance second-period per capita government spending, g, which is exogenously given. Let $\pi_i=(\theta_i, \tau_i)$ denote the tax policy of country i, and let $\pi=(\pi_h, \pi_f)$ denote the vector of such policies. Each government has monopoly rights to tax all capital and labour income earned within its borders; thus, each government can earn tax revenue from the investment of foreigners. The budget constraint of government i is

$$g \leqq \theta_i R(k_i^h + k_i^f) + \tau_i wn^i. \tag{1.2}$$

Each government i faces an optimal taxation problem: choose tax rates π_i to maximize the welfare of a representative consumer of its country, subject to the budget constraint (1.2).

Events in the model are sequential. In the first period, first consumers decide how much to consume and save, then governments set tax rates, and finally consumers decide in which country to invest. In the second period, consumers decide how much to consume and work and then governments collect tax revenues. Notice that this timing convention is a simple way to introduce the possibility of *capital flight*: under it, savings will flee the country that taxes capital income too highly.

The consumer's problem is conveniently expressed as a two-stage problem. Since the consumer's budget constraints will bind with equality, they can be substituted out and the home consumer's problem written as

$$\max_{\{s^h\}} [U(y-s^h)+\beta V^h(s^h, \pi)] \tag{1.3}$$

where

$$V^h(s^h, \pi) = \max_{\{k_h^h, n^h\}} U((1-\theta_h)Rk_h^h+(1-\theta_f)R(s-k_h^h)+(1-\tau_h)wn^h, \bar{n}-n^h).$$

This problem defines the home consumer's optimal policies for savings, home investment, and labour supply, which are denoted by $S^h(\pi)$, $K_h^h(s^h, \pi)$, and $N^h(s^h, \pi)$. Together with the budget constraints, they can be used to obtain the optimal policies for consumption $C_1^h(\pi)$, $C_2^h(s^h, \pi)$ and foreign investment $K_f^h(s^h, \pi)$. Notice that this notation allows these policies to depend on all four tax parameters, $\pi = (\theta_h, \tau_h; \theta_f, \tau_f)$. Since labour is immobile, however, these functions do not vary with the foreign tax on labour. Also, since savings are mobile, consumers will invest all their savings in the country with the higher after-tax rate of return and thus the lower tax rate on capital income. Assume that, if the after-tax returns in the countries are equal, consumers invest all their savings in their own country. The problem and the optimal policies for a representative consumer in the foreign country are symmetric.

Consider next the problem of the home government. The objective function of this government is $W^h(s^h, \pi)$, where

$$W^h(s^h, \pi) = U(y-s^h)+\beta U(C_2^h(s^h, \pi), \bar{n}-N^h(s^h, \pi)). \tag{1.4}$$

The budget constraint of the home government is

$$g \leqq \theta_h R(K_h^h(s^h, \pi)+K_h^f(s^f, \pi))+\tau_h w N^h(s^h, \pi) \tag{1.5}$$

where $K_h^f(s^f, \pi)$ denotes the foreign consumers' investment in the home country.

Finally, two assumptions will greatly simplify the computation of equilibrium and the comparison of welfare levels in the two regimes. First, assume that $g > Ry$. This condition will guarantee that, in any equilibrium, labour must always be taxed. Second, assume that financing government spending solely through a labour tax is always feasible. In Kehoe (1986), the case without either of these assumptions is analyzed. The same results hold in that case; however, the computation of equilibrium is substantially more complicated and requires numerical simulations.

2. A NONCOOPERATIVE REGIME

Consider first the regime in which governments set tax rates noncooperatively. At the time the tax rates are set, the savings decisions of the consumers have already been made. Hence, governments set tax policies as functions of the level of savings in both countries,

s^h and s^f. Denote these policies $\theta_h(s^h, s^f)$ and $\tau_h(s^h, s^f)$ for the home country and $\theta_f(s^h, s^f)$ and $\tau_f(s^h, s^f)$ for the foreign country. When making its decision, the home government takes as given these savings levels, the policy functions of all the consumers, and the policy functions of the foreign government. Thus, the home government chooses tax policy $\pi_h = (\theta_h, \tau_h)$ as a function of the savings levels, to maximize (1.4) subject to (1.5). The problem of the foreign country is symmetric.

In this noncooperative regime, the *Nash tax policies* are a vector of policy functions $(\pi_h^*(s^h, s^f), \pi_f^*(s^h, s^f))$ that satisfy each government's budget constraint and

$$W^h(s^h, \pi_h^*(s^h, s^f), \pi_f^*(s^h, s^f)) \geqq W^h(s^h, \pi_h, \pi_f^*(s^h, s^f)) \tag{2.1}$$

for all π_h that satisfy the home government's budget constraint (and likewise for the foreign government). An equilibrium in this regime is called a *perfect Nash equilibrium* and is defined as a set of allocations $(c_1^i, c_2^i, n^i, s^i, k_h^i, k_f^i)$ and tax rates π_i for $i = h, f$ such that, with π_h and π_f given, the allocations solve the consumer's problem for $i = h, f$ and the tax rates satisfy $\pi_i = \pi_i^*(s^h, s^f)$ for $i = h, f$.

This equilibrium is characterized in two steps: first, the Nash tax policies for any level of aggregate savings; then, using these, the allocations.

Proposition 1 (Characterization of the Nash Tax Policies). *The Nash tax rates on capital are identically equal to zero. For each s^i, the tax rate on labour τ_i is given in the solution to this problem: Choose c_2, n^i and τ_i to solve*

$$\max U(Rs^i + (1-\tau^i)wn^i, \bar{n} - n^i) \tag{2.2}$$

subject to

$$U_1^i / U_2^i = (1-\tau_i)w \tag{2.3}$$

$$g \leqq \tau_i wn^i. \tag{2.4}$$

Proof. First, in any Nash equilibrium, the tax rates on capital must be identically equal to zero. Clearly, these tax rates cannot be positive. If both were positive, then at least one of the governments could cut its rates, attract all the world's savings, and make itself strictly better off. If only one of the governments set a positive rate, then that government could make itself strictly better off by lowering its rate. Similarly, these tax rates cannot be negative. If either government were subsidizing capital, it could lose less revenue by cutting its subsidy. Since the marginal product of labour is constant, cutting the subsidy would make that country strictly better off. Finally, if one government sets its tax rate on capital identically equal to zero, the other government is indifferent among all possible policies for taxing capital, including the policy in which the tax rate is identically zero. Such a policy is always feasible since, recall, each country can finance its spending solely through a labour tax.

Next, for each savings level s^i, the Nash labour tax τ_i is given in the solution to (2.2). Since the foreign labour tax does not enter the home consumer's policy functions, the government's problem immediately reduces to the optimal tax problem in the proposition. ||

Combining the definition of a perfect Nash equilibrium with Proposition 1 and the consumer's problem (1.3) implies immediately that a solution to the following optimal taxation problem is a perfect Nash equilibrium:

$$\max_{\{s^i, n^i, \tau_i\}} U(y - s^i) + \beta U(Rs^i + (1-\tau_i)wn^i, \bar{n} - n^i) \tag{2.5}$$

subject to (2.3) and (2.4).

3. A COOPERATIVE REGIME

Consider next the regime in which countries set tax rates cooperatively. Imagine that the two governments set tax rates to maximize the sum of their objective functions subject to their budget constraints. To keep the analysis simple, concentrate on symmetric equilibria. (For an analysis of the type of complications that arise with asymmetric cooperative equilibria, see Chari and Kehoe (1986).) Of course, when the tax rates are equal, home savings will equal foreign savings, all the home savings will be invested in the home country, and all the foreign savings will be invested in the foreign country. Thus, the problem then resembles that of two closed economies. The superscripts and subscripts can be dropped, and the cooperative problem can be written this way: Taking as given the current state (s, s) and the policy functions of consumers, choose tax schedules $\theta(s, s)$ and $\tau(s, s)$ to solve

$$\max W(s, \pi) \tag{3.1}$$

subject to

$$g \leqq \theta R s + \tau w N(s, \pi).$$

The policy functions $\hat{\pi}(s, s) = (\hat{\theta}(s, s), \hat{\tau}(s, s))$ that solve (3.1) are the *cooperative tax policies.* An equilibrium in this regime is a *perfect cooperative equilibrium* and is defined as a set of allocations and tax rates π_i for both countries that, with π_h and π_f given, the allocations solve the consumer's problem for $i = h, f$ and the tax rates satisfy $\pi_i = \hat{\pi}_i(s^h, s^f)$ for $i = h, f$. We characterize this equilibrium by first solving for the cooperative tax policies. Then we use these to show that the cooperative equilibrium solves an optimal tax problem in which the tax rates on capital are constrained to equal one and the savings levels are constrained to equal zero.

Proposition 2 (Characterization of the Cooperative Tax Policies). *The cooperative tax rates on capital are identically equal to one. For each s, the cooperative tax rate on labour is given in the solution to this problem: Choose n and τ to solve*

$$\max U((1-\tau)wn, \bar{n} - n) \tag{3.2}$$

subject to

$$U_2/U_1 = (1-\tau)w \tag{3.3}$$

$$g \leqq Rs + \tau wn. \tag{3.4}$$

Proof. Since savings are already given, they are completely inelastic with respect to the tax on capital. At the time tax rates are set, however, the labour supply decision has yet to be made, so the labour tax distorts the labour supply. To minimize distortions, governments raise as much revenue as they can from the taxation of savings. The assumption that $g > Ry$ implies that even if all the endowment is saved and taxed away, revenues from this tax are less than government spending. Thus, the tax on capital is identically equal to one. Finally, since labour is immobile, home consumers' policies do not depend on the foreign labour tax. Thus, the problem reduces to an optimal tax problem of a closed economy with the capital tax constrained to equal one. ||

Combining the definition of a perfect cooperative equilibrium with Proposition 2 implies immediately that the solution to this optimal taxation problem is a perfect cooperative equilibrium:

$$\max_{\{n,\tau\}} U(y) + \beta U((1-\tau)wn, \bar{n} - n) \tag{3.5}$$

subject to (3.3) and (3.4).

4. WELFARE COMPARISONS

In Sections 2 and 3, we have seen that the solutions to certain optimal taxation problems are noncooperative and cooperative equilibria. It is easy to show that the cooperative equilibrium is unique and thus problem (3.5) completely characterizes the cooperative equilibrium. Without further restrictions, such as preferences that give rise to linear decision rules, there may be multiple Nash equilibria. Then problem (2.5) characterizes the Nash equilibrium with the highest level of welfare. Since the main purpose of this paper is to provide a counterexample, it is not necessary to characterize all the Nash equilibria; it is only necessary to show that there is at least one Nash equilibrium strictly better than the cooperative equilibrium.

The optimal taxation problems of (2.5) and (3.5) can be used to rank welfare levels of the noncooperative and cooperative equilibria. Notice that the cooperative equilibrium tax problem (3.5) is simply the Nash equilibrium tax problem (2.5) together with the constraint that savings must be zero. Thus, the welfare level in the Nash tax problem is greater than or equal to that in the cooperative problem. It is strictly greater as long as the allocations in the two problems are different, that is, as long as savings are not zero in the Nash equilibrium. A necessary and sufficient condition for the Nash allocation to be strictly preferred is that, at the cooperative allocation, $U'(\hat{c}_1)/U_1(\hat{c}_2, \bar{n}-\hat{n}) < R\beta$ holds, where from the cooperative maximization problem, $\hat{c}_1 = y$ and $\hat{c}_2 = w\hat{n} - g$.

5. DISCUSSION OF ASSUMPTIONS

The model presented in this paper stands as a simple counterexample to the belief that policy cooperation is always beneficial. As such, the model has been constructed to be as simple and transparent as possible. In this section, we examine some of the model's simplifying assumptions and discuss how they could be generalized.

An assumption that has proved particularly useful is that the production function is linear. It is easy to see that a nearly identical analysis would yield the same results as long as the production function is separable in capital and labour. If instead we assume that this function is nonseparable, several parts of the analysis change. In the cooperative regime, the tax rate on capital is still one, but the level of welfare changes. Suppose that the marginal product of labour declines as the capital stock declines. If capital is essential for production, so that this marginal product declines to zero as the capital stock does, no equilibrium will exist. To avoid this, we could assume that some initial capital stock—say $\bar{k}$—is untaxable. Then an equilibrium in the cooperative regime would have $k = \bar{k}$. Welfare in this regime would decrease as $\bar{k}$ is decreased. The analysis in the noncooperative regime also changes. Since capital increases the marginal product of labour, each government has an incentive to subsidize capital and the Nash tax rates on capital would be negative. In equilibrium, there would be an overabundance of capital. Thus, with a nonseparable production function, the levels of welfare in both regimes change. These levels depend on the shapes of the utility function, the production function, and the initial endowments. By choosing $\bar{k}$ appropriately, we could construct examples in which cooperation is undesirable. We could, however, choose these functions so that cooperation is desirable and thus produce a counterexample to this counterexample.

Another assumption of the model is that all capital is mobile. Instead, there could be two types of capital: some stuck in its country and some mobile. Then, in the cooperative regime, governments would tax both types of capital at the same rate. For a high level of government spending, this rate would be one. In the noncooperative regime, the government would tax the immobile capital at rate one and the mobile capital at rate zero. Constructing a counterexample in this case is easy; however, it would just add notation.

Finally, the model has two countries and two periods. It is easy to check, either directly or using the general approach of Chari and Kehoe (1986), that as the number of countries is increased, both the noncooperative and cooperative allocations are unchanged. For an analysis of similar environments with an infinite number of time periods, see Kehoe (1987) and Chari, Kehoe, and Prescott (1988).

6. CONCLUSION

The main result in this paper is driven by a time inconsistency problem that arises even with benevolent governments. One interpretation of this type of problem is the following. Given a technology for commitment and a closed economy, the relevant tax problem of the government is the static Ramsey problem. Without such a technology, however, the relevant tax problem is this static problem together with dynamic incentive compatibility constraints. For the model, these constraints require that the tax on capital be equal to one. In a two-country world, the cooperative regime has these same constraints. In a noncooperative regime, in contrast, the competition among governments produces a different set of dynamic incentive constraints—namely, that the tax on capital always be zero—and the resulting level of welfare may be higher. It should be clear that what drives the result is not a conflict between the governments and their own citizens, but rather the fact that the different institutional arrangements produce different dynamic incentive constraints. Loosely, the intuition for the result is that, in a dynamic economy where government commitment is not feasible, competition among governments may act like partial commitment and hence may be preferred to cooperation.

An implication of this paper is the following. Consider a situation in which governments have no access to a commitment technology, are currently in a noncooperative regime, and are contemplating setting up a new institution through which governments cooperate. This paper shows that the value of such an institution may well be negative. Of course, if it is feasible for governments to set up an institution through which they can simultaneously guarantee both commitment and cooperation, then they should do so, and everyone would be better off.

In the paper, we have compared welfare under alternative arrangements. In one arrangement, policy-making is decentralized among competing policy makers; in the other, it is centralized in a single decision-making body. Extending this type of analysis to other settings would be interesting. For example, consider a country composed of many states. One could ask whether it is better to decentralize policy-making by letting each state choose its own tax and spending policies or to centralize this policy-making in one decision-making body. Is it better to establish separate entities governing monetary and fiscal policies or to have one entity that decides both?

Finally, although the model in this paper is constructed mainly to produce a counterexample, it is interesting in its own right. The model suggests that the possibility of capital flight in a strategic setting makes the analysis of taxation in an open economy drastically different from that in a closed economy. Another extension would be to analyze the alternative tax equilibria in a model with a more detailed tax structure, perhaps in a calibrated, multi-country, general equilibrium model.

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