**Tipo de documento:** Working Paper N°6
**ISSN**: 0327-9588



# Intergovernmental transfers and public sector expenditures : a game theoretic approach

**Autoría:** Sanguinetti, Pablo

**Fecha de publicación**: 1994

ISSN 0327-9588

UNIVERSIDAD TORCUATO DI TELLA

WORKING PAPER N° 6

# INTERGOVERNMENTAL TRANSFERS AND PUBLIC SECTOR EXPENDITURES A GAME-THEORETIC APPROACH

By Pablo Sanguinetti

## 1. Introduction

The fact that the overall fiscal performance of a country is actually determined by the interaction of many fiscal authorities within the public sector has been, of course, recognized since long time ago. Nevertheless, until recently the issue has mostly been neglected by the formal literature both in the areas of public finance and macroeconomics.

One reason for this neglect may be found in the fact that the presence of stable and enforceable rules, regulating the interaction among various government jurisdictions, assures that fiscal responsibilities are well established among those public sector agencies. Thus, overall fiscal decisions can be thought "as if" they are taken by a "representative" agent called "the government". In other words, no important insight is lost by assuming the existence of an "integrated" public sector which sets economy-wide public expenditures and taxes.

Though this seems to be the case for a number of developed nations, it is certainly not for some developing countries. In particular, Argentina in the last two decades or so seems to be a clear example of the kind of problems that may result as a consequence of a markedly uncoordinated behavior among different government jurisdictions.

The purpose of this paper is to present a simple theoretical framework that captures this coordination problem and its implications in terms of public finances. The framework adopts a game-theoretic point of view to investigate the consequences of different modes of interaction between Federal and Provincial jurisdictions for the determination of the overall public sector expenditure and taxes. In this sense, the exercise offers another

perspective through which the old question regarding the forces behind the observed growth of the public sector can be looked at[1].

More specifically, the types of questions we deal with can be stated in the following way: Does the institutional framework which regulates the fiscal relationship among different government jurisdictions matter in terms of the overall level of public sector expenditure and taxes? Do intergovernmental grants and decentralization of expenditure decisions imply inefficiencies in the provision of public goods, at both the central and provincial levels?

These questions are not new. Many authors have directly or indirectly tried to answer them, both at a theoretical and empirical level. On one hand, there is the traditional literature concerned with normative issues such as the type of grants policy that Central governments should follow in order to induce local governments to spend in sectors with inter-jurisdictional spillovers[2]. The problem with these studies is that they mostly use partial equilibrium constructions, where intergovernmental transfers are assumed to be exogenous from the point of view of the local governments. Thus, this feature of the model does not allow local governments to behave in a strategic way, behavior that seems to be observed in some real world experiences as the next section documents. On the other hand, there is a more recent literature that takes a political-economy approach to intergovernmental

---

[1] There are many approaches to the problem. A public choice point of view can be found for example in Brunner and Buchanan (1977) and (1978) and in Mueller (1989). On the other hand, studies that relates the size of the government to distribution activities of the latter are, for example, Peltzman (1980), Meltzer and Richard (1981) and Lindert (1989).

[2] See for example Hirsch (1970) , Oates (1972), McGuirre (1973), Waldauer (1973) , Gramlich (1977), and Slack (1980).

grants[3]. These papers emphasize the effects of various congressional decision schemes on the level of transfers to different regionally-located constituencies. Unlike the above normative approach, here game-theoretic frameworks have been extensively applied. Nevertheless, the lack of an explicitly modeled federal government with tax and expenditure powers impedes an assessment of the consequences for aggregate public sector expenditures of the strategic interaction between regional constituencies and the central authorities . Besides, this type of framework seems not to be entirely suitable for the case of countries where the legislature is not an effective determinant of fiscal policy.

Yet another non-normative approach to intergovernmental transfers is found in the public choice literature[4]. Here intergovernmental grants are seen as originating in the pressure from sub-national levels of government to avoid the fiscal competition (for better local public services at lower tax costs) that would result from interregional mobility of individuals[5]. Thus, in this competitive scenario local authorities cannot take advantage of their "power to tax" and fulfill their postulated objective of maximizing tax revenues. Though this characterization of a revenue-maximizing Leviathan may be insightful in some special circumstances, its general validity is doubtful as the empirical examination of the model has shown[6]. Moreover, its normative implications are rather extreme: widely used tax-sharing schemes should be completely avoided.

---

[3] See , for example, Weingast et. al.(1981) and Iman (1988),(1990).

[4] See, for example, Brennan and Buchanan (1980) chapter 9.

[5] See Tiebout (1956) for the seminal contribution to the mobility approach. More recent treatments can be found in Epple, D. and Zelenitz (1981) and Henderson (1985).

[6] See, for example, Oates (1985).

In what follows we move away from the above mentioned scenarios and develop instead a theoretical exercise where strategic behavior is granted, both among the local jurisdictions and between the latter and the central government . Thus, we provide a general equilibrium characterization of the determination of government expenditures, both at local and federal level, in which the tax consequences of this expenditures decisions are taken into consideration. Moreover, unlike other game-theoretic approaches to the problem, the introduction of a Federal level of government allows us to consider an intermediate regime, besides cooperation and the Nash-type non-cooperative case, in which the Federal government is able to commit some of its policy variables. As we discuss below the introduction of this regime has important consequences in terms of welfare and policy implications.

The rest of the paper is organized as follows. In the next seccion we develop the basic model. Section 3 considers some policy implications and finally, section 4, presents some general conclusion and future lines of research.

## 2. Public Sector Expenditures and Intergovernmental Transfers: A simple model.

In this section a simple framework is developed with the purpose of highlighting some of the key forces behind the behavior of the public sector as was illustrated in the last section. The model is built in the public finance tradition so that monetary considerations will not be incorporated[7].

---

[7] A monetary approach to the issue of decentralized policy-making in the presence of competing government jurisdictions could be found in Aizenman (1989) . Also in Heymann and et.al. (1987) a game-theoretic framework is employed to investigate the relation between transfers ( here interpreted in a broader sense to include

The closest antecedent of what we are going to develop below is a model presented in Barrow (1986) in which intergovernmental transfers are also studied using a game-theoretic framework. Nevertheless, in that model the game is played only by n local jurisdictions. That is, no federal level of government is considered. As a consequence, even if the transfer to an individual region is endogenously determined, the aggregate amount of transfers to all regions is fixed.

Let's assume a one period closed-economy setting where there is a federal government (FG) and n local (provincial) governments (LG) each of which rules in a corresponding region of a federative country[8]. Each region is inhabited by a representative individual which implies, in a rather obvious application of the median voter theorem, that preferences of the local government coincide with that of the representative agent. Preferences are defined over leisure, an aggregate private consumption good, a federal public good and a local public good[9]. Formally,

$$U^i = U^i(L_i, c_i, g_i, g_f) \qquad i=1,..,n \qquad (1)$$

---

those channelized to the private sector), fiscal deficit and inflation .

[8] For the purpose of the present theoretical exercise, a federative country need not necessary imply the existence of true federal political institutions. Rather, a fiscal interpretation is preferred. In this sense Oates (1972) had defined a federal government as .." A public sector with both centralized and decentralized levels of decision making in which choices made at each level concerning the provision of public services are determined largely by the demands for these services of the residents of the respective jurisdiction."

[9] All the results derived below go through if instead of assuming that local expenditure falls in a local public good, it is postulated that local government expenditure consist of a transfer payment to increase private consumption of the regionally-located representative individual.

where: $U^i$= utility function corresponding to the individual who lives in region i.

$L_i$ = leisure consumed by individual i.

$c_i$= private consumption of individual i.

$g_i$= local public good expenditure in region i.

$g_f$= federal public good expenditure.

As usual $U^i$ is a concave double differentiable utility function[10]. On the other hand, preferences of the federal government are assumed to be a weighted average of the preferences of all individuals (LGs)[11],

$$U^f = \sum_{i=1}^{n} w^i U^i \quad ; \sum_{i=1}^{n} w_i = 1 \qquad (2)$$

Households in all regions are endowed with one unit of leisure which can be consumed or supplied to the local labor market[12]. Income from labor is taxed by a uniform-proportional tax t levied by the Central government. A very simple linear production technology is assumed, identical in all regions, such that labor is transformed into goods in a one-to-one fashion (real wages are equal to one). Given the above assumptions and using the private consumption good as numeraire, the budget constraint of the

---

[10] As it is seen, the local public good has no interregional spillover effects. This differentiate the present analysis from the "fiscal federalism" literature where those effects played a major role in complicating the efficient provision of public services by individual localities. See, for example, Gordon (1983).

[11] Thus, the postulated federal government preference schedule actually represents a social welfare function.

[12] Therefore, labor is not mobile across regions. this assumption distinguishes the present research from Tiebout-type models. The justification is based on the fact that the mobility model loses significance as more geographically extensive regions are considered. See Oates (1977) pag. 9.

individual who lives in region i is given by $c_i = (1 - t)\ l_i$ ; where $l_i = 1 - L_i$ is the labor supply.

In general Provinces finance their expenditures mainly with two resources : local taxes and transfers from the central government . Nevertheless, in other to isolate the key role played by these transfers in the determination of both local and aggregate level of expenditures, local taxes are going to be dropped from the local governments' budget constraints[13]. Therefore , the theoretical exercise that follows should be interpreted as explaining that part of local expenditures beyond the level that is financed by local taxes . Hence, the budget constraint of the local government of region i is given by $g_i = T_i$ [14].

On the other hand, the FG finances its total expenditure, given by transfer payments plus expenditure in the federal public good, employing the revenues from the uniform labor income tax[15],

---

[13] Of course, in a more general setting it should be recognized the interaction among local taxes, local expenditures and transfers. Particularly, grants from the FG can be used not only for raising local outlays, but also to reduce local taxes. Nevertheless, the existence of this relationship between taxes and grants does not alter the qualitative results derived below where local taxes are not considered . The only consequence will be that part of the "expenditure" effect of the transfer is going to be eliminated through lower local taxation. For an empirical account on the tax versus expenditure effects of a FG grant program in USA see Adams (1986).

[14] Notice the lump-sum character that adopts the transfers to local government . This is how the literature has interpreted the unconditional grants channeled through tax-sharing schemes . See Oates (1972) . Also, for the Argentinean case, see Kippes (1984).

[15] Deficits (debt) are not allowed to be an alternative way to finance government outlays neither at the local, nor at the central level of governments. This fact, of course, lessens the extent to which the framework can be used to explain real world cases, like the one of Argentina, where deficits are observed. Nevertheless, it should be emphasized that the main purpose of the present theoretical exercise is to highlight some of the forces behind the

$$g_f + \sum_{i=1}^{n} T_i = t \sum_{i=1}^{n} l_i \qquad (3)$$

A key assumption that will drive the results refers to the alternative scenarios, regarding the way the two types of governments interact with each other, under which the model is going to be solved. In one case, called the cooperative regime, all policy variables (both at the FG and LG level) are set in a fully coordinated way, so that all the relevant externalities are taken into account. Hence, the solution corresponds to a benchmark Pareto Optimum equilibrium.

A second case , called the noncooperative regime, corresponds to a setting where each LG and the FG move simultaneously, choosing the optimal value for the policy variable they control, taking as given the policy choices of the other public agencies. Thus, this second regime leads to a Nash equilibrium for the game played among the LGs and between the latter and the FG.

Finally, a third regime is also explored, which is a sort of intermediate case between the two mentioned above. Here it is assumed that the FG has the ability to precommit its policy. Formally, this is reflected in the fact that the central authority moves first choosing the optimal values for its policy instruments. Then, in a second stage, all local governments simultaneously choose their policy variables given the strategy already chosen by the FG. Notice that in this intermediate regime the LGs are still playing a Nash game among themselves, but they are Stackelberg followers in the game they play against the FG. The main purpose of the theoretical exercise that follows is to compare the three types of solutions.

---

determination of government expenditures, not of deficits.

## 2.1 Cooperative regime

Let's first solve the problem of the consumer. Regardless of their location, individuals decide private consumption and labor supply such that their welfare is maximized. The solution to the problem gives rise to an indirect utility function of the following form,

$$V^i(t;g_l;g_f)=\max_{c_i,\,l_i} U^i(L_i,c_i,g_l,g_f)$$

s.t.

$$c_i=(1-t)\,l_i$$

$$l_i=1-L_i$$

Applying the envelope theorem it is easy to show,

$$\frac{\partial V^i}{\partial t}=V^i_t\leq 0 \quad ; \quad \frac{\partial V^i}{\partial g_l}=V^i_{g_l}\geq 0 \quad ; \quad \frac{\partial V^i}{\partial g^f}=V^i_{g_f}\geq 0$$

The cooperative solution can be found by solving a version of what in public finance is known as the optimal tax problem, which in the present framework is just the problem of the FG[16],

$$\max_{t,\,g_t,\,\{T_i\}} \sum_{i=1}^{n} w_i V^i(t;g_l;g_f)$$

s.t

[16] The noun "version" is due to the fact that in this model, contrary to the optimal tax literature, government expenditure is also endogenous. See Sandmo (1973) for a classical reference on the optimal tax problem.

$$g_i = T_i$$

$$g_f + \sum_{i=1}^{n} T_i = t \sum_{i=1}^{n} l_i(t)$$

$$T_i \geq 0 \ , \ t \geq 0 \ , \ g_i \geq 0 \ , \ g_f \geq 0$$

Replacing the constraints into the objective function and solving the resulting concave problem we obtain the following first order conditions (for an interior optimum),

$$-\sum_{i=1}^{n} w_i V_t^i = \sum_{i=1}^{n} w_i V_{g_f}^i \left( \sum_{i=1}^{n} l_i(t) + t \sum_{i=1}^{n} l_i'(t) \right) \quad (4)$$

$$w_i (V_{g_i}^i - V_{g_f}^i) = \sum_{j \neq i}^{n} w_j V_{g_f}^j \quad i = 1, \ldots, n \quad (5)$$

The above marginal conditions have a straightforward economic interpretation. In (4) it is seen that a cooperative determination of the labor income tax requires that, at the margin, the social cost of the tax, represented by the sum across individuals of the derivative of the indirect utility function with respect to the tax, be equal to the social benefits, in turn, measured by the marginal utility of consumption of the federal public good, also added across households. The point is, of course, that the FG faces a trade-off with respect to the chosen tax level . If, say, the tax is increased, on one hand the consumer is negatively affected as private consumption decreases, but on the other, the increased government revenues allow for a greater level of federal public good consumption which naturally increases welfare[17].

---

[17] Of course, it is assumed that the FG is located in the "right" side of the income-tax Laffer curve. Thus the term $(\Sigma_i l_i(t) + t\ \Sigma_i l_i'(t))$ is positive.

In turn, (5) implies that the Pareto optimal transfer to region i should be set in such a way that, at the margin, the net benefit of the transfer to that region (represented by the left hand side of (5)) has to be equal to its social costs, measured by the externalities that the , say, increase in the transfer to i impinges on all other localities . From the equation it is easy to see that one channel through which these externalities are materialized is reduced federal public good consumption (right hand side of (5))[18]. Thus, as would be expected, the cooperative solution to the problem takes proper account of the spillovers that the behavior of one locality imposes on all the others.

Expressions (4) and (5) depict a system of n+1 equations in n+1 unknowns : t , $T_1,..,T_n$. Hence, in principle, it can be solved for the endogenous variables in terms of the weights and other preference and technology parameters. Nevertheless, this route is not going to be pursued here. Instead , in the next sections parallel expressions to the ones already obtained are derived for the case of the other two regimes.

## 2.2 Non Cooperative regime.

In this setting, it is assumed that both local and central governments move simultaneously choosing the optimal level of their respective policy variables, taking as given the actions of the other jurisdictions. Thus each local government solves,

$$\max_{g_i} \; V^i(t, g_i, g_f)$$

s.t

---

[18] The other two channels that are implicit in (1) and (2) are increased federal taxes and lower local public good consumption. This point will be further discussed later on, when it is derived the noncooperative solution to the model.

$$g_i = T_i$$
$$g_f + \sum_{i=1}^{n} T_i = t \sum_{i=1}^{n} l_i(t)$$

$$g_i = T_i$$
$$g_f + \sum_{i=1}^{n} T_i = t \sum_{i=1}^{n} l_i(t)$$

Replacing the constraints into the objective function and solving the resulting optimization problem, the following first order conditions are obtained,

$$V^i_{g_i}(t,T) - V^i_{g_f}(t,T) = 0 \quad i=1,..,n \quad (6)$$

where $T = (T_1,..,T_n)$.

The economic interpretation of the above expressions is similar to the one given in the case of the cooperative regime. However, a key difference should be noticed: cost and benefits of changing local expenditure do not include terms that capture the external effects that each region impinges on all the others. Thus, the optimal policy in this case is evaluated only in terms of the direct consequences for the own region. Of course, this is a natural result of the noncooperative Nash-type solution to the model and suggests that the equilibrium values of the involved policy variables (i.e transfers) will differ from the ones obtained in the cooperative regime.

Alternatively, equations (6) could be seen as implicitly defining the reaction functions for each local government such that the equilibrium level of the transfer to an individual locality is a function of the transfers to all the other regions and of the federal tax . Formally, each first order condition in (6) defines an implicit function of the following form,

$$F^i(T, t) = 0 \qquad i=1,..,n. \qquad (7)$$

Applying the implicit function theorem to (7) it is easy to verify that[19],

$$\delta T_j/\delta T_i \leq 0 \qquad (8.a)$$

$$\delta t /\delta T_i \geq 0 \qquad (8.b)$$

It now becomes evident, as we have claimed above, that the negative externalities imposed by one region on all the others is not only channeled through lower federal public good consumption, but also through lower transfers (local public good consumption) and higher federal taxes. In this sense, condition (8.a) indicates that the Nash game played by local governments results in a sort of regional competition for transfers where higher transfers to one region means lower transfers to another . Thus , by not internalizing this effect, the actions of local authorities generate inefficiencies in the allocation of federal government grants. In the same way, (8.b) reflects another source of inefficiency, this time due to the fact that the tax-cost of the transfer to region i is not borne by that region alone, but is shared with all other provinces. This is another illustration of the well-known case where concentration of benefits and dispersion of costs give rise to inefficiencies.

It is worthwhile to notice that similar results have been derived by other authors. Thus, the inefficiency materialized through transfer competition has been stressed by Barrow (1986). On the other hand, Weingast and et. al. (1981), Inman (1988),(1990), Heymann and et. al (1987) and Aizenman (1989) emphasize the tax-cost share of the transfers as the main force behind the inef-

---

[19] A sufficient condition for this result to hold is that federal and local public goods are utility complements.

ficiencies. Nevertheless, no one of these papers deals with the externality channeled through federal public good consumption.

Equation (6) alone does not completely characterize the non-cooperative solution to the problem. Simultaneously with the LGs, the central authority chooses the optimal level for its policy variables, taking as given the expenditure/transfer decisions of the sub-national levels of government. Thus, the FG solves,

$$\max_{g_f,\, t} \sum_{i=1}^{n} w_i V^i(t, g_i, g_f)$$

s.t.

$$g_f + \sum_{i=1}^{n} T_i = t \sum_{i=1}^{n} l_i(t)$$

Replacing the constraint into the objective function and solving for t we obtain,

$$\sum_{i=1}^{n} w_i V_t^i = - \sum_{i=1}^{n} w_i V_{g_f}^i \left( \sum_{i=1}^{n} l_i(t) + t \sum_{i=1}^{n} l_i'(t) \right) = 0 \qquad (4')$$

The above condition is formally identical to the one derived in the cooperative regime (equation (4)). Thus, same economic intuition applies. However, this does not mean that the same value for the federal government policy variables will be found in both scenarios. $V_t$ and $V_{gf}$ are also functions of the transfer's level. As the previous discussion suggests, transfer payments will be different across regimes, implying in turn that the value for the FG's policy variables will also differ.

## 2.3 Commitment regime.

As indicated earlier, the possibility exists of an intermediate regime where partial cooperation among the different players is postulated. The key assumption here is that the federal government is able to precommit its policy by setting the level for its fiscal variables in advance of the actions of the local jurisdictions. In doing that , of course, the FG takes into account how its action will affect the policies chosen a posteriori by the LGs. Thus, a partial cooperation environment develops, justifying the above characterization of an intermediate regime.

Formally, the optimal policy problem of the local governments should be solved first. This was already done in the last subsection obtaining the following first order conditions,

$$V^i_{g_i}(.) = V^i_{g_f}(.) \quad (6')$$

As indicated, the above system of equations implicitly defines the following reaction functions,

$$T_i = T_i(T_{-i}, t) \qquad i = 1,..,n. \qquad (9)$$

for which it was found that $\delta T_i / \delta t \geq 0$.
Now, solving the problem of the FG using (9) as an additional constraint, we obtain the following condition,

$$\sum_{i=1}^{n} w_i \{V^i_t + V^i_{g_i} \frac{\partial T_i}{\partial t} + V^i_{g_f} ( \sum_{i=1}^{n} l_i(t) + t \sum_{i=1}^{n} l'_i(t) ) - \sum_{i=1}^{n} \frac{\partial T_i}{\partial t} \} = 0 \qquad (10)$$

The above equation represents the equilibrium condition for the optimal value of the FG's policy variables (i.e tax and expenditure) when the FG acts as a leader player in the policy game. As indicated earlier, in deciding its optimal policy, the FG takes

into account how the local government decisions are going to be affected. This is capture by the derivative $\delta T_i/\delta t$ .

Yet, another way of interpreting this equilibrium is that through the proper choice of its policy variable (t) , the FG picks up the best Nash equilibrium of the game played among the LGs. This is illustrated in figure 1 which depicts the extensive form of the game played between the federal government and the n local jurisdictions. Each of the nodes named $LG^1$, $LG^2$,.. represents a solution to the Nash game played among the provincial governments. Each solution has an associated payoff function $V^i(T^i,t^i)$. Thus, through the proper choice of t (or $g_f$) the FG is able to select the NE with the highest payoff. As a consequence, it is natural to think that, in terms of efficiency properties of the equilibrium, the outcome will be located somewhere in between the ones obtained in the previous two scenarios.

## 2.4 Comparing regimes.

The objective of this section is to derive precise predictions regarding the levels of transfers, local expenditures, federal expenditures, federal taxes and finally, the size of the entire public sector across regimes. Since the level of generality employed in the preceding sections complicates this task substantially, in the analysis that follows it is going to be adopted the usual assumption of symmetry, postulating that all individuals are identical both in terms of preferences and endowments. Moreover, additional restrictions would be required with respect to the precise functional form for the preference function.

Under the mentioned symmetry assumption the first order conditions corresponding to the three regimes can be rewritten in the following way,

Cooperative regime:

$$V_t = - n V_{gf} (l(t) + tl'(t)) \quad (11)$$

$$V_g = n V_{gf} \quad (12)$$

Noncooperative regime:

$$V_t = - n V_{gf} (l(t) + tl'(t)) \quad (13)$$

$$V_g = V_{gf} \quad (14)$$

Commitment regime:

$$V_t + V_g \, \delta T / \delta t + V_{gf} ( nl(t) - n \, \delta T/\delta t) = 0 \quad (15)$$

$$V_g = V_{gf}$$

The differences in the FOC across regimes become now more apparent (obviously for n>1). They imply crucial discrepancies in the equilibrium values for the policy variables. Moreover, assuming that the preference function takes the familiar Cobb-Douglas shape $U(.)= A \, c^{\alpha} \, g^{\beta} \, gf^{\sigma} \, L^{\eta}$ , where $\alpha+\beta+\sigma+\eta=1$ , the following results are found,

a) $T^c < T^s < T^{nc}$ , $g^c < g^s < g^{nc}$

b) $t^c = t^s < t^{nc}$ , $G^c = G^s < G^{nc}$ .

c) $gf^c > gf^{nc} > gf^s$ .

d) $V^c(.) > V^s(.) \geq V^{nc}(.)$

where: c= cooperative regime.
nc= non-cooperative regime.
s= commitment regime.

For calculations see appendix.

With respect to a), it was already suggested that in the non-cooperative regime the negative (positive) externality produced by the increase (decrease) in the transfer to one region is not taken

into account. This leads to greater levels of transfers in this scenario compared to the cooperative one. But, why are the levels of transfers in the noncooperative setting also greater than in the commitment case ?. The idea is that in this latter equilibrium the LGs are still playing a Nash game among themselves so that the above mentioned externalities are still present. Nevertheless, the fact that the FG can precommit its policy forces the LGs to partially internalize the consequences of their actions. For example, if the FG set in advance the level for the federal tax rate[20], the LGs realize that a too high level of transfers imply a too low level of federal expenditures (because taxes cannot change), outcome that naturally affects negatively the welfare of consumers. In other words, a "credible threat" that the FG will not re-optimize after the movement of the LGs, makes provincial authorities more aware of the implicit trade-off among the policy variables as depicted in the budget constraint of the FG. This is so because in the case where the central authorities pre-establish a level for the federal tax, the mentioned trade off is not among three variables (T,t and $g_f$), but only two: T and $g_f$. This tends to make transfers lower in the commitment regime than in the noncooperative one, where the possibility of commitment from the part of the FG does not exist, and bigger than in the cooperative regime where all externalities are accounted for.

Of course, the same behavior as the one derived for the transfers is found for local expenditure, given the fact that local taxes are not considered. However, as indicated earlier, even in the case where local taxes are contemplated, the same pattern will be found for the behavior of local expenditure across regimes. Assuming that

---

[20]Given the balanced budget constraint assumption, this is equivalent to setting a level for aggregate public sector expenditures.

local taxes have no interregional spillover effects[21], the only difference is that the absolute value of local expenditure will be lower in all regimes compared to the present case where local taxes are not permitted. This is because part of the "expenditure" effect of the transfer will be eliminated through lower local taxation.

What is the intuitive basis for b) ? Why is it that the level of the labor income tax is higher in the noncooperative equilibrium than in both the cooperative and the commitment regimes ? The explanation is that, faced with the greater level of transfers (when going from cooperative to a noncooperative scenario), and without any restriction in the use of its policy variables (i.e no commitment), the FG will find it optimal to partially meet the increased level of transfers by raising in the federal tax rate. Why is it that the tax rate will be equal in the cooperative and commitment regimes?. The answer is simply that, in the latter case, the FG is already playing in a cooperative way, as it takes into account the reaction of the LGs in deciding its optimal policy. Thus it is natural that the level chosen for the tax will correspond to the one found in the cooperative case. Of course, given the balanced budget constraint assumption, the same pattern of behavior derived for the federal tax will be found in the case of overall public sector expenditures.

In the case of c), it is straightforward to see why federal government outlays are greater in the cooperative regime compared to the noncooperative case. As indicated earlier, faced with a greater level of transfers, the FG in the noncooperative scenario has two margins of adjustment: it can raise taxes (result mentioned in b) ) and reduce the level of expenditure in the federal public good. This way of adjustment will generate the necessary additional

---

[21] In other words, "tax competition" considerations are ruled out. On tax competition see, for example, Wilson (1985) and (1986), Oates and Schwab (1988), Wildasin (1988) and Miltz and Tulken (1986).

resources to finance the higher level of transfers with a minimum cost for the consumers. But, why is federal expenditure lower in the commitment case compared to the noncooperative one?. The key point is that in the former case the FG pre-establishes a level for its tax rate (and so, for its tax revenues). As a consequence, the excess of local expenditure (compared to the cooperative scenario) that the Nash game among the LGs gives rise to, has to be met only by reducing expenditure in the federal public good. This should be contrasted with the noncooperative result where the excess of local expenditure (again, compared to the cooperative case) is met not only by reducing federal expenditure, but also by increasing taxes.

Finally, d) states the expected result in terms of the welfare ordering of the different regimes. The first inequality is, of course, due to the fact that in the cooperative case all externalities are accounted for. The second inequality is based in the simple observation that the FG in the commitment regime has always the possibility of choosing the level for its policy variables that correspond to the noncooperative equilibrium. Thus, welfare in the former regime will always be at least at the noncooperative level. Of course, the fact that the FG moves first allows him to improve upon that solution by the proper choice of its policy variables.

## 3. Some Policy implications.

What are the policy implications that can be derived from the above theoretical analysis ?. It is clear that the ideal is to somehow reach the cooperative equilibrium. But, How can this equilibrium be implemented? What are the fiscal institutions, if they exist at all, that assure that all players in the policy game will be coordinated in that "good" solution?.

At first glance it seems that the implementation of the cooperative solution requires either a pretty centralized setting or a big deal of information. Thus, one scenario in which the mentioned equilibrium can be achieved is a completely centralized scheme where local expenditure (transfers) are not actually set by decentralized levels of government, but are determined directly by the central authorities. In doing that, the FG maximizes a welfare function which is imposed by the latter and is identical to all individuals regardless where they live. Recall that this was precisely the way the model was solved . But, of course, this solution will be truly optimal only in the special case where preferences of the regionally-located households are indeed identical and equal to the one imposed by the FG. In the more realistic case where differences in preferences are recognized, a FG-determined uniform transfer will no longer be the best policy. Actually, one of the major justification for decentralization of expenditure decisions is precisely that differences in preferences across regions exist. Thus, to take advantage of this fact, subnational level of governments ( which are more "close to the people") should be able to choose their own level of expenditure[22]. In other words, decentralization of fiscal decisions is a natural consequence of recognizing diversity in tastes together with the lack of knowledge about this diversity from the part of more centralized units of governments.

But then, if a more realistic scenario is assumed where both diversity of preferences and decentralization of expenditure decisions are allowed, it is found that a cooperative solution to the policy game would require more information than what is required in the case where no externalities are involved. This is because each player (LGs and FG) should have information not only about its own preferences (which is the usual assumption), but also about all other players preferences. In this way the external

---

[22] See Oates (1972).

effects inflicted by the action of one locality on all the others can be calculated and properly taken into account[23].

On the other hand, it can be said that real world political institutions like legislatures avoid the indicated need of information for achieving the cooperative solution. In a representative legislature the natural bargaining process will lead to a situation where the negative external effects that the action of one region impose on all the others will be identified as the representatives of the affected regions stand up against such action[24].

Even though it is true that a centralized budget-bargaining process, like the one carried out in a legislature, would help to eliminate inefficiencies in the determination of intergovernmental transfers, it is not a complete solution to the problem, as the empirical evidence has shown[25]. Even for the case of advanced countries, like USA, where the legislature-determined budget of the public sector is a key determinant of fiscal policy, decentralized decisions schemes at the congress level-- "universalism" in the words of the political scientists[26]-- have resulted in increased transfers to local governments. Think of the problem posed by the

---

[23] Of course, it is implicitly assumed that the cooperative policy so calculated for each locality can somehow be enforced by some external agent. For example the FG. That is, no free rider behavior is permitted. Dropping this assumption will add a new problem, besides the mentioned information requirements, to the implementation of the cooperative equilibrium.

[24] Heymann and Navajas (1989) emphasizes the need for a collective bargaining procedure, like a legislature instance, to avoid "bad" solutions in the policy game that leads to the determination of the fiscal deficits in high inflationary countries. See also Leijonhufvud and Heymann (1990).

[25] See, for example, Inman (1988),(1990), Weingast and et. al. (1981).

[26] See, for example, Niou and Ordeshook (1984).

achievement of the cooperative solutions for developing countries, like argentina, where the legislature instance is not even available.

All the arguments given above try to suggest that the accomplishment of the cooperative solution becomes perhaps too difficult a target to be reached in real world policy.
Nevertheless, the alternative is not complete noncooperation. As it was indicated earlier, there is an intermediate regime that implies an improvement with respect to the indicated scenario and which seems to be more at hand for the policy-maker. This is, of course, the Commitment case. This regime has straightforward policy implications and is not subject to the problems of excessive information requirements for its application. The only requirement is that the federal government should be able to commit some of its policy variables. This is not an easy task; but it is comparatively easier to achieve than the cooperative case, where besides more information, a commitment attitude is required from all players (i.e all LGs besides the FG). Moreover, it is clear from the analysis of section 3.4 that it is not necessary for the FG to set all policy variables in advance. Just by committing to one of them, there will be an improvement with respect to the noncooperative scenario. Of course, this result is based on the logically previous assumption that the FG can be "committed" to maintain an balanced budget . If instead fiscal deficits are allowed, the additional condition required, for the same results to go through, is that the central authorities are able to credibly pre-establish a level for the federal fiscal deficits.

The previous discussion sounds well suited for describing recent events in some developed countries, like the USA, where legislated levels for the fiscal deficits were established in an effort to precommit some of the key policy variables of the FG. Thus, this fact naturally leads us to identify the situation of those developed countries as being closed to a commitment-type equi-

librium. On the other hand, as the empirical evidence suggested, the experience of some developing countries, like Argentina in the discussed period, seems to be closer to correspond to a non-cooperative solution. The important question that remains unanswered is how can we go from one regime to the other. Although this is not going to be answered here, some thought is given to the issue in the final section of the paper.

## 4. Concluding Remarks.

The question of the transition from a noncooperative to a partially cooperative regime, like the commitment case discussed earlier, is not trivial. Why would a country avoid to take that step if the implied result is that everyone will be better off?. In the specific case of Argentina, it was indicated that a new law, with the purpose of regulating the fiscal interaction between the FG and the provinces, was passed in 1988. Why did it take three years to pass a law that amended some of the drawbacks of the old legislation and, in this sense, represented a clear movement towards a more cooperative equilibrium?. Why was the ill-designed legal framework, that carried important costs for the economy as a whole, maintained for so long?.

Clearly these questions cannot be answered within the framework presented in this paper, and this should be recognized as a limitation of the present analysis. A correct answer to the above questions involves making endogenous the so far exogenous choice of regimes. The key issue that seems to be at the core of the problem is that the Pareto improvement accomplished by a movement towards cooperation is subject to important distributive considerations. How should the gains from cooperation be distributed among the players (LGs)? . Elements of bargaining and uncertainty enter then into the picture. Playing in a noncooperative way may be a

perfectly rational strategy for obtaining an expected size of the "pie" in a future cooperative arrangement[27].

On the other hand, the answer to the question regarding the transition from one regime to another may also have a more applied dimension. The hypothesis that some developed countries are closer to a commitment equilibrium warrants a careful study of the institutions that enable the FG of those countries to precommit some of its key fiscal instruments . From this type of analysis, some lessons can be drawn for determining what characteristics the institutional framework should have for a more cooperative federal-provincial fiscal equilibrium to result.

Despite the fact that the present analysis seems not to answer perhaps the most relevant questions, it should be recognized the simple framework presented earlier serves as a starting point for a thorough study of issues involved in the fiscal interaction among different government jurisdictions. It was shown that noncooperative behavior between FG and LG could lead to an undesirable equilibrium, where too much of local expenditure and too little of federal outlays are obtained. Moreover, this "bad" equilibrium also implied an excessive "size" of the aggregate public sector . The discussion of the data for the case of Argentina seemed to conform with the qualitative predictions of the model and, thus , provided a preliminary empirical support to the framework.

---

[27] See, for example, Alesina and Drazen (1989).

## Appendix

Given the assumed preference function, the FOC of the cooperative regime ( equations (11) and (12)) can be rewritten as (notice that symmetry implies $w_i = 1/n \ \forall \ i$),

$$\alpha / (1-t) = \sigma B / (tB - T) \qquad (A.1)$$

$$\beta / T = \sigma / (tB - T) \qquad (A.2)$$

where $B = \alpha/\eta+\alpha$ .

(A.1) and (A.2) is a system of two equations with two unknowns. Thus, it can be obtained,

$$T^c = \beta\alpha / (\beta+\sigma+\alpha)(\eta+\alpha) \qquad (A.3)$$

$$t^c = (\sigma/\sigma+\alpha) + \beta\alpha/(\sigma+\alpha)(\beta+\sigma+\alpha) \qquad (A.4)$$

In turn, the FOC corresponding to the noncooperative regime can be rewritten as,

$$\alpha / (1-t) = \sigma B (tB - T) \qquad (A.1')$$

$$\beta / T = \sigma / n(tB - T) \qquad (A.5)$$

Solving the system of equations it is obtained,

$$T^{nc} = n\beta\alpha / (\eta+\alpha)(\sigma+\alpha+\beta n) \qquad (A.6)$$

$$t^{nc} = (\sigma/ \sigma+\alpha) + n\beta\alpha/(\sigma+\alpha)(\sigma+\alpha+\beta n) \qquad (A.7)$$

From the FOC of the local government problem (equation (A.5) above) the following expression is derived,

$$T = [\alpha\beta n/ (\sigma+\beta n)(\eta+\alpha)] \, t \qquad (A.8)$$

Now plugging (A.8) in equation (15) of the text (FOC for the commitment regime), we obtain the following expression,

$$-\alpha /(1-t) + \beta/t + \sigma/t = 0 \qquad (A.9)$$

Solving for t,

$$t^s = \beta+\sigma/\beta+\sigma+\alpha \qquad (A.10)$$

Plugging (A.10) back in (A.8) it is obtained,

$$T^s = [\alpha\beta n/ (\sigma+\beta n)(\eta+\alpha)] + (\beta+\sigma)/(\beta+\sigma+\alpha) \qquad (A.11)$$

From (A.3) , (A.6) and (A.11) it is easy to establish that $T^{nc} > T^s > T^c$ . Similarly, from (A.4), (A.7) and (A.10) it is found that $t^{nc} > t^s = t^c$ .

To prove that $gf^c > gf^{nc}$ we just derive the budget constraint of the federal government with respect to T,

$$g_f = n \, (tB - T)$$

$$\delta g_f/\delta T = n( \, (\delta t/\delta T) \, B - 1)$$

The expression for the derivative $\delta t/\delta T$ is derived from equation (A.1) which appears in both regimes. Thus,

$$\delta g_f/\delta T = ((\alpha/\alpha+\sigma) - 1) < 0 \, .$$

Therefore, as $T^{nc} > T^c$ then $gf^c > gf^{nc}$ .

To prove that $gf^{nc} > gf^{s}$ the expression for both variables are computed and then compare . Thus, replacing the values for T and t, already obtained for the commitment regime, in the budget constraint of the federal government,

$$gf^{s} = n[\alpha\sigma(\beta+\sigma)/\ (\beta+\sigma+\alpha)(\eta+\alpha)(\sigma+\beta n)] \qquad (A.12)$$

Doing the same for the commitment case it is found,

$$gf^{nc} = n[\ \sigma\alpha\ /\ (\eta+\alpha)(\sigma+\alpha+\beta n)] \qquad (A.13)$$

Comparing (A.12) and (A.13) it is easy to show that $gf^{nc} > gf^{s}$ .

## References

Adams, C. (1986): "General Revenue Sharing". Enviroment and Planning C: Government and Policy, 4, 265-277.

Alesina,A. and Drazen, A. (1989): "Why are Stabilizations Delayed". Mimeo.

Aizenman (1989): "Competitive Externalities and the Optimal Seignorage". Mimeo.

Barrow M. (1986): "Central grants to local governments: A game theoretic approach". Enviroment and Planning C: Government and Policy, 4, 155-164.

Brunner and Buchanan (1977): "Towards a Tax Constitution for Leviathan". Journal of Public Economics, december, 8, 255-273.

----------(1978): "Tax Instruments as Constraints on the Disposition of Public Revenues". Journal of Public Economics, June, 9, 301-318.

----------(1980): The power to tax: Analytical Foundations of Fiscal Constitutions. Cambrifge, New York, Cambridge University Press.

Carciofi, R (1989): " The Breakdown of the Fiscal Pact: An Interpretation of the Evolution of the Argentine Public Sector in the last two Decades". Working Paper, Cepal, Buenos Aires (in spanish).

Epple, D and Zelenitz, A. (1981): "The implications of Competition among Jurisdictions: Does Tiebout Need Politics? ". Journal of Political Economy, 89(6), 1197-217.

FIEL (1987): "The Public Sector in Argentina". Mimeo. (in spanish).

Gordon, D. (1983): "Optimal Tax Approach to Fiscal Federal ism". In C. McLure Ed. Tax Assignment in Federal Countries. The Australian National University Press.

Gramlich E. (1977): " Intergovernmental grants: A review of the literature". In W. Oates Ed. The Political Economy of Fiscal Federalism. Lexington Books, Lexington, MA.

Henderson, J.(1985): "The Tiebout Model: Bring Back the Entrepreneurs". Journal of Political Economy, 93(2), 248-64.

Heymann, D. and Leijonhufvud, A.(1990): "Ryde Lectures", chapter V. Mimeo.

--------- and Navajas (1989): "Conflicto distributivo y deficit fiscal" . Mimeo.

----------and Warnes(1988): "Conflicto distributivo y Deficit Fiscal: Algunos Juegos Inflacionarios". Instituto Di Tella, Serie Seminarios 12/88.

Hirsh (1970): The economics of State and Local Government. Mc Graw-Hill, Inc. New York.

Inman (1988): "Federal Assistance and Local Services in USA: The evolution of a New Fiscal Order". In S. Rosen Ed. Fiscal Federalism: Quantitative Studies. University of Chicago Press.

--------(1990): "Public Debts and Fiscal Politics: How to Decide?". American Economic Review, May, 80 (2), 81-85.

Kippes, G. (1984): "Coparticipacion Federal de Impuestos: Un Enfoque Alternativo para el Analisis de la Ley N 20.221". Anales, 17 Jornadas de Finanzas Publicas, Cordoba.

Lindert (1989): " Modern Fiscal Redistribution: A preliminary Essay". Working Paper Series # 55 , Agricultural History Center. University of California , Davis.

McGuirre M.(1973): "Notes on grants in aid and economic interactions among governments". Canadian journal of Economics, 6, 207-221.

Meltzer and Richard (1981): " A Rational theory of the Size of the Government". Journal of Political Economy, October, 89 (5), 914-927.

Mintz, J. and Tulkens, H. (1986): "Commodity Tax Competition between Member States of a Federation: Equilibrium and Efficiency". Journal of Public Economics, 29, 133-172.

Mueller (1989): Public Choice II. Cambridge University Press.

Musgrave (1959): The Theory of Public Finance. New York, Mc Graw-Hill.

Niou, E. and Ordeshook, P. (1984): "Universalism in Congress". Mimeo. University of Texas at Austin.

Oates, W (1972): Fiscal Federalism . Harcourt Brace Jovanovich, Inc. New York.

------ (1977): "An Economist Perspective on Fiscal Federalism". In Oates Ed. The Political Economy of Fiscal Federalism. Lexington Books.

-------(1985): "Searching for Leviathan: An Empirical Study". American Economic Review, September, 75, 748-757.

---------and Schwab, R. (1988): " Economic Competition among Jurisdictions: Efficiency Enhancing or Distortion Inducing?". Journal of Public Economics, 35, 333-354,

Pelzman (1980):"The Growth of the Government". Journal of law and Economics, October.

Porto, A. and Nunez Minana (1981): " Efectos de la reforma tributaria nacional de 1980 sobre las finanzas provinciales". Anales de la 14 Jornadas de Finanzas Publicas, Cordoba.

--------------------(1982): " Coparticipacion Federal de Impuestos: Distribucion primaria (1935-1981)". Anales de las 15 Jornadas de Finanzas Publicas, Cordoba.

Sandmo, A. (1976): "Optimal Taxation: An Introduction to the Literature". Journal of Public Economics, 6.

Schenone (1987) : "Public Sector behavior in Argentina, 1970-1985". Mimeo.

Secretaria de Hacienda (1987): "Relaciones Fiscales Nacion-Provincias: Bases para un nuevo pacto Federal". Mimeo.

-----------------------(1989):"Esquema Ahorro-Inversion del Sector Publico Argentino: 1970 - 1988". Mimeo.

Slack E. (1980): "Local fiscal response to intergovernmental transfers". Review of Economics and Statistics, 62, 364-370.

Tanzi V. (1986): "The Growth of Public Expenditure in Industrial Countries: An International and Historical Perspective". Washington, D.C., IMF mimeo.

Wildasin, D. (1988): " Nash Equilibria in Models of Fiscal Competition". Journal of Public Economics, 35, 229-240.

Waldauer, C. (1973): "Grant structures and their effects on aided government expenditures: An indifference curve analysis". Public Finance, 28, 218-226.

Weingast, B. Shepsle,K. and Johnsen, C. (1981): "The Political Economy of Benefits and Costs: A neoclassical Approach to Distributive Politics". Journal of Political Economy, 89 (4), 642-664.

Wilson, J. (1985): "Optimal Property Tax in the Presence of Interregional Capital mobility". Journal of Urban Economics, 17,73-89.

----------(1986):" A Theory of Interregional Tax Competition". Journal of Urban Economics, 19, 296-315.