

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

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ABSTRACT

It is well known that the fiscal performance of a country is actually determined by the interaction of many fiscal authorities within the public sector. The purpose of this paper is to present a simple model that 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 expenditures and taxes. We motivate the theoretical exercise presenting evidence regarding the fiscal performance of Argentina in 1970-1987 where an ill-designed system of intergovernmental grants has been associated with increasing provincial government deficits and of public sector expenditures.

SÍNTESIS

Es bien sabido que el desempeño fiscal de un país está de hecho determinado por la interacción de muchas autoridades fiscales en el sector público. El propósito de este trabajo es presentar un modelo simple que adopta un punto de vista de la teoría de juegos para investigar las consecuencias de diferentes formas de interacción entre las jurisdicciones federales y fiscales para determinar los gastos e impuestos globales del sector público. El ejercicio teórico se motiva presentando evidencia relativa al ejercicio fiscal de Argentina durante 1970-1987, en que su sistema mal diseñado de asignaciones inter-gubernamentales ha estado asociado a déficit y gastos cada vez más altos en el sector público.

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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 for a long time. 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 so for some developing countries. In particular, Argentina during the seventies and the eighties is 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 twofold. First, we want to illustrate, using data for Argentina between 1970 and 1987, how a bad fiscal performance (increasing government expenditure and deficits) can be associated with an ill-designed regulatory mechanism that induced, loosely speaking, a "non-cooperative" behavior among several public agencies, particularly, between the Provinces and the Federal government. Second, we develop a simple theoretical framework which, though inspired on the Argentinean experience, aims to be of more general application.

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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 the 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 spillovers². 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, a behavior that seems to be observed in some real world experiences as documented in the next section. On the other hand, there is a more recent literature that takes a political-economy approach to intergovernmental grants³. 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 literature⁴. Here intergovernmental grants are seen as

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

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

³ See, for example, Weingast et al. (1981) and Inman (1988, 1990).

⁴ See, for example, Brennan and Buchanan (1980), Chapter 9.

originating from the pressure exerted by 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 individuals⁵. 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 shown⁶. Moreover, its normative implications are rather extreme: widely used tax-sharing schemes should be completely avoided.

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 the local and federal level, in which the tax consequences of these expenditure 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 paper is organized as follows. The next section discusses the case of Argentina regarding Federal-Provincial fiscal relationship during the eighties and seventies. This discussion serves as a motivation for the theoretical analysis that is developed in section 3. Section 4 considers some policy implications and, finally, section 5, presents some general conclusions and future lines of research.

2. SOME PRELIMINARY EVIDENCE: ARGENTINA 1970-1987

Can the presence of an ill designed system of intergovernmental grants be associated with inefficiencies in the sense of an over-spending behavior by sub-national levels of government and an under-spending pattern of federal authorities? This section tries to answer this question by discussing some fiscal developments occurred in Argentina in the 1970-1987 period.

The fact that one reason underlying Argentina's long lasting monetary instability was the country's chronic fiscal problems is well known. Less known are the specific forces that were behind the fiscal imbalances, in particular, the

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

⁶ See, for example, Oates (1985).

way that different government sectors participate in the overall public sector disequilibrium⁷.

TABLE 1
COMPOSITION OF THE CONSOLIDATED PUBLIC SECTOR DEFICIT
(% of GDP)

YEAR	AGGREGATE DEFICIT	FEDERAL GOVERNMENT	GOVERNMENT	PUBLIC ENTERPRISES	SOCIAL SECURITY
1970	1.8	-1.2	0.8	2.4	-0.1
1971	4.6	-0.1	1.5	3.3	-0.1
1972	5.6	0.2	2.2	3.2	0.0
1973	7.5	2.5	2.7	2.9	-0.5
1974	8.0	1.8	3.2	3.2	-0.3
1975	15.4	4.3	6.7	4.7	-0.3
1976	11.7	3.4	3.2	5.1	0.0
1977	5.1	1.0	1.3	2.8	0.0
1978	6.8	1.6	1.9	3.3	0.0
1979	6.2	0.3	1.4	4.5	0.0
1980	7.5	1.0	1.9	4.6	0.0
1981	13.3	4.1	3.9	5.3	0.0
1982	15.0	6.0	2.1	6.9	0.0
1983	15.6	3.8	5.2	5.9	0.8
1984	12.6	1.7	5.4	4.8	0.7
1985	5.9	-5.6	6.3	4.0	1.2
1986	4.3	-5.4	6.2	2.2	1.3
1987	8.3	-3.6	7.1	3.9	0.9

(-) : surplus

Source: Heymann and Navajas (1989)

This is illustrated in Table 1 which shows data on the overall non-financial public sector deficit and its breakdown by level of government for the 1970-1987 period. It is seen that besides the Federal government (FG), Provinces (LGs) and Public Enterprises (PEs) have been major contributors to global disequilibrium. Periods of acute fiscal crisis, 1973-1976 and 1981-1983, in which the consolidated public deficit reached values above 15 points of GDP, coincide with an increasing participation of the Provinces and State Owned Enterprises in the aggregate level of deficit. For example, LGs and PEs contributed with 6.7 and

⁷ A thorough analysis of the public sector in Argentine is presented in FIEL (1987) and in Carciofi (1989). A more summary study of fiscal developments in the last years can be found in Schenone (1987) and Heymann and Navajas (1989).

4.7 points of GDP, respectively, to the deficit observed in 1975, and with 5.2 and 5.9 points of GDP, respectively, to that of 1983. However, the contrasting performance between the central authorities, on the one hand, and the Provinces and/or Public Enterprises on the other, is much more pronounced in periods of relative adjustment: 1970-1972, 1977-1980 and 1985-1987. In all these periods, the adjustment effort of the FG is not followed by the LGs and/or PEs. Of special interest is the period 1985-1987, where the central government carried out a substantial fiscal adjustment, exemplified by an average surplus of almost 5 points of GDP, while, on the other hand, PEs, and especially LGs, were running huge disequilibria with deficits above 6 points of GDP (in the case of LGs).

In table 2 the data of table 1 is conveniently rearranged in order to further illustrate the leading role of the sub-national levels of government, and especially that of the provincial administrations, in the fiscal crises of 1975 and 1983, together with their expansive behavior during the FG-led adjustment period 1985-1987. The provincial governments have the maximum share (about 40 percent) in the deficit variation during the fiscal crises of 1970-1975 and 1980-1983. Moreover, during the adjustment of 1985-1987, provincial governments continued to run deficits while other levels of government were running surpluses. Thus, they "contributed" with a negative share in the deficit variation that took place in that period^a.

TABLE 2
SECTORAL SHARES IN THE VARIATION OF THE
CONSOLIDATED PUBLIC SECTOR DEFICIT

	1970-75		1975-80		1980-83		1983-87	
	% GDP	share	% GDP	share	% GDP	share	% GDP	share
A.DEFICIT	13.6	100	-7.9	100.0	8.1	100.0	-7.3	100.0
FED.GOV.T.	5.5	40.8	-3.3	41.7	2.8	34.5	-7.4	100.0
STATE GOV.T.	5.9	43.0	-4.8	60.7	3.3	40.7	1.9	-26.0
PUBL.ENT	2.3	17.0	-0.1	1.2	1.3	16.0	-2.0	27.3
SOC.SEC.	-0.2	-1.3	0.3	3.7	0.8	9.8	0.1	-1.36

Source: data of table 1

^a Of course, it should also be noticed that in the adjustment period of 1975-80, the fiscal behavior of the provincial governments was quite good, having the maximum share (about 60%) in the deficit correction that took place in that period.

TABLE 3
COMPOSITION OF PUBLIC SECTOR EXPENDITURES
(% of GDP)

	1970	1975	1980	1983	1987
AGGREG.EXP	33.66	39.50	43.89	49.75	44.51
FED.GOV.T.	10.48	11.67	12.97	15.77	11.83
STATE GOV.T.	7.55	10.60	11.60	11.40	12.79
PUBL.ENT	11.14	13.22	13.49	17.48	14.82
SOC.SEC.	4.49	4.01	5.88	5.10	5.07

Source: Carciofi (1989)

So far, the uncoordinated behavior between the FG and the LGs, both in periods of acute fiscal crisis and of moderate adjustment, has been illustrated employing fiscal deficit measures. In table 3 additional data is displayed for the purpose of investigating how much of the above phenomenon is due to the behavior of the expenditure corresponding to each level of government. Hence, it is shown that one of the reasons behind the fiscal crisis of 1975 was a general increase in public expenditure in which the LGs contributed the most. In turn, in the disequilibrium that led to the crises of 1983, the first place, in terms of rising spending, was taken by PEs. Finally, the FG headed the way in the global adjustment of 1983-1987, reducing its level of outlays by almost 4 points of GDP⁹. Meanwhile, LGs were the only sector that increased its level of outlays in that period.

The distinct asymmetric fiscal performance of the provincial and central levels of government between 1985 and 1987 justifies the presentation of additional data, this time disaggregating among tax revenues, expenditures and transfers. Table 4 shows that local government expenditure increased 28 percent above the already high level of 1983. Provincial revenues also rose, though not as much. As a consequence, transfers from the FG increased in real terms above the, once again, high level of 1983. Nevertheless, it can be said that the transfer payments to the LGs did not represent a major problem for the central authorities as they only increased 4 percent over the whole subperiod. But this is misleading because we should take into account the overall strategy towards a general public sector adjustment encouraged by the central authorities, especially since 1985. It

⁹ The reduction of FG expenditures is greater than this value when transfers to local governments are netted out. See table 5 below.

is clear from table 4 that the rise in provincial expenditures and in transfers implied an important burden for the Federal government. This is because the adjustment required that the central government cut down its expenditure (net of transfers) and raise its tax revenue substantially (-17 percent and +67 percent, respectively) so that even with an expansion in Provincial outlays, a drop in the overall public sector deficit was obtained (recall the data presented in table 1).

How can the above stylized fact of an uncoordinated, and sometimes markedly opposite fiscal performance between the provincial and central governments be explained? There could be many explanations; nevertheless, as mentioned at the beginning of this section, the one to be suggested here stresses the poor design of the fiscal institutions regulating the FG-LG financial relationship.

TABLE 4
STATE AND FEDERAL EXPENDITURES AND REVENUES
(Australas of 1986)

	STATE GOVERNMENT			FEDERAL GOVERNMENT			Net of Transfers %
	1983	1986	% change	1983	1986	% change	
T. EXPENDITURE	6.531	8.345	28	18.136	16.061	-11	-17
T. REVENUE	6.748	7.765	15	7.613	12.628	67	
TAXES	1.793	2.601	45				
TRANSFERS	4.955	5.164	4				

Source : Secretaria de Hacienda (1987)

2.1. Federal - Provincial Fiscal Regime

Since 1935 the financial interaction between the national government and the provincial jurisdictions has been regulated by a "revenue sharing" scheme (Regimen de coparticipacion impositiva). Under this regime, the provinces entrust the central government with the task of administering a number of nation-wide taxes like income tax, VAT, etc. Revenues from these taxes are then distributed between the FG and the set of Provincial jurisdictions (primary distribution) and,

in a second stage, the amount assigned to the provinces is split among them (secondary distribution). Thus, two important issues that the regulation should clearly determine are the tax revenues that are going to be subject to the sharing rule and the coefficient of primary distribution.

The above scheme is complemented with a regime of Extraordinary Treasury Transfers (ETT) which has the explicit objective of transferring funds to the LGs in the case of unusual events. Supposedly, these funds are paid back by the provinces at the moment they receive the resources channeled through the revenue sharing rule.

The main claim this section tries to make is the following. The presence of this system of intergovernmental grants can, under certain circumstances, provide a wrong signal to local governments in the sense of giving them incentives to raise local expenditure beyond what can be considered a sustainable level¹⁰. Such circumstances are related to problems of design and enforceability of the scheme, both of which seem to have been present in the case of Argentina.

The legal framework which regulates the operation of the tax-sharing scheme has been subject to many changes since 1935 and it is not central to this paper to offer a detailed account of its evolution¹¹. Nevertheless, two events that took place in the 1980's illustrate the type of problems and the instability that the regime has been subject to. First, the tax reform of 1980 eliminated the employers' social security contribution and determined that the associated deficit of the social security system should be partly met using the tax revenues that were subject to the revenue sharing rule. Thus, since that year, the actual amount of funds received by the provinces through the scheme became dependent on the behavior of another agency within the public sector: the social security system¹².

The second rather extreme event refers to the complete absence of a legal tax-sharing rule between 1985-1987. When the regime established by the 1973 law expired in 1984, it took three years, until 1988, to approve a new one. During that period the transfers to the provinces were subject to the arbitrariness of the bilateral negotiations between the FG and LGs. That is, no legislative-approved regime was used¹³.

¹⁰ By "sustainable" is meant a level of local expenditure that can be financed with a long-run average level of local taxes and transfers from the FG.

¹¹ A detailed historical description of the evolution of the regime is presented in Porto and Nunez Minana (1982) and Carciofi (1989). See also Secretaria de Hacienda (1989).

¹² The change implied a substantial reduction in the funds channeled through the tax-sharing rule to the provinces since 1981. A detailed analysis of the consequences of the 1980 tax reform is developed in Porto and Nunez Minana (1981).

¹³ The fact that the amount transferred in past years was used as a reference point in the negotiations did not make the bargaining process less intense or unpredictable. See Carciofi (1989).

Overall, changes in regulation, such as the ones exemplified above, made the amount of real resources that the provinces could obtain from the tax sharing system very unpredictable and unstable¹⁴. Thus, whatever the difference between what provincial governments considered a normal or historical level for the transfers and the actual one, it was covered employing the Extraordinary Treasury Transfers (ETT) mechanism¹⁵. Table 5 presents some data which illustrate the point. It is observed that, in the 1972-1986 period, the resources obtained by the set of provinces through the sharing rule was pretty unstable, going from zero in the years 1985-1986 to a maximum of 3767 million (australes at 1986 constant prices) in 1980. The transfers channeled through the ETT mechanism allowed the provinces to get a relatively more stable level of resources from the FG. However, this increasing use of the supposedly extraordinary ETT mechanism undermined the functioning of the whole system of intergovernmental transfers. This is because of the rather unrestricted character of the ETT exemplified in the fact that no maximum limit for their utilization (by the LGs) was established¹⁶.

Therefore, what in theory was a regime that should have helped to set stable rules for regulating the resource distribution between both levels of government jurisdictions, was in practice undermined by successive changes in the legal framework that made "justifiable" the more extensive use of the less regulated part of it: the ETT mechanism.

We conjecture that this environment induced the LGs to act in a non-cooperative way, making them think that they can "move" choosing the level of local expenditure which is more appropriate from their own point of view, without taking into account the effect of their actions on the other provinces' policy variables, or on the level of expenditures and taxes of the central government. This idea will be further developed in the theoretical exercise presented in the next section.

So far the existence of problems in the institutional framework has been stressed as one of the main causes behind the incentive of the LGs to over-spend. Nevertheless, in Argentina there was another force, this time external to the regime itself, that may have exacerbated the indicated unrestricted character of the intergovernmental transfer mechanism. It was the inflationary shocks mentioned before. Through their devastating effects on both shared federal and local tax revenues, inflation outbursts like those produced in 1975 and 1983 had

¹⁴ To the uncertainty of what can be obtained in nominal terms implied by the mentioned instability of the legal framework, we should add the problem of inflationary shocks that generate an additional obstacle in the prediction of the real value of the funds to be obtained. Inflationary aspects are further discussed below.

¹⁵ Obviously in the 1985-1987 period mentioned all transfers to the provinces were made through the ETT.

¹⁶ This problem was solved by the new legislation passed in 1988 which established a maximum limit for the use of ETT by the provincial governments.

catastrophic effects on LGs finances putting additional pressures on the level of transfers needed from the FG¹⁷.

TABLE 5
FEDERAL TRANSFERS TO STATE GOVERNMENTS
(Australas of 1986)

YEAR	TAX-SHARE RULE	ETT 1972-86=100	TOTAL	TRANS.IDX
1972	1,373	816	2,189	53.2
1973	1,928	1,669	3,597	87.4
1974	2,780	2,271	5,051	122.7
1975	1,418	4,578	5,996	145.7
1976	2,393	2,142	4,535	110.2
1977	3,701	611	4,312	104.8
1978	3,317	515	3,832	93.1
1979	3,363	288	3,651	88.7
1980	3,767	317	4,084	99.2
1981	2,849	1,152	4,001	97.2
1982	2,241	648	2,889	70.2
1983	1,864	3,173	5,037	122.4
1984	1,710	2,393	4,103	99.7
1985	0	3,904	3,904	94.9
1986	0	4,525	4,525	109.9

Source : Secretaria de Hacienda (1987).

As a consequence, it is not surprising to find that periods of high levels of transfer (see table 5) and increased level of local expenditure are not only associated with periods of bad institutional design (as in 1985-1987), but also with periods of very high inflation (as in 1974-1975 and 1983) .

In summary, the above evidence suggests that in cases where the fiscal regime that regulates the financial relationship among different government jurisdictions is not properly designed and, in addition, this characteristic is magnified by the existence of high and volatile inflation, a kind of non-cooperative behavior among these government agencies can develop. The

¹⁷ The FG has had hard times in handling these pressures given that local governments arguments for greater transfers properly relied on the fact that the FG was whipping out its tax revenue through its loose monetary policy.

experience of Argentina in the 1970-1987 period, and especially between 1985 and 1987 is illustrative in this respect. For these latter years it is observed that this type of scenario can result in high levels of local expenditure. For a given level of local revenues, this will imply increasing amounts of transfers from the FG which, in turn, is forced to reduce its own level of expenditure and to increase nation-wide tax revenues. In principle, the size of the public sector, measured by the aggregate expenditure level, could either increase or fall depending on whether the rise in provincial outlays offset or not the decrease in federal government expenditures.

3. 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 incorporated¹⁸.

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 us assume a one period closed-economy setting where there is a federal government (FG) and n local (provincial) governments (LGs) each of which rules in a corresponding region of a federative country¹⁹. 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

¹⁸ 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 et al. (1988) a game-theoretic framework is employed to investigate the relation between transfers (here interpreted in a broader sense to include those channeled to the private sector), fiscal deficits and inflation.

¹⁹ For the purpose of the present theoretical exercise, a federative country need not necessarily imply the existence of true federal political institutions. Rather, a fiscal interpretation is preferred. In this sense, Oates (1972) has 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."

private consumption good, a federal public good and a local public good²⁰. Formally,

$$U^i = U^i(L_i, c_i, g_i, g_f) \quad i=1, \dots, n \quad (1)$$

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 function²¹. On the other hand, preferences of the federal government are assumed to be a weighted average of the preferences of all individuals (LGs)²²,

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

Households in all regions are endowed with one unit of leisure which can be consumed or supplied to the local labor market²³. 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 a numeraire, the budget constraint of the 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.

Section 2 showed that the Provinces finance their expenditures mainly with two resources : local taxes and transfers from the central government. Nevertheless, in order to isolate the key role played by these transfers in the determination of both local and aggregate level of expenditures, local taxes are

²⁰ All the results derived below hold if instead of assuming that local expenditure falls in a local public good, it is postulated that local government expenditure consists of a transfer payment to increase private consumption of the regionally-located representative individual.

²¹ As it is seen, the local public good has no interregional spillover effects. This differentiates 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).

²² Thus, the postulated federal government preference schedule actually represents a social welfare function.

²³ 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 (1977:9).

going to be dropped from the local governments' budget constraints²⁴. 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 $g_i = T_i$ ²⁵.

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 tax²⁶,

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

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, and 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 non-cooperative 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

²⁴ Of course, in a more general setting the interaction among local taxes, local expenditures and transfers should be recognized. Particularly, grants from the FG can be used not only to increase 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 an FG grant program in the USA see Adams (1986).

²⁵ Notice the lump-sum character that the transfers to local government adopt. 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).

²⁶ 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, such as the case of Argentina, where deficits are observed. Nevertheless, we should emphasize that the main purpose of the present theoretical exercise is to highlight some of the forces underlying the determination of government expenditures, not of deficits.

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.

3.1. Cooperative Regime

Let us 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,

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

s.t.

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

$$l_i = 1 - L_i$$

Applying the envelope theorem it is easy to show,

$$\frac{\partial V^i}{\partial t} = V_t^i \leq 0 ; \frac{\partial V^i}{\partial g_i} = V_{g_i}^i \geq 0 ; \frac{\partial V^i}{\partial g_f} = V_{g_f}^i \geq 0$$

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 only the problem of the FG²⁷,

²⁷ 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.

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

s.t

$$g_i = T_i$$

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

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

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

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

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

The above marginal conditions have a straightforward economic interpretation. In (4) we see 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 measured, in turn, 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 welfare²⁸.

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))²⁹. 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, \dots, T_n . Hence, in principle, the system 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 two sections, parallel expressions to the ones already obtained are derived for the case of the other two regimes.

3.2. 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

$$g_i = T_i$$

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

²⁸ Of course, it is assumed that the FG is located on the "right" side of the income-tax Laffer curve. Thus, the term $(\sum l_i(t) + t \sum l_i'(t))$ is positive.

²⁹ 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 the non-cooperative solution to the model is derived.

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

$$V_{s_i}^i(t, T) - V_{s_j}^i(t, T) = 0 \quad i = 1, \dots, n \quad (6)$$

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

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 region itself. Of course, this is a natural result of the non-cooperative 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,

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

Applying the implicit function theorem to (7) it is easy to verify that³⁰,

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

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

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 one. Thus, by not internalizing this effect, the actions

³⁰ A sufficient condition for this result to hold is that federal and local public goods are utility complements.

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 et al. (1981), Inman (1988, 1990), Heymann et al. (1988) and Aizenman (1989) emphasize the tax-cost share of the transfers as the main force behind the inefficiencies. Nevertheless, none 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,

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

The above condition is formally identical to the one derived in the cooperative regime (equation (4)). Thus, the 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_i and V_{g_f} 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.

3.3. 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,

$$V_{s_i}^i(.) = V_{s_f}^i(.) \quad (8')$$

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

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

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,

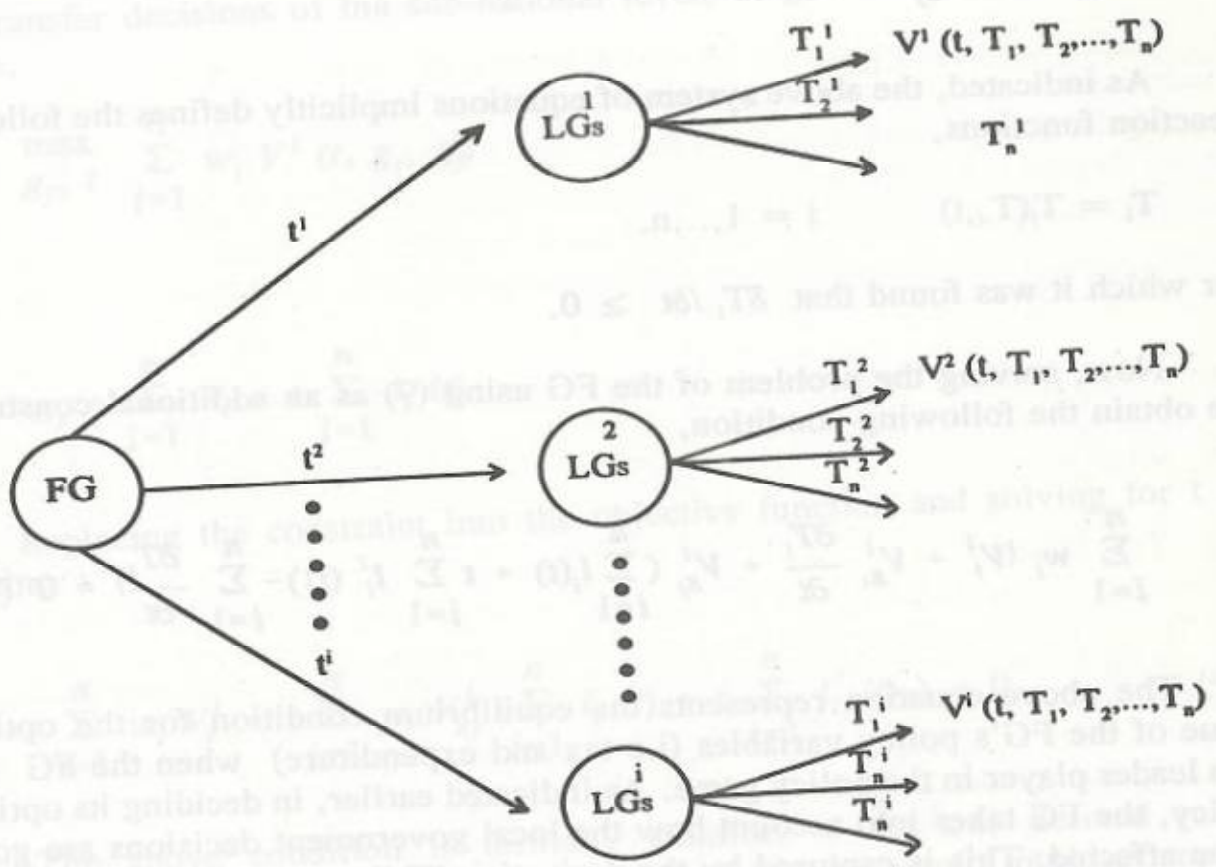
$$\sum_{i=1}^n w_i \left(V_t^i + V_{s_i}^i \frac{\partial T_i}{\partial t} + V_{s_f}^i \left(\sum_{i=1}^n l_i(t) + t \sum_{i=1}^n l_i'(t) \right) - \sum_{i=1}^n \frac{\partial T_i}{\partial t} \right) = 0 \quad (10)$$

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 captured 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, \dots 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_i) 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.

FIGURE 1
EXTENSIVE FORM OF THE GAME:
COMMITMENT REGIME



3.4. 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 we are going to adopt 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:

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

$$V_g = n V_{g^f} \quad (12)$$

Non-cooperative regime:

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

$$V_g = V_{g^f} \quad (14)$$

Commitment regime:

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

$$V_g = V_{g^f} \quad (14')$$

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 $U(.) = A c^\alpha g^\beta g^f \sigma L^\eta$, 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) $g^f^c > g^f^{nc} > g^f^s$.

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 non-cooperative setting also greater than in the commitment case? The idea is that in the 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 sets the level for the federal tax rate in advance³¹, the LGs realize that a too high level of transfers implies a too low level of federal expenditures (because taxes cannot change), an outcome that naturally affects negatively consumers' welfare. 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 between two of them: T and g_f . This tends to make transfers lower in the commitment regime than in the non-cooperative one, where the possibility of commitment by the FG does not exist, and to make them higher 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 local taxes have no interregional spillover effects³², 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 non-cooperative equilibrium than in both the

³¹ Given the balanced budget constraint assumption, this is equivalent to setting a level for aggregate public sector expenditures.

³² In other words, "tax competition" considerations are ruled out. On tax competition see, for example, Wilson (1985,1986), Oates and Schwab (1988), Wildasin (1988) and Mintz and Tulkens (1986).

cooperative and the commitment regimes? The explanation is that, faced with the greater level of transfers (when going from a cooperative to a non-cooperative 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 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 non-cooperative case. As indicated earlier, faced with a greater level of transfers, the FG in the non-cooperative 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 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 non-cooperative one? The key point is that in the former case the FG pre-establishes a level for its tax rate (and also 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 non-cooperative 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 on the simple observation that the FG in the commitment regime always has the possibility of choosing the level for its policy variables that correspond to the non-cooperative equilibrium. Thus, welfare in the former regime will always be at least at the non-cooperative level. Of course, the fact that the FG moves first allows it to improve upon that solution by the proper choice of its policy variables.

4. EMPIRICAL EVALUATION OF THE MODEL AND SOME POLICY IMPLICATIONS

How well does the above framework explain the stylized facts presented earlier? What are the policy implications that can be derived?

With respect to the first question, despite the simplicity of the framework, the qualitative results conform in general with the observed behavior. In particular, when the fiscal interaction between the FG and the set of LGs is carried out within a non-cooperative regime, local expenditure rises and federal expenditures decline. Furthermore, as the decline in federal outlays is lower than the rise in local expenditure, aggregate public sector disbursements rise. This is precisely what the data in section 2 showed, especially for the 1985-1987 period³³.

Of course, there is still a problem with the empirical interpretation of the theoretical results derived above. This is based on the fact that the model does not give predictions about the time-series behavior of the variables involved, but on the behavior of those variables across regimes. Nevertheless, in the empirical account, special attention was given to episodes that described important changes in regulation that, in turn, suggested changes in regimes, particularly, toward a non-cooperative scenario. In any case, it is recognized that a thorough empirical analysis of the issue is needed.

With respect to the policy implications, 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 great 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 of 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 justifications for decentralization of expenditure decisions is precisely that differences in preferences across regions exist. Thus, to take advantage of this fact, sub-national tiers of government (which are more "close to the people") should be able to choose their own level of expenditure³⁴. In other words, decentralization of fiscal decisions is a natural consequence of

³³ Actually, from the data presented in section 2 it is not clear that the non-cooperative game played among the different government jurisdictions generates, all other things being equal, an increase in public sector expenditures, especially in the 1985-87 period. Additional data is required in order to clarify this point.

³⁴ See Oates (1972).

recognizing diversity in tastes together with the lack of knowledge about this diversity shown by the more centralized units of government.

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 that which 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 effects inflicted by the action of one locality on all the others can be calculated and properly taken into account³⁵.

On the other hand, it can be said that real world political institutions, as, for instance, the 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 imposed by the action of one region on all others will be identified as soon as the representatives of the affected regions oppose such an action³⁶.

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 shown³⁷. Even in the case of advanced countries, such as the USA, where the legislature-determined public sector budget is a key determinant of fiscal policy, decentralized decision schemes at the Congress level – "universalism" in the words of the political scientists³⁸ – have resulted in increased transfers to local governments. Think of the problem posed by the attainment of cooperative solutions in the case of developing countries, as is that of Argentina, where the budget mechanism supported by legislative action was not even available at that moment.

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 non-cooperation. 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

³⁵ 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, apart from the already mentioned information requirements, to the implementation of the cooperative equilibrium.

³⁶ Heymann and Navajas (1989) emphasizes the need for a collective bargaining procedure, such as a mechanism supported by legislative action, to avoid "bad" solutions in the policy game that leads to the determination of the fiscal deficits in countries with high inflation. See also Heymann and Leijonhufvud (1990).

³⁷ See, for example, Inman (1988, 1990) and Weingast et al. (1981).

³⁸ See, for example, Niou and Ordeshook (1984).

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 in addition to more information, a commitment attitude is required from all players (i.e., all LGs apart from the FG). Moreover, it is clear from the analysis in section 3.4 that the FG need not set all policy variables in advance. Only by committing to one of them, there will be an improvement with respect to the non-cooperative scenario. Of course, this result is based on the logical previous assumption that the FG can be "committed" to maintain a balanced budget. If instead fiscal deficits are allowed, the additional condition required, for the same results to go through, is that the central authorities be 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, such as 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 close to a commitment-type equilibrium. On the other hand, as the empirical evidence suggested, the experience of some developing countries, as is the case of Argentina in the period under analysis, seems to be closer to correspond to a non-cooperative solution. The important question that remains unanswered is how we can go from one regime to the other. Although this will not be answered here, some thought is given to the issue in the final section of the paper.

5. CONCLUDING REMARKS

The question of the transition from a non-cooperative to a partially cooperative regime, such as the commitment case discussed earlier, is not trivial. Why would a country refrain from taking such a 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, aimed at 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 that the so far exogenous choice of regimes be made endogenous. 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 then enter into the picture. Playing in a non-cooperative way may be a perfectly rational strategy for obtaining an expected size of the "pie" in a future cooperative arrangement³⁹.

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. Some lessons can be drawn from this type of analysis so as to determine 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 that the simple framework presented earlier serves as a starting point for a thorough study of the issues involved in the fiscal interaction among different government jurisdictions. It was shown that a non-cooperative behavior between the FG and an 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 during 1970-1987 seemed to conform with the qualitative predictions of the model and, thus, provided a preliminary empirical support to the framework.

APPENDIX

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

$$\alpha / (1-t) = \sigma B / (tB - T) \quad (\text{A.1})$$

$$\beta / T = \sigma / (tB - T) \quad (\text{A.2})$$

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

³⁹ See, for example, Alesina and Drazen (1989).

(A.1) and (A.2) is a system of two equations with two unknowns. Thus, we can obtain,

$$T^c = \beta\alpha / (\beta + \sigma + \alpha)(\eta + \alpha) \quad (\text{A.3})$$

$$t^c = (\sigma / \sigma + \alpha) + \beta\alpha / (\sigma + \alpha)(\beta + \sigma + \alpha) \quad (\text{A.4})$$

In turn, the FOC corresponding to the non-cooperative regime can be rewritten as,

$$\alpha / (1-t) = \sigma B (tB - T) \quad (\text{A.1}')$$

$$\beta / T = \sigma / n(tB - T) \quad (\text{A.5})$$

Solving the system of equations we obtain,

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

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

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

$$T = [\alpha\beta n / (\sigma + \beta n)(\eta + \alpha)] t \quad (\text{A.8})$$

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

$$-\alpha / (1-t) + \beta/t + \sigma/t = 0 \quad (\text{A.9})$$

Solving for t,

$$t^* = \beta + \sigma / \beta + \sigma + \alpha \quad (\text{A.10})$$

Plugging (A.10) back into (A.8) we obtain,

$$T^* = [\alpha\beta n / (\sigma + \beta n)(\eta + \alpha)] + (\beta + \sigma) / (\beta + \sigma + \alpha) \quad (\text{A.11})$$

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

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

$$g_t = n(tB - T)$$

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

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

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

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

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

$$g_f^c = n[\alpha\sigma(\beta + \sigma) / (\beta + \sigma + \alpha)(\eta + \alpha)(\sigma + \beta n)] \quad (\text{A.12})$$

Doing the same for the commitment case, we find,

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

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

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