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**Federal Grants, Local Public-Good Provision, and Consumption  
Smoothing**

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# Federal Grants, Local Public-Good Provision, and Consumption Smoothing\*

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## I. Introduction

This paper addresses two very important, but usually neglected, aspects of Argentina's federal revenue-sharing system. The first aspect refers to the *horizontal* tensions present -in addition to the traditional vertical one of lack of fiscal correspondence- in the current system of revenue-sharing [Porto (1999)]. At the federal level, these horizontal tensions take the form of conflicting goals among Ministries regarding policy making in the provinces. For example, Ministries do not coordinate efforts to help provinces to solve the problem of financing the provision of local public-goods while achieving provincial fiscal balance. At the local -i.e. provincial- level horizontal tensions take the form of conflicting goals between the citizenry and an imperfectly controlled politician-bureaucrat who wants to minimize administrative effort and can, in this way, affect the (stochastic) cost of public good provision. The second aspect of the federal tax system that we want to address refers to the degree of risk-sharing between federal and local jurisdictions over uncertain outcomes; which is an important issue from the point of view of economic welfare. Risk-sharing was not explicitly discussed in the bilateral agreements that paved the way to the current federal revenue-sharing system, and it is not clear how to deal with it in future reforms of the system. Nicolini et al. (1999) find some evidence of risk-sharing motives in the management of ATNs, but they do not address explicitly the issue of private consumption smoothing, nor relate the problem of risk-sharing to the horizontal tensions aforementioned.

Taken together, these two aspects of revenue-sharing create a difficult distribution

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problem because they make it impossible for a federal authority that finances local public-good provision with federal grants to distinguish local government effort from the random effect of shocks out of any observed cost realization. The main objective of this paper is to start thinking about a solution to such a problem by running an "economics thought-experiment", i.e. by including these aspects of revenue-sharing in a model economy and theoretically explore the form that fiscal arrangements between federal and local governments should take in order to maximize economic welfare. The model can thus be cast in the standard framework of an agency problem involving a conflict between incentives and insurance. In particular, this can be achieved by finding the form of a federal grant that partially finances the provision of a local public-good in a federation where local governments are run by imperfectly-controlled politician-bureaucrats, and the stochastic distribution of the cost of public-good provision depends on the administrative effort exerted by the local government. The most important question being whether, or by how much, risk-sharing must be traded-off for the right incentives within the model. There is a growing consensus among Argentine economists that some sort of rule regarding this particular point should be adopted in actual agreements between jurisdictions (Saiegh and Tommasi, 1999); and that this rule should specify punishments and rewards (Porto, 1999), that is, the exact trade-off between incentives and insurance.

Formally, we model the fiscal relationship between federal and local jurisdictions as a contract between the local government and a Federal Fiscal Agency (FFA). In its optimal form, this contract would specify the type of grant scheme to be followed by the FFA as well as the optimal levels of local public-good and administrative effort to be provided by the local government. However, since we shall be assuming that administrative effort is unobservable and the provision of local public-goods is not verifiable, this optimal contract would not be legally enforceable and, in consequence, would never be signed. Instead, we show that the grant scheme should be designed in a way that the information given by the *realized* cost -assumed observable- is used by the FFA to induce the local government to behave in compliance with contractual terms. We therefore show how the FFA must weigh its risk-sharing and incentive concerns. In the optimal case, federal institutions would typically try to insure local consumption against cost shocks. However, when local government's effort is unobservable, this insurance can be only implemented at the expense of the right incentives.

The paper is organized as follows. Section II introduces and justifies the model economy to be used to analyze interjurisdictional contracts. In section III the optimal contract under perfect observability of administrative effort and public good provision is derived. This contract is a benchmark since the insurance and incentives motives of the FFA are not in conflict here. In section IV the contract for the more realistic case of unobservable administrative effort and not verifiable level of public good provision is derived. Section V concludes.

## II. The Model

We think of the economy as populated by three agents: a federal authority, a local (provincial) government, and a local representative consumer.

### *Representative consumer*

The representative consumer has a fixed real income  $y$  which finances the consumption of a private good  $C$  and the lump-sum taxes levied by local and federal governments,  $r_l$  and  $r_f$ , respectively. The budget constraint is the following

$$(1) \quad y = r_l + r_f + c$$

A local public good  $\gamma$  is provided by the local government, and the consumer's preferences over private and public good consumption are given by the utility function  $V(c, \gamma)$ , with

$$V(c, \gamma) = u(c) + v(\gamma)$$

Both  $u(\cdot)$  and  $v(\cdot)$  are increasing and concave functions of their arguments.

### *Local government*

The local government is managed by an imperfectly-controlled politician-bureaucrat whose objective function is  $L(c, \gamma, e; \theta)$ , with

$$(2) \quad L(c, \gamma, e; \theta) = V(c, \gamma) - \theta v(e)$$

That is, local government's objective only partially coincides with that of the representative consumer. Local government's welfare is given by  $V(c, \gamma)$  minus the term  $v(e)$ , which represents its dislike for administrative effort  $e$ .<sup>1</sup> We assume that local government's

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<sup>1</sup> We do not explain how this objective function come to be (a political economics problem), but

objective function is concave in all its arguments; i.e.  $u'(c) > 0$ ,  $u''(c) < 0$ ,  $v'(\theta) > 0$ ,  $v''(\theta) < 0$  and  $v'(e) > 0$ ,  $v''(e) > 0$ .

### *Technology*

The local public good is provided by the local government. We assume that the cost of providing the public good depends on local government administrative effort  $e$  and the realization of a shock. Let  $\kappa_i$  be the marginal and per unit physical cost of providing the public good in state of nature  $i$ ,  $i = 1, \dots, n$ , and define  $p_i(e) = p[\kappa = \kappa_i | e]$  the probability of occurrence of  $\kappa_i$  conditioned on  $e$ ; i.e. administrative effort affects the distribution of probability of  $\kappa_i$ . We can rationalize this specification by thinking of administrative effort as the effort to control the size of the local bureaucratic structure, and by further assuming that the provision of the public good can not be implemented without the aid of local bureaucracy. We assume (as is standard in the literature) that  $p_i(e) > 0$ , for all  $i$ , all  $e$ .

This means that any cost may result for any effort of local government. Of course,  $\sum_{i=1}^n p_i(e) = 1$ .

### *Local market-clearing allocations*

Local government finances the provision of the public good with local lump-sum taxes,  $r_i$ , and a state-contingent federal grant. Let  $\tau_i$  be the federal grant in state of nature  $i$ . Then the following must hold for all  $i$

$$(3) \quad r_i + \tau_i = \kappa_i \gamma$$

We assume that the amount of federal taxes  $r_f$  levied is fixed, but that local taxes  $r_i$  can be changed by the local government in a way dictated by this budget constraint. Granted this prerogative to the local government, the true budget constraint of the local economy can be derived from the local government's budget constraint (3) and the consumer's budget constraint (1), and it is given by

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rather take an economic policy analyst's view and assume that the parameter  $\theta \in [\underline{\theta}, \bar{\theta}]$  is the equilibrium value of some game between local political forces representing the citizenry and the bureaucracy. For example, a society in which  $\theta = \underline{\theta}$  can be thought of as being more democratic and more politically developed; i.e. as having been able to achieve local governments with the

$$(4) \quad y + \tau_i = c + \kappa_i \gamma + r_f$$

An allocation for this local economy is given by the levels of private good consumption, public good provision, administrative effort and local lump-sum taxes levied, and can be found by solving the local government's problem, which is to maximize the expected value of (2) subject to (4) for given  $y, \tau_i, r_f$  and  $\kappa_i$ . Formally, the problem is to

$$\text{Max}_{e, \gamma} \sum_{i=1}^n p_i(e) \{u(y + \tau_i - r_f - \kappa_i \gamma) + v(\gamma) - \theta v(e)\}$$

Local taxes levied and local private consumption can then be derived from the levels of administrative effort and public-good provision that solve this problem.

This problem looks similar to the approach of optimal taxation models in which the optimal tax is the one which maximizes the utility function of the representative consumer subject to the budget constraint of the economy, but it is very different indeed; the difference is that in optimal taxation models the government spending to be financed by optimal taxation is given and exogenous, and here it is partially determined by the local government's own behavior; even more, local government's objective function is different to the consumer's one.

### *Federal fiscal authorities*

We assume that grants to the local economy are administered by a Federal Fiscal Agency (FFA). We assume for the present case that this agency only cares for the net transfer to the local economy, so that its objective is to maximize  $\sum_{i=1}^n p_i(e) [r_f - \tau_i]$ .

We model federal authorities as a FFA rather than resorting to a full-modeling of the federal government because we want to concentrate on grant giving and isolate this problem from other concerns the federal government may have. The FFA has one clear objective in our model: to maximize the expected net revenue from the province; while the objectives of a federal government are multiple; for example, in grant designing a federal government may weigh not only the insurance and incentives concerns we want to study

here but also a concern for macroeconomic adjustment and stability (Saiegh and Tommasi, 1999). Another good reason not to model the federal government but work instead with a federal agency with definite objectives is that (also according to Saiegh and Tommasi, 1999) the federal government is a self-interested opportunistic actor itself in the game which defines the amount and type of grant given to the provinces; however, to take into account this behavior would exceed the purpose of this paper, since, among other things, we would have to move from a setting of bilateral contractual arrangements to more complicated settings where the federal government signs multilateral contracts with several provinces at the same time. Finally, the implications for institutional reform coming from much of the political economics literature suggest that the federal government should be actually replaced by a federal agency for the purpose of intergovernmental fiscal agreements, so by modeling the problem as contract between the FFA and the local government we do not lose generality and concentrate on the issues that matter.

#### *Intergovernmental contracts*

We assume that the FFA proposes a contract to the local government which the latter must accept or reject. The FFA must propose an acceptable contract, i.e. a contract that assures the local government a given minimum level of utility  $\underline{U}$ . Is the contractual view inevitable when dealing with federal grants design? There are good reasons to believe that the answer is an emphatic yes. Porto (1999) emphasizes that the incentives of federal authorities are different from those of a provincial government. In the case of federal grants, this is very clear: while the federal government wants to maximize the net federal revenue in a given province, the provincial government wants to maximize the part of the cost of public good provision not financed by local taxation. In the same line of argument, Saiegh and Tommasi (1999) emphasize that “revenue-sharing mechanisms and intergovernmental transfers systems are the results of bargaining processes in which numerous political actors with different interests are involved”, while Nicolini et al. (1999) study opportunistic behavior of local governments as deviations from contracts previously signed between local and federal jurisdictions. We concentrate on bilateral contracts not only for analytical convenience but also because the initial negotiations which paved the way to present revenue-sharing system were actually bilateral in essence (Saiegh and Tommasi, 1999).

### III. Intergovernmental contracts: The benchmark case

Although it is actually very difficult to observe the administrative effort of the local government and to verify the provision of the local public-good, in this section we assume the contrary and derive the optimal contract under perfect observability. We do so because this contract provides a benchmark for the analysis of the trade-off between insurance and incentives found in the case of unobservable effort. When effort is observable and the provision of public-good verifiable, then total consumption insurance can be provided to the local representative agent along with the incentives for the local government to provide the right levels of administrative effort and local public-good. The form of this contract is given by the solution to the following problem:

$$\begin{aligned}
 & \underset{[e, \gamma, \tau_{i=1, \dots, n}]}{\text{Max}} \sum_{i=1}^n p_i(e) [r_f - \tau_i] \\
 \text{s.t} \quad & \sum_{i=1}^n p_i(e) u(y + \tau_i - r_f - \kappa_i \gamma) + v(\gamma) - \theta v(e) \geq \underline{U} \quad (\text{PC})
 \end{aligned}$$

This problem can be solved in two steps. In the first, we compute the optimal grant scheme for any administrative effort and any level of public good. In the second step, we compute the administrative effort and the level of public good consistent with the grant computed in step one; this effort and this level of public good are the ones to be effectively implemented by the local government in this environment with observable effort and verifiable provision of the local public-good.

#### *The grant scheme*

The optimal grant scheme, for given levels of administrative effort and public good, is the one that minimizes the expected grant subject to the participation constraint of the local economy. Formally,

$$\begin{aligned}
 & \underset{[\tau_{i=1, \dots, n}]}{\text{Min}} \sum_{i=1}^n p_i(e) \tau_i \\
 \text{s.t} \quad & \sum_{i=1}^n p_i(e) u(y + \tau_i - r_f - \kappa_i \gamma) + v(\gamma) - \theta v(e) \geq \underline{U} \quad (\text{PC})
 \end{aligned}$$



Let  $\lambda$  be the Lagrange multiplier associated with the participation constraint (PC) facing the FFA; since  $c_i = y + \tau_i - r_f - \kappa_i \gamma$ , the first-order condition with respect to  $\tau_i$  is the following

$$(5) \quad \frac{1}{u'(c_i)} = \lambda$$

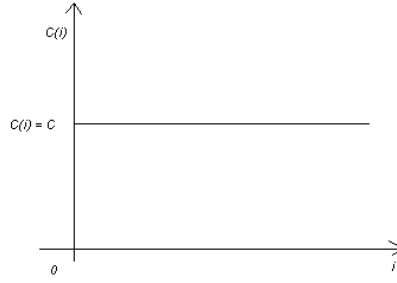
From this equation we derive two important conclusions:

1.  $\lambda > 0$ , since the marginal utility of consumption is always positive in an internal solution. This implies that the PC is binding, which means that local government gets its reserve utility in this contract.
2.  $c_i = \bar{c}$ , a constant, for all  $i$ . This means that private consumption is the same across states of nature. Thus, the FFA offers the local government a contract which implies that grants are given to the local government in a way that completely insures the representative consumer against surprises in the cost of the public good. Notice that this constitutes a Pareto Optimal allocation since local government is assumed to be risk-averse while the FFA is risk-neutral. This also implies that local government does not have to change local taxes to finance exogenous changes in the cost of public good provision. Figure 1 illustrates this result.

Since the participation constraint binds,  $\bar{c} = u^{-1}[\underline{U} - v(\gamma) + \theta v(e)]$ , the optimal grant is given by the following formula

$$\tau_i = T + \kappa_i \gamma \quad \text{for all } i, \quad i = 1, \dots, n$$

with  $T = u^{-1}[\underline{U} - v(\gamma) + \theta v(e)] + r_f - y$ , a constant. Therefore, in order to insure the consumer, the FFA designs a grant which is linear in the cost of providing the public.



**Figure 1: Full insurance in the benchmark contract**

*Administrative effort and local public-good provision*

Now we solve the second part of the problem. The optimal levels of administrative effort and public good to be provided by local government are those which maximize the expected utility of the FFA given the optimal contract to be provided in any given state of nature. Formally,

$$\begin{aligned} & \underset{[e, \gamma]}{\text{Max}} \sum_{i=1}^n p_i(e) [r_f - \tau_i] \\ \text{s.t} \quad & \tau_i = u^{-1} [\underline{U} - v(\gamma) + \theta v(e)] + r_f - y + \kappa_i \gamma \end{aligned}$$

given  $\underline{U}$ ,  $y$ , and  $r_f$ .

For a given administrative effort, the first-order condition with respect to public-good provision is

$$\sum p_i(e) \kappa_i = (u^{-1})' [\underline{U} - v(\gamma) + \theta v(e)] v'(\gamma)$$

This is the familiar *Samuelson condition* for the provision of public goods. The LHS is the expected marginal cost of providing the public good, and the RHS is the ratio of the marginal utility of public good consumption to the marginal utility of private good consumption. Therefore, under this grant scheme, the Pareto Optimal amount of public good is provided.

The first-order condition with respect to administrative effort is the following:

$$\sum p_i'(e) \kappa_i \gamma = (u^{-1})' [U - v(\gamma) + \theta v(e)] \theta v'(e)$$

Given the level of public-good provision, this equation gives the optimal administrative effort. It is the effort for which the expected marginal decrease in the cost of providing the public good resulting from an increase in effort (LHS) just equals the marginal compensation required by the local government to exert it.

#### IV. Intergovernmental contracts: The asymmetric information case

In the previous section we derived the Pareto Optimal benchmark contract. However the FFA needs instead to design contracts which take into account the moral hazard implied in the relationship between the federal and provincial governments. In this section we derive the grant scheme taking into account the unobservable nature of administrative effort and public-good provision. In particular, we show how the FFA must deal with the trade-off between efficiency and incentives, i.e. by how much we depart from optimal insurance in order to give enough incentives.

The grant scheme can be found by solving the following program:

$$\underset{[e, \gamma, \tau_i, i=1, \dots, n]}{\text{Max}} \sum_{i=1}^n p_i(e) [r_f - \tau_i]$$

s.t.

$$\sum_{i=1}^n p_i(e) \mu(y + \tau_i - \kappa_i \gamma - r_f) + v(\gamma) - \theta v(e) \geq \underline{U} \quad (\text{PC})$$

$$(e, \gamma) \in \arg \max_{e, \gamma} \left\{ \sum_{i=1}^n p_i(\bar{e}) \mu(y + \tau_i - \kappa_i \bar{\gamma} - r_f) + v(\bar{\gamma}) - \theta v(\bar{e}) \right\} \quad (\text{IC})$$

This is a much more complicated problem because it is not necessarily a convex programming problem. Following Holmström (1979) we redefine effort and assume that probabilities satisfy the *linear distribution function condition*.<sup>2</sup> That is, there are two conditional probability distributions over the states of nature, one for high effort,  $p_i^H$ , and another one for low effort,  $p_i^L$ . In this setting we can think of the local government's behavior as being characterized by a mixed strategy approach to problem of choosing

<sup>2</sup> The method by Grossman and Hart (1983) cannot be applied to this case.

effort. Let's redefine  $e$  such that  $p_i(e) = ep_i^H + (1-e)p_i^L$ , with  $e \in [0,1]$ . That is, the local government can play a mixed strategy which defines a new probability distribution which is a linear combination of the other two. We should now interpret  $e$  as follows: as  $e \rightarrow 1$ , the more the new probability distribution resembles the high effort conditional probability distribution.

We assume states of nature  $i$  are ordered according to the realized size of the shock, i.e.  $\kappa_1 < \kappa_2 < \dots < \kappa_n$ . We also assume that the likelihood ratio  $\frac{p_i^H - p_i^L}{p_i(e)}$  is decreasing in  $i$ ; that is, the larger is the difference  $p_i^H - p_i^L$  with respect to  $p_i(e)$ , the more precise the signal that a larger effort has been exerted. This property is known as the monotone likelihood ratio condition.

When  $p_i(e)$  is defined in this way  $\bar{e}$  and  $\bar{\gamma}$  are unique, and we can replace the IC in the maximization problem above with the first-order conditions for the administrative effort and the level of public good which satisfy IC. Then, the problem of the optimal scheme solves the following problem:

$$\underset{[e, \gamma, \tau_i, i=1, \dots, n]}{\text{Max}} \sum_{i=1}^n [ep_i^H + (1-e)p_i^L] (r_f - \tau_i)$$

s.t.

$$\sum_{i=1}^n [ep_i^H + (1-e)p_i^L] u(y + \tau_i - r_f - \kappa_i \gamma) + v(\gamma) - \theta v(e) \geq \underline{U} \quad (\text{PC})$$

$$v'(\gamma) - \sum_{i=1}^n [ep_i^H + (1-e)p_i^L] u'(y + \tau_i - r_f - \kappa_i \gamma) \kappa_i = 0 \quad (\text{IC 1})$$

$$\sum_{i=1}^n [p_i^H - p_i^L] u(y + \tau_i - r_f - \kappa_i \gamma) - \theta v'(e) = 0 \quad (\text{IC 2})$$

Let  $\lambda$ ,  $\mu_\gamma$ , and  $\mu_e$  be the Lagrange multipliers for PC, IC 1, and IC 2, respectively. Then the first-order condition with respect to  $\tau_i$  is given by

$$(6) \quad \frac{1}{u'(c_i)} = \lambda + \mu_e \left[ \frac{p_i^H - p_i^L}{p_i(e)} \right] - \mu_\gamma \frac{u''(c_i)}{u'(c_i)} \kappa_i$$

This equation is an extended version of (5), but corrected for the presence of moral hazard in the behavior of the local government. As can be observed an important first conclusion can be derived from (6): private consumption is not fully insured anymore; it shall vary with the realization of the shocks. In order to give the right incentives the FFA would propose a contingent grant such that the amount granted would be lower whenever there is a sign of low effort, this would force the local government to rise local taxes and lower private consumption for a given level of public-good provision; therefore this contract gives the right incentives to the local government to make a lot of effort, since it is costly for the local government to affect private consumption of the representative agent. As we can see full insurance cannot be given to the representative agent if the FFA has also to give the right incentive to the local politician-bureaucrat to make administrative effort and provide the public good.

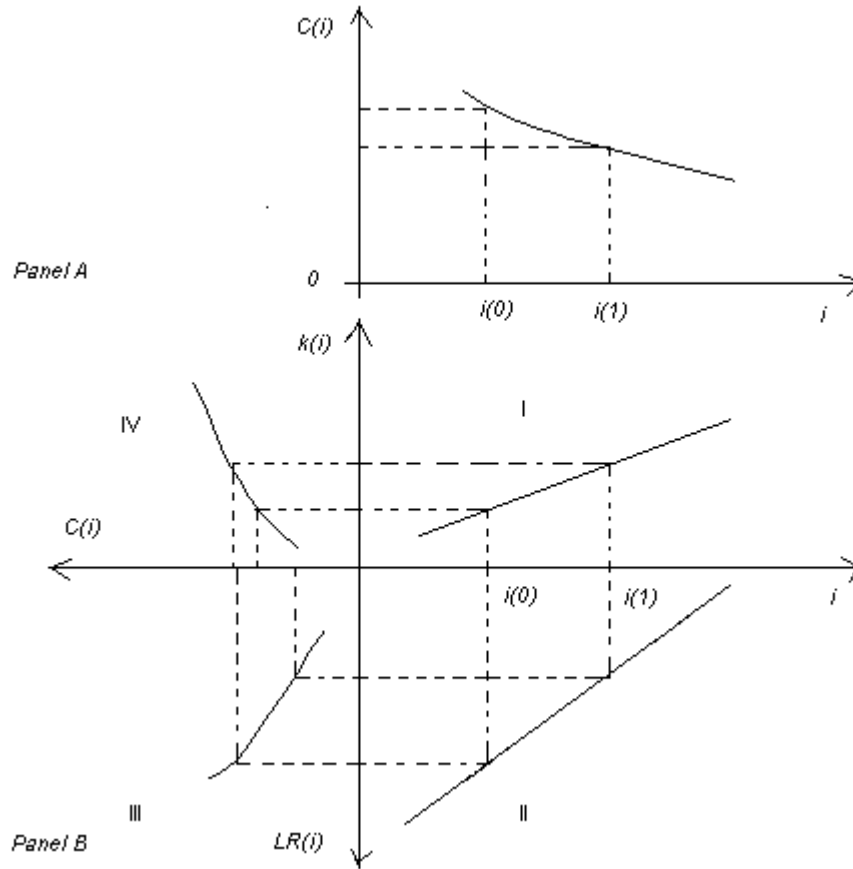
The analysis of equation (6) will tell us by how much we have to depart from full insurance. In what follows we assume that the coefficient of *absolute risk aversion* is constant; i.e.  $r_A(c_i) = -\frac{u''(c_i)}{u'(c_i)} = r_A$  for all  $c_i$ , with constant absolute risk-aversion (CARA) preferences. Now re-write (6) as follows

$$\frac{1}{u'(c_i)} = \lambda + \mu_e \left[ \frac{p_i^H - p_i^L}{p_i(e)} \right] + \mu_\gamma r_A K_i$$

Ignoring for a moment the third term on the RHS, the rest of the equation is the familiar result from contract theory which establishes that payments to the agent should be linked to the signal of the effort exerted. In our case this means that private consumption shall vary directly with variations in the likelihood ratio  $\frac{p_i^H - p_i^L}{p_i(e)}$ ; the lower the likelihood ratio the stronger the signal that a low effort has been exerted and therefore a lower consumption should be allowed. This is easy to see since the lower the RHS, the lower the LHS should be as well, which requires a higher marginal utility or lower consumption. That is, the incentive scheme to make the local government exert the required administrative effort is to give a grant that will imply less local private consumption whenever the cost of providing the public good is higher. The intuition, again, is that consumption shall fall in bad states

because the FFA will lower the amount granted to the local government in those states: since the provision of the public-good wont be much lower then, from local government's budget constraint (3), the only way to finance the increase in cost provision is by increasing local taxes, which will affect private consumption [from the consumer's budget constraint (1)]. The fact that increasing local taxes is costly to the local government (who maximizes, at least in part, the welfare of the representative agent) this scheme gives the local government the right incentives to make more effort and increase the likelihood of lower expected costs. Therefore, from the analysis of changes in the LHS to changes in the second term of the RHS we find that the contract implies a negative relationship between private consumption and the likelihood ratio; this negative association is necessary for the FFA to give incentives to the local government.

Now let's include the third term of the RHS into the analysis. Notice that because the coefficient of risk aversion is positive this contract implies a positive relationship between private consumption and the marginal and per unit cost of providing the public-good. Behind this positive association is the insurance concern of the FFA. Notice then that the interaction between both, the negative change in private consumption that results from a decline in the likelihood ratio, and the positive one that results from an increase in costs determine the schedule of  $c_i$  over all states  $i$  (This result is illustrated in Figure 2). That is, the term  $\mu_\gamma r_A \kappa_i$  can be thought of as a correction term related to insurance in some way. It moderates the *punishment* of the FFA over the local economy that a fall in the likelihood ratio would imply. Private consumption falls with  $i$  if private consumption falls with the likelihood ratio by a larger amount than it increases with  $\kappa_i$ . The resulting variation in private consumption depends on the relative weight of the likelihood ratio and the efficiency-correcting term; the weights being the positive Lagrange multipliers  $\mu_e$  and  $\mu_\gamma$ . It seems safe to expect that the first effect is stronger than the second one.



**Figure 2: Imperfect Consumption Insurance with Moral Hazard**

In Figure 2, panel B, quadrants I and IV illustrate the relationship, resulting from the contract, between the realized cost and private consumption, for a given the value of the likelihood ratio ( $LR$ , in Figure 2), in two states of nature  $i(0)$  and  $i(1)$ ; while quadrants II and III illustrate the relationship, resulting from the contract, between the likelihood ratio and private consumption, for a given the value of the realized cost, in those two states of nature; then, in panel A, Figure 2 depicts the net effect on consumption of going from one state of nature to the other (worse) one.

The consumption insurance concern summarized in the term  $\mu_\gamma r_A \kappa_i$  is related to local public-good provision and local taxation in the following way: the federal authority needs the local government to do two things, to provide the correct administrative effort and to provide the correct amount of public good. Suppose for a moment that we do away with the correcting term then private consumption varies only with changes in the likelihood ratio. Assume that in a given state this likelihood ratio is very low then, for a given level of public-good provision, this would entail an important fall in private consumption, because the size of the federal grant falls and local taxes are risen; however, a

drop in private consumption then rises the marginal utility of private consumption in that state, which causes an additional increase in the expected marginal cost of providing the public-good; public-good provision would fall greatly and welfare will be additionally affected unless we correct the fall in consumption by limiting the rise of local taxes, this correction is dictated by the term  $\mu_\gamma r_A \kappa_i$ ; it adjusts the fall in private consumption so that public good provision does vary too much across states. That is, federal grants should fall in bad states but without hurting the provision of local public-goods that much. This scheme would thus provide the right incentives to the local government to provide both, administrative effort and the public good.

If the coefficient of absolute risk aversion is not constant then the movements in  $c_i$  are difficult to follow from movements in the likelihood ratio and the efficiency-correction term; but we can still analyze the grant scheme for the case of *constant relative risk aversion*. If the utility function is characterized by a constant relative risk aversion; i.e.

$$r_R(c_i) = -\frac{u''(c_i)c_i}{u'(c_i)} = r_R \text{ for all } c_i, \text{ with constant relative risk-aversion (CRRA) preferences}$$

then (6) can be re-written as

$$\frac{1}{u'(c_i)} = \lambda + \mu_e \left[ \frac{p_i^H - p_i^L}{p_i(e)} \right] + \mu_\gamma r_R \left( \frac{\kappa_i}{c_i} \right)$$

It is easy to see that correction of private consumption fluctuations is larger (that is,  $c$  falls less in bad states) as a consequence of changes in either  $\frac{p_i^H - p_i^L}{p_i(e)}$  or  $\kappa_i$  with CRRA than with CARA preferences. Regarding the schedule of  $c_i$  over all states  $i$ , it is difficult to say how much it differs from one case to the other.

## V. Conclusion

This paper addresses theoretically the issues of "horizontal tensions" and "risk-sharing" facing federal authorities in their fiscal relationship with provincial governments in Argentina. We find the extent to which federal authorities must deviate from a linear grant scheme, that perfectly insures consumers across states of nature, to give provincial governments incentives to exert the right amount of administrative effort on the local



bureaucracy. The extent of departure from perfect insurance is determined by the interaction between changes in the amount of federal resources granted to the province which are dictated by the probability distributions of public-good cost and changes in the amount of resources granted which are dictated by an efficiency-correcting term. This term is, in turn, determined by the coefficient of risk aversion of the representative consumer and the realized cost of local public-good provision.

In this model economy the amount of federal resources granted must change in a way which is inversely proportional to the change in the cost of providing the local public-good. In the actual fiscal relationship between federal and provincial jurisdictions of Argentina not unusually we observe the opposite phenomenon. Sometimes federal resources are granted proportional to the size of local bureaucracy ( a proxy for the cost of providing the local public-good); moreover, there is a feeling that provincial governments which make an above average administrative effort are not rewarded, while those which have budget trouble due to overcrowding bureaucracies are not being punished with a decline in federal funds. Our model would then explain why under this circumstances provincial governments seem reluctant to make a definitive administrative effort to reduce the size of local bureaucracy and improve the provision of local public-goods.

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