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Essays on Mexican Fiscal Federalism: A Positive Analysis

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Essays on Mexican Fiscal Federalism: A Positive Analysis

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Dedication

I dedicate this dissertation work to my wife Vanessa, my daughter Paola, my son to be born in a few weeks, but specially with all my love to Pablito (†).

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The love and support from my family are determinant in my life, as they were in my effort to complete this dissertation work. Nonetheless, I owe my dissertation supervisor, Professor Dale O. Stahl, special recognition for his intelligent advice, support, and patience. I also want to thank the other Committee Members, who provided insightful comments and observations that enhanced this dissertation work. Of course, all errors that appear here are only mine. Finally, I want to thank my Professors from the Economics School at Universidad Autónoma de Nuevo León, who served as role models to me. Dr. Jorge N. Valero Gil deserves a special mention for encouraging me and many other classmates to pursue a graduate degree.

Essays on Mexican Fiscal Federalism: A Positive Analysis

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The purpose of this dissertation is two fold. At the policy level, this dissertation contributes to the debate over the reform of the Mexican fiscal federalism regime by providing quantitative, positive analyses of it. This dissertation, on the other hand, makes a contribution to the theory of fiscal federalism by developing a theoretical model to explain the non-fungibility of unconditional grants when these account for most of the recipient government's revenues, which is a case not considered in the literature. The dissertation is divided in six chapters, where the first chapter is the introduction and the sixth chapter concludes. The second chapter reviews the fiscal federalism literature, but focus on the issues that are relevant for this dissertation: the intergovernmental allocation of spending and revenue-raising functions as well as the "flypaper effect." The third chapter describes and analyzes the fiscal federalism regime in Mexico and the claims for fiscal decentralization. Centralized spending responsibilities depart from what the literature prescribes as optimal; however, the

actual intergovernmental assignment of revenue sources does not. Nonetheless, the analyses on Mexican federalism focus on the decentralization of revenue sources instead of spending responsibilities. The fourth chapter presents a quantitative analysis of the determinants of intergovernmental distribution of revenue-sharing transfers or *participaciones*, which represent the main source of revenue for sub-national governments. The goal is to evaluate the effectiveness of the modification to the revenue-sharing formula made early in the 1990s, which had the purpose of inducing a more equitable distribution of these transfers while maintaining the incentives for fiscal effort on behalf of recipient governments. Empirical estimates show no evidence that supports the effectiveness of the formula modification. The fifth chapter estimates the response of state governments to the *participaciones* they receive and develops a theoretical model to explain the non-fungibility of unconditional grants when the recipient government's own revenues are not enough to finance a minimum provision level of the public good. Empirical results show that state governments in Mexico get to spend all the *participaciones* monies they receive, which to some extent is explained by the developed model.

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CHAPTER 1: INTRODUCTION.

This dissertation work provides a set of positive, quantitative analyses of the Mexican fiscal federalism regime. A goal of this dissertation is to make a contribution to the debate over the reform of the fiscal federalism regime in Mexico.¹ This reform is a pending issue in the national agenda of that country. This dissertation also makes a contribution to the theory of fiscal federalism. It develops a theoretical model to explain the non-fungibility of unconditional grants when these account for most of the revenues of the recipient government, which is a case not considered in the literature.

The dissertation includes five chapters where chapter 1 is this introduction, which presents an overview of the dissertation work. Chapter 2 reviews the fiscal federalism literature, but focuses on those areas that are relevant for the purposes of this dissertation work: (i) the optimal intergovernmental allocation of both spending responsibility and revenue-raising authority, and (ii) the allocation effects of intergovernmental grants-in-aid—in particular, the “flypaper effect.” Furthermore, the issue-oriented review of the literature would serve as a theoretical framework for the topics discussed in the following chapters.

¹ A growing literature on this issue has emerged, although most of the analyses are descriptive and their policy recommendations are drawn from the mainstream, normative fiscal federalism literature.

Fiscal federalism literature calls for the centralization of the most productive, mobile tax bases and, at the same time, for the assignment of allocation functions to the lowest layer of government possible. The outcome is then a mismatch in the assignment of spending responsibilities and revenue collection faculties for a given layer of government. Sub-national governments, in particular, are negatively affected by such vertical fiscal imbalance. Nonetheless, an appropriate set of grants-in-aid may remedy this problem. The analysis of the Mexican fiscal federalism, chapter 3, is based on intergovernmental assignment of public function that the fiscal federalism literature prescribes.

The normative, mainstream literature treats intergovernmental revenue-sharing transfers as lump-sum transfers. As a result, equal increases in revenue-sharing transfers and local private income would have the same impact on the recipient jurisdiction's allocation decision; e.g., revenue-sharing grants have income-changing effect only. In contrast, the "flypaper effect" refers to the empirical finding that revenue-sharing transfers have a larger impact on public spending than what the mainstream literature predicts. The response of Mexican state governments to the revenue-sharing transfers they receive from the federal government is the subject of study in chapter 5.

Chapter 3 describes and analyzes the current fiscal federalism regime in Mexico and the claims for fiscal decentralization, in particular. The constitutional

framework and intergovernmental agreements on tax collection and public spending explain fiscal centralization in Mexico. Centralized spending responsibilities depart from what the literature prescribes as optimal. In Mexico, the federal government is involved in functions that are better suited for sub-national governments like the provision of water, housing, hospitals, culture, sewerage, streets, among others. Similarly, state governments are involved in functions that are better suited for municipal governments like city planning, transit and local trade regulation.

The actual intergovernmental assignment of revenue sources, on the other hand, corresponds to what the fiscal federalism literature prescribes as optimal. Federal government collects taxes from mobile bases like income and consumption, whereas sub-national governments collect taxes from immobile tax bases like property and rely on benefit-taxation like user-fees.

Nonetheless, analyses on Mexican federalism focus mainly on the decentralization of revenue sources instead of spending responsibilities. In particular, the focus is on the reform of the National System of Fiscal Coordination (NSFC), which is a revenue-sharing grants program that allows the federal government exclusive access to the most productive tax base. Revenue-sharing transfers are called *participaciones*. In 1999, the amount of *participaciones* state governments receive is four times larger than state collection of own revenues. A reform of the NSFC would allow sub-national governments

access to broader and more productive tax bases; e.g., surtax on the federal income tax or on the federal value-added tax, or the devolution of certain tax bases. On the other hand, it is argued that a clear link between local public spending and local revenue collection would increase accountability and efficient provision. This argument and the financial pressures sub-national governments suffer, may explain the primary focus of the literature on the decentralization of revenues.

The source of the financial pressures that state governments suffer is placed on the NSFC, because it does not provide enough revenues to these; restricts sub-national governments from using more productive tax bases; and may even disincentive local collection of own revenues. The reform of the current fiscal federalism regime in Mexico would necessarily involve a revision of the NSFC. The assessment of the *effective* determinants in the distribution of revenue-sharing transfers among recipient governments, and the response of these to *participaciones* should be the first step in analyzing the current fiscal federalism regime in Mexico. Chapters 4 and 5 address these issues.

Chapter 4 presents a quantitative analysis of the determinants of the distribution of revenue-sharing transfers among state governments in Mexico. Cross-sectional and panel data models are estimated with that purpose. The goal of this chapter is to evaluate the effect of the modification to the revenue-sharing formula, made early in the 1990s, on the allocation of *participaciones* per capita

across states. That is, whether state collection of assignable federal taxes per capita and state population are indeed determinants in the distribution of revenue-sharing grants per capita among states, as well as whether states with low development levels benefit more with the new formula than with the previous one. This chapter includes also a detailed description of the revenue-sharing grant system.

The analyses in chapter 4 find no evidence that supports that the major modification to the revenue-sharing formula significantly altered the state distribution of these transfers in per capita terms. In other words, the time series analysis shows that: (1) state collection of assignable federal taxes per capita is not an effective determinant in the distribution of *participaciones* per capita; (2) state population does determine the distribution of *participaciones* per capita but negatively; and (3) a state development level does not determine the distribution of *participaciones* per capita. Instead, individual state and time effects seem to be the main determinants in the distribution of revenue-sharing transfers across states.²

Chapter 5 estimates the response of state governments in Mexico to the revenue-sharing transfers they receive from the federal government. A first goal is to test whether state governments treat *participaciones* as lump-sum transfers; e.g., “flypaper effect” test. If such is not the case, a further goal is to evaluate two

² This opens a venue for a future extension, which is discussed at the end of this chapter.

non-nested hypotheses that might explain the presence of the flypaper effect in the Mexican case. One explanation is that the flypaper effect is due to the mechanism used to distribute revenue-sharing transfers, which creates a fiscal illusion that induces recipient governments to allocate more resources to the public sector than otherwise. This chapter, on the other hand, presents a novel explanation for the presence of the flypaper effect: this phenomenon is expected to occur when intergovernmental grants account for most of the recipient government's budget. That is, a state government in Mexico would spend most of the revenue-sharing grant monies it receives simply because it has no other source of revenues to finance a minimum provision level of local public goods.

The analysis in chapter 5 finds that state governments in Mexico get to spend all the *participaciones* monies they receive. The marginal propensity to consume of state public goods out of *participaciones* is close to one. On the other hand, the marginal propensity to consume of state public goods out of private income is close to zero. These results are aligned with other estimates in the literature according to Hines and Thaler (1995).

The irresponsible behavior of state governments to changes in the received level of *participaciones* cannot be satisfactorily explained through a fiscal illusion argument. This argument, as the estimation results from the McGuire model show, would require that state governments treat *participaciones* as open-ended

matching grants with a very low matching requirement. Indeed, the after-grant price of local public goods would be driven to zero.

Estimates from the alternative model show that, to some extent, state governments do not react to increases in the *participaciones* —by providing tax cuts— due to the fact that these are practically their only source of revenues. When a state government is not able to meet a minimum public spending level, the estimate of the marginal propensity to consume the state public good out of *participaciones* is 1.0296. A super flypaper effect would exist in this case; e.g., *participaciones* would *induce* recipient governments to collect more own revenues. On the other hand, once a minimum public spending level is met, a state government would use part of the *participaciones* monies to provide some tax cuts. In this case, the estimate of the marginal propensity to consume the state public good out of *participaciones* is 0.8210.

This dissertation has several venues for futures extensions. Regarding the effective determinants in the allocation of revenue-sharing transfers across recipient states, an extension to the analysis presented in this dissertation work may consider the fact that the current system was built on a derivation principle that favored those states with larger total revenues; e.g., oil producing states as well as those with more developed markets. It is thus possible that such derivation principle may be still determining the distribution of revenue-sharing transfers across states. Testing this hypothesis would be a natural extension to chapter 4.

Regarding the recipients' response to *participaciones*, chapter 5, state governments may find optimal to spend *participaciones* monies instead of collecting their own revenues simply because it is politically risk-free. That is, it is the federal government's responsibility to collect public revenues whereas state governments get the credit for their spending. As a result, state government would have the incentive to request more *participaciones* than new tax responsibilities. In this sense, the current revenue-sharing grants system may create perverse incentives. Thus, another possible extension to this dissertation work is to evaluate, within a principal-agent framework, the incentives that the Mexican revenue-sharing grants system creates.

CHAPTER 2: LITERATURE REVIEW.

2.1 INTRODUCTION.

The goal of this chapter is to provide an issue-oriented instead of a comprehensive review of the literature. This chapter thus focuses on those areas of the fiscal federalism literature that are relevant for the purposes of this dissertation work. The discussion on the intergovernmental allocation of spending responsibility and revenue-raising authority would serve as the theoretical framework for the analysis of the Mexican fiscal federalism, which chapter 3 presents. The discussion on the allocation effects of intergovernmental grants-in-aid would serve as the theoretical framework for the analysis of the response of Mexican state governments to federal revenue-sharing transfers, which chapter 5 presents. The “flypaper effect,” in particular, receives special treatment.

Oates (1968, 1972) and Musgrave and Musgrave (1980) are classical references in the mainstream fiscal federalism literature, whereas Oates (1999) discusses also the new economic approaches to the field.³ Fiscal federalism, in sum, studies the allocation of public functions and policy instruments among the

³ Boadway and Wildasin (1984, chapter 15) and Rosen (1985, chapter 19) provide excellent reviews of the fiscal federalism literature. References on specific subjects of the field are provided through out the chapter.

different layers of government in a federal regime, as well as the intergovernmental relationships that arise from the resulting arrangement.

The functions that the public sector performs, according to Musgrave (1957), can be classified according to the objectives they serve: economic stabilization, income distribution, and allocation of resources. Economic stabilization requires the maintenance of high levels of employment with stable prices. Income distribution requires the achievement of the most equitable distribution of income possible. Allocation requires the efficient use of resources.⁴ The public sector uses monetary and fiscal policy instruments to pursue these objectives. Therefore, fiscal federalism deals with issues like whether welfare programs should be run by the federal government or by the states; whether environment protection should be a federal, state, or local responsibility; whether property taxes should be collected by the municipal or state government level; whether local governments should print money.

The performance of the public sector, following welfare economics, should be evaluated according to the efficiency and equity criteria. Economic efficiency requires that all potential benefits from trade to be exhausted, whereas the equity criterion requires that aggregate income to be *justly* distributed among the individuals in the society. Income distribution and allocation functions are directly linked to the equity and efficiency criteria, respectively. Economic

⁴ The allocation function, at the aggregate level, involves determining the consumption of social-public goods vs. the consumption of private goods. It further determines how much of each public good and service is to be provided and in which location.

stabilization relates to both equity and efficiency criteria. For instance, in an economy that suffers from high levels of inflation, production planning is poor since prediction of nominal variables would not be reliable. At the same time, inflation is a regressive tax and so the poorer bear its burden the most.

In the context of a federal regime, as it is discussed in section 2.2, the central government is better qualified than sub-national governments to address both the macroeconomic stabilization and income distribution functions. In the case of allocation functions, the central government is better qualified than sub-national governments to serve some of these functions but not all. That is, sub-national governments would only be fitted to serve some resource allocation functions. As a result, the performance of sub-national governments should only be evaluated according to the efficiency criterion.

The structure of this chapter is as follows. Sections 2.2 through 2.4 discuss the mainstream approach to the intergovernmental allocation of public functions, the intergovernmental allocation of spending responsibilities, and the intergovernmental allocation of revenue sources. The following section discusses three alternative approaches to intergovernmental grants-in-aid, with special focus on the recipient government's response to grants. The last section discusses the empirical anomaly called the flypaper effect.

2.2 CENTRALIZED VERSUS DECENTRALIZED PUBLIC SECTOR.

This section discusses the optimal intergovernmental allocation of public functions. Mainstream fiscal federalism theory —Oates, 1968 and 1972; Musgrave and Musgrave, 1980— prescribes that the central government ought to perform both stabilization and income redistribution functions, whereas some allocation functions should be assigned to a particular level of government and others may be pursued jointly by different levels of government. On the other hand, the literature prescribes that monetary policy ought to be an exclusive faculty of the central government, whereas fiscal instruments may be subject of use by different layers of government. The argument for the centralization of monetary authority is that uncoordinated local creation of money would create inflationary episodes.

Nationwide stabilization policies are more effective than locally implemented ones, since national economies are normally less open than regional economies within a nation and capital is less mobile across national borders than across jurisdictional lines within a country. For instance, the effectiveness of locally implemented expansionary policies would be undermined by the fact that a sizable share of what is consumed locally is imported from other jurisdictions. The benefits of such policies would spill over those other jurisdictions. Therefore, provided local policymakers care only about the wellbeing of their constituency, decentralized stabilization policies would be implemented sub-optimally. As a

result, there exists a consensus that only the central government ought to perform the stabilization function.⁵

Mobility of residents across jurisdictions undermines sub-national governments' ability to achieve income redistribution goals. Local income distribution policies are likely to be self-defeating. These policies involve transfers of income from the wealthy to the poor, thus wealthy residents would have an incentive to migrate out while poor residents from other jurisdictions would have an incentive to migrate in. Income distribution policies, as a result, may actually increase the income gap.⁶ In contrast, the central government does not suffer from this problem because international mobility of residents is far more difficult than interjurisdictional mobility. Therefore, the performance of sub-national governments should not be evaluated according to the equity criterion. As a matter of fact, the intergovernmental allocation of spending responsibilities and revenue sources—discussed in the following two sections—are evaluated according to the efficiency criterion only.

Despite the arguments favoring the centralization of income redistribution policies, there is not a consensus on this issue. Rosen (1985, pp.510-511) argues that it is an empirical matter whether or not individuals' decision to locate in a

⁵ Actually, Persson and Tabellini (1996a) show that local governments should participate and be held accountable for the macroeconomic performance of the country. Otherwise, local governments would take more actions that may benefit them individually but harms the overall performance of the country.

⁶ Such outcome would hold even if all jurisdictions implement the same redistribution policy, provided fiscal residua from such policy varies across jurisdictions —Boadway and Wildasin, 1984, ch. 15.

community is influenced by the available tax-spending package. On theoretical grounds, Pauly (1973) makes the case for the optimality of locally implemented income redistribution policies, provided preferences for income redistribution vary across jurisdictions and people care mostly about the poor who live in their same locality. However, Pauly's analysis is based on restrictive assumptions such as immobile residents. Also, Pauly's assumption that residents care more about the poor living in their jurisdiction does not necessarily translate to demand for local redistribution policies; e.g., "voters are unwilling to provide for welfare payments, while willing to contribute to Community Fund activities" —Musgrave and Musgrave, 1980, p.525.⁷

In general, income redistribution programs should be centralized the more aggressive the redistribution goal is, the more mobile residents are, and the more similar the preferences for redistribution across jurisdictions are. Thus, different government levels may provide some income redistribution programs jointly. Federal government may finance and set the policy guidelines of the program, whereas local governments provide the information and infrastructure to target those segments of the population that needs the assistance the most.

In contrast to the economic stabilization and income redistribution functions, the debate arises when the intergovernmental assignment of allocation functions is analyzed. Indeed, the only consensus is that no government level

⁷ Persson and Tabellini (1996b) show that while locally provided income distribution programs would fall short of the socially desirable level, centrally provided income distribution programs would create incentives that would lead the program to exceed the socially desirable level.

should exclusively perform all the allocation functions. The optimal intergovernmental assignment of allocation functions has several dimensions, which the following two sections discuss.

Public spending and taxation are the fiscal instruments the public sector has to perform its allocation function.⁸ However, different factors determine the optimal intergovernmental assignment of each policy instrument. As a result, it is unlikely that the resulting fiscal arrangement would involve a one-to-one mapping between the intergovernmental allocation of spending responsibilities and revenue sources. In fact, lower government levels are generally assigned spending responsibilities that exceed their revenue collection faculties. This phenomenon is called *vertical fiscal imbalance*. Therefore, one may analyze the optimal intergovernmental assignment of spending responsibilities and revenue sources separately.

2.3 THE EXPENDITURE ASSIGNMENT.

This section discusses the determinants of the intergovernmental assignment of spending responsibilities. A socially desirable intergovernmental assignment of spending responsibilities should meet equity and efficiency criteria. The central government, as discussed above, better serves equity objectives than sub-national governments. The central government, thus, should better provide

⁸ Only fiscal instruments are considered since, as it is discussed above, locally run monetary policy is likely to create inflationary episodes and thus it is not subject to decentralization.

welfare programs such as food stamps, subsidized housing, and medical insurance. Sub-national provision of public goods and services is then to be evaluated according to the efficiency criterion only.

Efficiency requires that a public good be provided at a level such that its social marginal benefit equates its marginal cost. Efficiency requires then that the provider government knows and meets the preferences of its constituency,⁹ and internalizes all the benefits and costs from the provision of public goods and services.

Fiscal federalism literature prescribes that the lowest level of government *possible* should provide the public goods and services. According to Oates' Decentralization Theorem:

...in the absence of cost-savings from the centralized provision of a good and of interjurisdictional external effects, the level of welfare will always be at least as high (and typically higher) if Pareto-efficient levels of consumption of the good are provided in each jurisdiction than if *any* single, uniform level of consumption is maintained across all jurisdictions —Oates (1972, p.54).

This theorem acknowledges that the optimality of a decentralized provision of public goods and services is compromised when these spill their benefits and/or costs over other localities, or when there exist economies of scale and/or scope. Moreover, the theorem implicitly assumes that (1) preferences vary

⁹ This is necessary for economic agents to consume their desired bundle of public goods and services.

across jurisdictions, (2) a centralized regime would render a uniform provision of public goods and services across jurisdictions whereas a decentralized regime would not, (3) the presence of intergovernmental asymmetries in information; and (4) stronger accountability at lower levels of government.

Decentralized provision of public goods and services is desirable when local preferences vary across jurisdictions, provided the central government is prone to render a nationwide uniform provision of public goods and services. Asymmetries in information and accountability across layers of government support also the decentralized provision of public goods and services. A local government, given its proximity to its constituency, is likely to know the local preferences for public goods better than the central government. That is, local governments may possess an information advantage to better meet local preferences than the central government. On the other hand, local constituency may observe and evaluate the performance of its local government more easily than that of the central government. Therefore, one might expect that accountability is stronger for lower layers of government than for the central government.

In contrast, as the decentralization theorem states it, the presence of economies of scale in the provision of public goods and services calls for their centralized provision. Similarly, economies of scope would prevent the

decentralization of public goods and services currently provided by the central government.

The fact that some public goods and services spill their benefits/costs beyond the boundaries of the jurisdiction in which they are provided poses an inefficiency problem that works against their local provision. A local government that primarily cares about its own constituency would fail to internalize such spillovers, and so it would provide those public goods and services inefficiently. Centralized provision of this type of public goods and services would not suffer from the spillover problem.¹⁰ A central government cares about the residents in all the jurisdictions, and so it would internalize all the benefits and costs of the goods and services it provides.

Efficiency, then, requires Oates' (1972) *perfect correspondence* principle; e.g., a government organization where the jurisdiction that provides a public good includes precisely all the individuals who benefit from it. Such government organization, however, can hardly be implemented as it may require too many government layers with overlapping jurisdictions, which would sharply increase the operation costs of the public sector. Nonetheless, one can still draw policy recommendations from the correspondence principle. For instance, that the central government should intervene in the provision of those goods and services that generate interjurisdictional externalities; e.g., national defense, interstate

¹⁰ As discussed in the section on intergovernmental grants below, these may be used to overcome the spillover problem and thus allow local provision of goods and services with spillovers.

highways, health services, regional development programs, natural resources among others. On the other hand, local governments should provide those public goods and services whose benefits and costs do not extend beyond jurisdictional limits; e.g., for the municipality government level would include: streetlights, local public parks, city planning, local police, cemeteries, among others.

Fiscal federalism literature, in sum, prescribes that the lowest level of government possible should provide the public goods and services. Several factors determine the optimal intergovernmental assignment of spending responsibilities, as result, such determination should be performed on a case-by-case basis.

2.4 THE TAX ASSIGNMENT.

This section discusses the determinants of the intergovernmental assignment of revenue sources. The theory of public finance evaluates taxation according to efficiency and equity criteria.¹¹ That is, taxes are evaluated according to how they affect economic agents' behavior and how the tax burden is distributed among them. However, fiscal federalism literature considers only the efficiency criterion to determine the optimal intergovernmental assignment of revenue sources. Interjurisdictional mobility of economic agents, as discussed in section 2.2, prevents the existence of equitable local tax systems.

¹¹Other criteria include: administrative issues; the flexibility of the tax's revenue with the level of economic activity; and the ease a tax can raise revenue.

A tax is said to be efficient if it causes the lowest deadweight loss per revenue dollar collected. Taxes cause welfare or deadweight losses by inducing economic agents to switch away from otherwise optimal behavior. Taxation¹² induces changes in the behavior of economic agents by altering the relative price of commodities. For example, if a new tax were levied on capital goods used in industry X only, capitalists would have an incentive to switch its investments from X to tax free industries Y. The flow of capital from X to Y would continue until the after tax rate of return on capital in X equates the rate of return in Y. Similarly, a specific tax on capital may induce economic activities to shift to more labor intensive technologies. Therefore, taxes may produce an inefficient allocation of resources among the different productive activities in the economy.

In addition to allocation efficiency, federal regimes should also take into account the distortions local taxes may create on the geographical location of economic resources. If capital gains are taxed at locality A but not at B, for instance, capital would flow from A to B until the after tax rate of return on capital at A equates the rate of return at B. Location efficiency then calls for an intergovernmental assignment of revenue-raising authority that minimizes the welfare losses from distorting the geographical location of economic resources. Fiscal federalism literature weighs heavily this location efficiency criterion.

¹² Lump-sum tax excluded.

In a federal regime, lower levels of government find it optimal to create both allocation and location distortions. In order to reduce the tax bill its constituency pays for the consumption of public goods and services, for instance, a local government would levy *source-based* taxes as opposed to *resident-based* taxes, so that residents from other jurisdictions pay for local public spending.¹³ On the other hand, local governments may compete for tax bases. In order to attract businesses to locate in its jurisdiction, a local government would offer fiscal incentives such as tax abatements. Several jurisdictions may compete to attract the same factory, which would increase the tax abatement the factory finally gets. Tax abatements may also result from a threat of relocation. At the end, the outcome of *tax competition* would be that local governments collect less tax revenues than they would otherwise.

In order to minimize the distortions in the geographical location of mobile factors of production, fiscal federalism literature (Oates, 1996; Musgrave, 1983) proposes that revenue sources should be assigned according to the following principles:

- local governments should rely on benefit taxation —e.g., user fees— of mobile economic units; otherwise, economic agents would avoid the tax by moving their resources to a jurisdiction that has not such type of tax or at least has a lower tax rate.

¹³ To the extent that tax exporting is successful, it reduces the effective price of locally provided public goods and services, which would induce local constituents to increase the consumption of them. Local jurisdictions would then over provide public goods and services. At the aggregate, the economy would inefficiently allocate more resources to the public sector than it would otherwise.

- central government should levy non-benefit taxes of mobile economic units —e.g., individual and corporate taxes—, given that mobility across national boundaries is far more restrictive than mobility within a nation.
- local governments may levy non-benefit taxes but on immobile tax bases —e.g., property taxes—, since taxes cannot be avoided by moving the base out of the jurisdictions that levies them.

In a federal regime, therefore, efficiency calls for the centralization of the most productive, mobile tax bases and, at the same time, for the assignment of allocation functions to the lowest layer of government possible. The outcome is then a mismatch in the assignment of spending responsibilities and revenue collection faculties at each layer of government. Sub-national governments, in particular, are negatively affected by such vertical fiscal imbalance. Nonetheless, as discussed in the next section, an appropriate set of grants-in-aid may remedy this problem.

2.5 INTERGOVERNMENTAL GRANTS-IN-AID.

This section presents the mainstream literature treatment of grants-in-aid, in particular, the response of recipient jurisdictions to them. Intergovernmental grants are deemed as a key component to federal regimes. These grants can be used to minimize the cost inherent to the decentralized provision of public goods

and services. Fiscal federalism literature (Oates, 1968, 1972; Musgrave and Musgrave, 1980; Boadway and Wildasin, 1984) supports the use of intergovernmental grants as policy instruments to address the efficiency and equity problems that arise in a decentralized regime. Intergovernmental grants may be used to correct for the spillover problem in the local provision of public goods and services. Grants-in-aid may also be used to transfer purchasing power from wealthy jurisdictions to poor ones.

Taxonomy.

The classification of intergovernmental grants is commonly based on the form of the grant. Grants-in-aid are then broadly divided into conditional and unconditional —Rosen (1985), Boadway and Wildasin (1984). Gamkhar (2002) offers a more comprehensive taxonomy of intergovernmental grants, which classifies grants according to their form, funding constraints, and distribution method. Gamkhar (2002) classifies grants into three broad categories: categorical, block, and revenue-sharing grants. Table 2.1 summarizes the different types of intergovernmental grants.

Categorical grants have strings attached so that the recipient government uses the grant monies for specific functions —e.g., grants for school lunches or computers for public schools—, which the grantor government specifies. Block grants, on the other hand, provide the recipient government with more discretion

as to how to spend the grant monies over a broader set of functions —e.g., a grant for education in general. Revenue-sharing grants, in contrast, impose no restriction on the behavior of the recipient government;¹⁴ thus, these grants can be considered general revenues for the recipient government.

Table 2.1: Classification of intergovernmental grants.

Design Type	Categorical			Block ^b	Shared Revenues	
	Non-Matching	Matching	Cost Re-imbursed			
		Open-Ended	Closed-Ended ^a			
Features	(1)	(2)	(3)	(4)	(5)	(6)
Matching required	None	Yes	Yes	None	None	None
Federal funding limitation	Yes	None	Yes	None	Yes	Yes
Formula (f) project (p)	f/p	f	f/p	f	f	f

Notes:

- a. Federal share of the matching funds stops once the appropriation limit on federal funding is reached.
- b. Most block grants have no requirement of statutory matching funds from the grant recipient.

Source: Gamkhar (2002)

Categorical grants are further classified as non-matching, matching, and cost-reimbursement grants. Matching grants specify a formula according to which

¹⁴ Revenue-sharing transfers are called unconditional grants, too. Fiscal federalism literature, also, commonly treats unconditional grants as lump-sum grants; however, this dissertation work discusses the need to differentiate one from the other in chapter 5.

the recipient government matches each grant-dollar with a certain number of dollars from its own revenues. The grantor government may cap the amount of money it is transferring through a grant —e.g., closed-ended matching grant— or may not —e.g., open-ended matching grant. Non-matching grants do not impose the matching requirement onto the recipient government, but do impose a limit to the funding level. The grantor government uses cost-reimbursement grants to cover all the expenses the recipient government incurred in specific grantor's programs.

Grants-in-aid are also classified according to the method of distribution as: formula or project based grants. Formula based grants are commonly distributed according to the characteristics of the recipient jurisdictions —e.g., population, provision level of specific public goods or services, among others—, whereas project based grants are distributed according to the merits of the project presented by the recipient jurisdiction.

Budget Effect.

Intergovernmental grants are a policy instrument the grantor government has to attain certain policy goals, like correcting for spillovers or equalizing tax bases. Alternative grant structures may serve different policy goals, since each goal may require a specific behavior on behalf of the recipient government. Grants can alter the recipient government's behavior through changes in its

resource constraint. The literature commonly assumes that the nominal restrictions attached to grant programs determine their impact on the recipient government's resource constraint.

Figure 2.1: Budget effect from alternative grants programs.

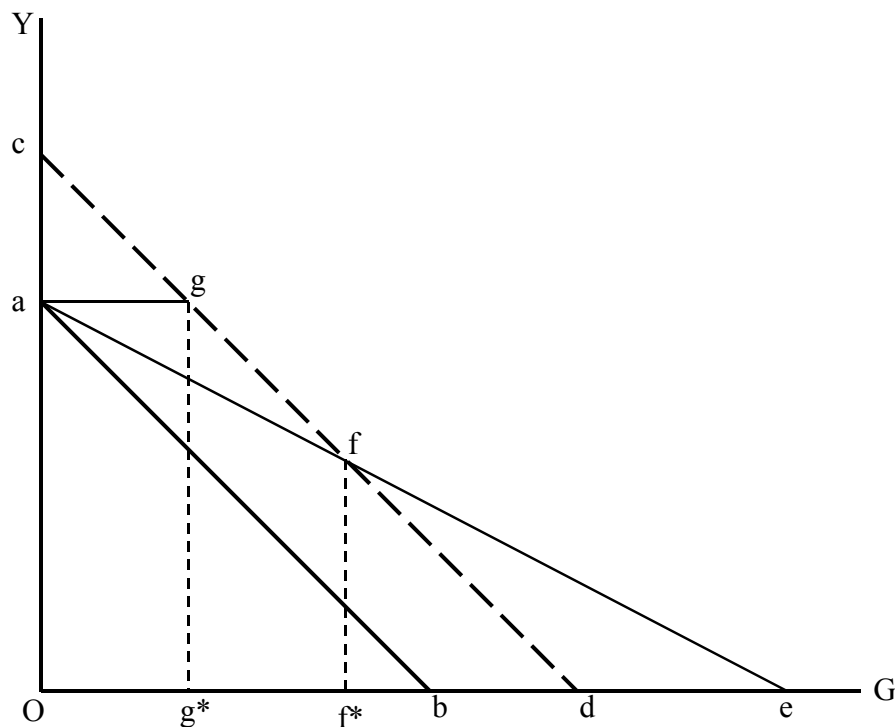


Figure 2.1 summarizes the budget effects from alternative grants-in-aid for the case of a two-sector local economy, where G and Y denote the public and private good, respectively. Let the triangle Oab represents the locality's pre-grant resource constraint. Assume further that the unit of measure of G and Y are such that the price of each good is normalized to one. As a result, the slope resource

constraint frontier, segment ab , equals 1. Even more, a \$1 increase in public spending would increase the provision level of G in 1 unit. The same holds for Y .

Consider the case of a revenue-sharing grant that increases the recipient jurisdiction's fungible resources by $\$(O_d - O_b)$. Such unconditional grant would transform the jurisdiction's resource constraint into triangle Ocd . The frontier of the resource constraint shifts out in a parallel fashion, which reflect the fact that unconditional grant monies are fungible resources to the recipient jurisdiction. That is, the revenue-sharing grant has income effect only.

The budget effect from an open-ended matching grant with constant subsidy rate, σ ,¹⁵ can be represented by the triangle Oae . The border of the resource constraint pivots outwards at the pre-grant maximum attainable level of the private good. Matching grants, through its subsidy component, reduce the relative price of the public good. In this case, the relative price of the public good drops from 1 before the grant, to $(1 - \sigma)$ after the grant. The budget effect from a closed-ended matching grant with constant subsidy rate, on the other hand, can be represented by the trapezoid $Oafd$. In this case, the grant subsidizes the price of the first O_f^* units of the public good only.

Consider now the case of a grant that constraints the recipient government to allocate all the grant monies to the provision of the public good. Assuming the

¹⁵ If the recipient jurisdiction, for instance, must match every dollar it receives through the matching grant with one dollar from its own resources, then, $\sigma = 0.50$.

size of this grant is $\$Og^*$, it would then transform the pre-grant resource constraint Oab into trapezoid $Oagd$. This type of grant does not alter the relative price of the public good.

Allocation Effects: Utility-Maximizing Approach.

The traditional approach (Henderson, 1968) to grants-in-aid assumes the existence of a benevolent social planner who allocates the jurisdiction's scarce resources between a private and a public good, in order to maximize the locality's social welfare function. Moreover, assuming convex social preferences, the standard consumer theory is used to analyze the effect that grants have on the allocation of a recipient jurisdiction's resources. The literature assumes also that recipient governments indeed observe the nominal restrictions attached to grants.

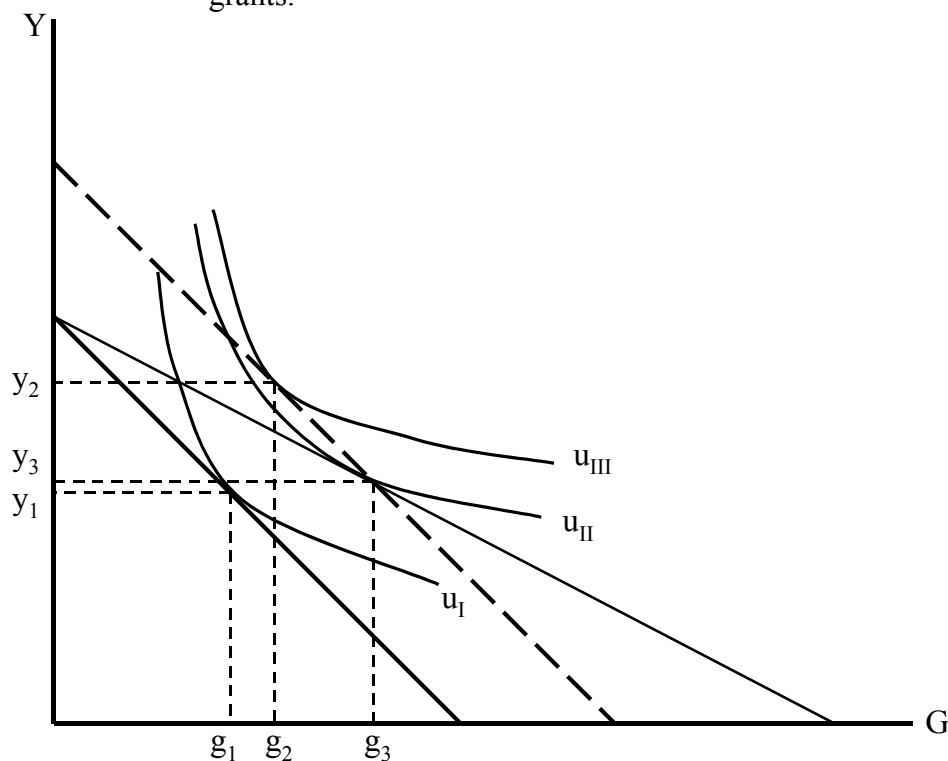
Figure 2.2 depicts the recipient jurisdiction response to a revenue-sharing grant and an open-ended matching grant with constant subsidy rate, where both grants provide an equivalent funding level.¹⁶ The pre-grant allocation is (g_1, y_1) . The unconditional grant induces a larger provision of both private and public good,¹⁷ which is shown by the after-grant allocation (g_2, y_2) . The increase in the provision of the private and public good is determined by the corresponding propensities to consume out of income. The local public sector receives the unconditional grant, but the benevolent social planner would then transfer some of

¹⁶ The basket (g_3, y_3) is feasible under either of the two grant programs being considered.

¹⁷ Provided both goods are normal goods.

these monies to private economic agents through cuts in local taxes. Unconditional grants, thus, may be seen as a veil for the tax cut —Gramlich (1977).

Figure 2.2: Allocation effects from revenue-sharing and open-ended matching grants.



The open-ended matching grant program, since it subsidizes the provision of the public good, has a larger expansionary impact on the provision of the public good than the unconditional grant; e.g., $g_3 > g_2$. The recipient jurisdiction, according to the case figure 2.2 depicts, uses some grant monies to substitute for local own revenues that would otherwise financed the provision of G ; e.g., $y_3 >$

y_1 . Even more, if the demand for the local public good is elastic with respect to its price, then the subsidy component would induce the recipient jurisdiction to allocate more own revenues to the provision of G ; e.g., increase local taxes, which would then reduce the provision of Y .

Figure 2.3: Equivalence of different grant programs, a special case.

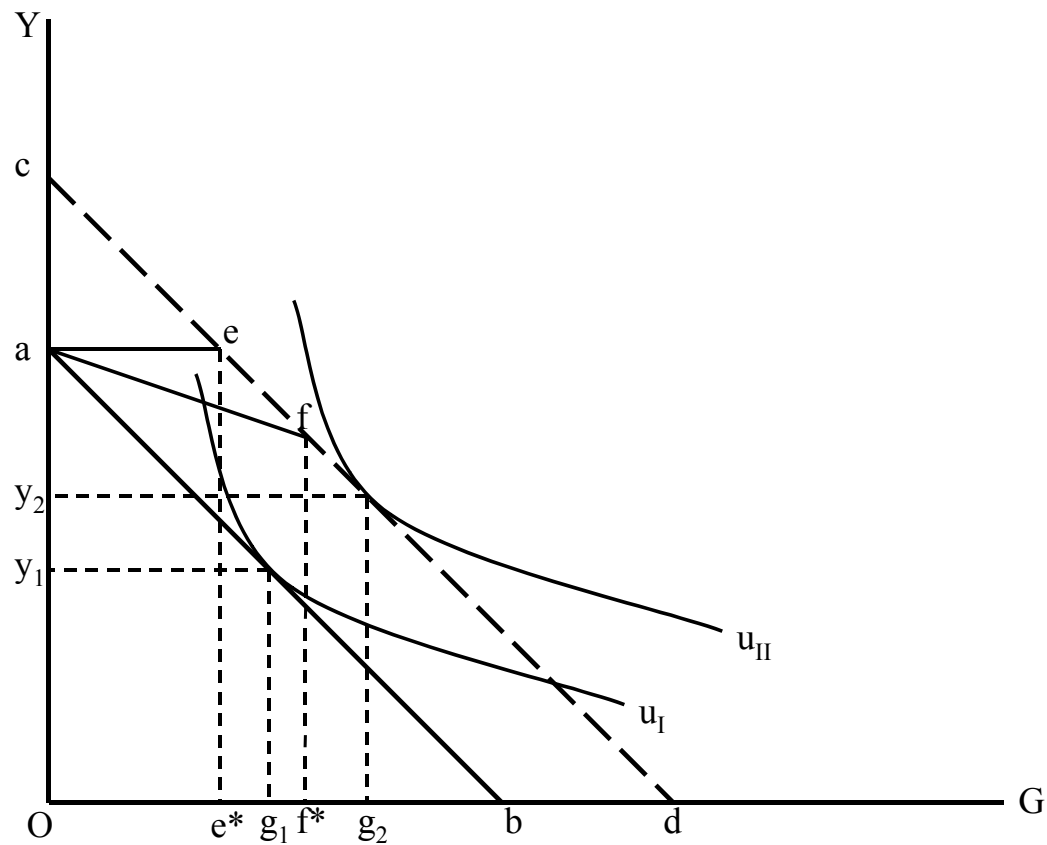


Figure 2.3 depicts a special case where the response of the recipient jurisdiction does not vary with the type of grant it receives. Assume the pre-grant resource constraints that the locality faces is given by Oab , thus, (g_1, y_1) denotes the pre-grant allocation of resources. Consider the following grant programs: (1) an unconditional grant that transforms the jurisdiction's resource constraint into Ocd ; (2) a grant that requires the recipient jurisdiction to spend all grant monies in the provision of the public good, which then transforms the jurisdiction's resource constraint into $Oaed$; (3) a closed-ended matching grant that subsidizes only the first Of^* units of the public good, which then transforms the jurisdiction's resource constraint into $Oafd$. If the recipient jurisdiction were to receive either of these three grant programs, its after-grant allocation decision would be the same, (g_2, y_2) —as long as the after-grant allocation falls on the segment fd of the after-grant resource constraint frontier.

The graphical analysis also points to the equivalence between a revenue-sharing grant of size $\$M$ and an equal increase in the jurisdiction's private income.—In terms of figure 2.3, $(Od - Ob) = (Oc - Oa)$ — Indeed, the after-grant allocation would always be the same in these two cases. This outcome is summarized as follows,¹⁸

But the fact that lump-sum grants and increases in income have indential impacts on the budget constraint immediately implies that one-dollar increase in lump-sum grants should have exactly the same effect on local spending as one-dollar increase in community income. Note that the theory does not specify what either of these propensities to spend must be.

¹⁸ This quote offers also an example where the term lump-sum grant is used instead of unconditional grant.

That depends on the indifference map, and more specifically on the shape of the income-expansion path, or income elasticity of demand for public goods. But the theory does specify that the two propensities should be identical —Boadway and Wildasin, 1984, p. 530.

The empirical validity of this last outcome is relevant for the purpose of this dissertation work, which focuses on analyzing the revenue-sharing program in Mexico. Therefore, the following sections would focus on the so called “flypaper effect” that implies that the marginal propensity to consume the public good out of unconditional grant monies is larger than the marginal propensity to consume the public good out of community’s private income.

Allocation Effect: A Note on the Voting Approach.

Bradford and Oates (1971 a, b) criticize the traditional utility-maximizing model on the grounds that intergovernmental grants are awarded to communities, collectivities, rather than a single decision maker. This distinction is relevant since the decision-making process is different in each case. A model that studies the allocation effects of intergovernmental grants should then include the process the collectivity goes through when deciding the after grant allocation of resources. Nonetheless, the voting model does not reverse the main outcomes from the utility-maximizing model discussed above.

Bradford and Oates (1971 a, b) assume that local governments allocate their resources according to the outcome of a political process where individuals

vote for the allocation closest to their most desired one. It is assumed that the nominal restrictions attached to grant programs are indeed observed. In this scenario and under some restrictive assumptions, there exists an individual whose vote decides the outcome of the election; e.g., the median voter in the simple majority rule case. The allocation effects of intergovernmental grants would then depend on the preferences of this decisive voter.

The voting model, under certain assumptions, is similar to the traditional-utility maximizing model in the sense that both base their analysis on the preferences of a single individual: the decisive voter and the social planner, respectively. Indeed, both models prescribe that open-ended grants have a larger expansionary impact on public spending than unconditional grants. Furthermore, if the unconditional grant is distributed among the individuals in a jurisdiction according to their share of local taxes, then,

A straightforward implication of the median voter rule is that a \$1 increase in community income has exactly the same impact upon public spending as receipt of \$1 unconditional grant —Rosen, 1985, p. 533.

Allocation Effect: Budget-Maximizing Approach.

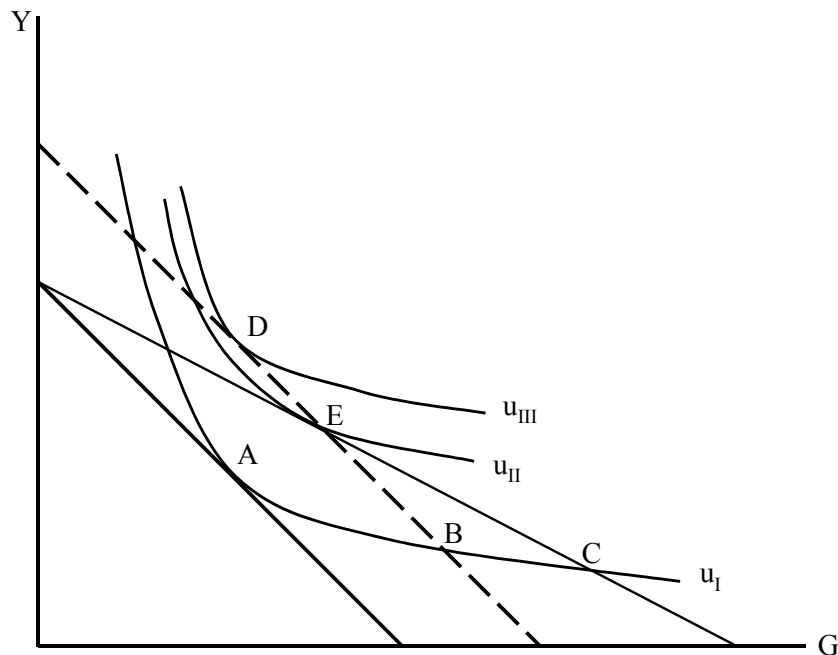
McGuire (1973) proposes a comprehensive review of the literature on intergovernmental grants in order to include crucial factors in the determination of grant effects, such as the assumed decision-making process at the recipient level, the objectives of the grantor, and discriminating tactics by the grantor. The

allocation effect of grants, for instance, would vary if bureaucrats in the recipient jurisdiction decide the allocation of resources instead of a social planner or through a voting process. This approach to grants-in-aid does render different outcomes than the previous two approaches.

Bureaucrats, according to Niskanen (1968), have preferences defined over their salary, political power, public reputation, and other perquisites of holding public office. The size of the budget of their offices, in particular, is a proxy for bureaucrats' preferences; e.g., the larger the budget the better. Thus, the bureaucracy model assumes a (public) budget-maximizing behavior at the recipient level. Since the use of intergovernmental grants undergoes complex bureaucratic processes, McGuire (1973) regards the budget-maximization assumption as compelling as the utility-maximization.

The recipient jurisdiction, according to the budget-maximizing bureaucracy model, would use all the grant monies to expand the provision of the public good regardless of the grant type it receives. Consider the cases of two equivalent sized grant programs, an unconditional grant and an open-ended matching grant. The pre-grant allocation of resources is given by point A in figure 2.4. If a benevolent social planner were to run the jurisdiction, she would choose allocation D in response to the unconditional grant and allocation E in the case of the open-ended matching grant.

Figure 2.4: Allocation effect under utility and budget-maximizing behavior.



In contrast, if a self-interested bureaucracy were to run the local government, it would increase the public budget to a maximum sustainable level, given the jurisdiction's resources and the constituency's preferences. Thus, the local bureaucracy would choose allocation B in response to the unconditional grant and C in the case of the open-ended matching grant. In either case, the local bureaucracy increases the public budget to a maximum level such that the constituency's utility level does not drop below its pre-grant level, u_I . "Output maximizing bureaucracy exploits all substitution possibilities whether the grant is conditional or unconditional." —McGuire, 1973, p.211. Bureaucrats may even expand government spending in excess of the grant size, by increasing taxes,

because the expanded provision of the public good may compensate the local constituency for the forgone consumption of the private good.

Although the budget- and utility-maximizing approaches render different after-grant allocations, the budget-maximizing approach also prescribes that an open-ended matching grant would have a larger expansionary effect in public spending than an equal sized unconditional grant. That is, allocation C involves a larger consumption of the public good than allocation B.

The bureaucracy model renders a very different outcome, regarding the allocation effect from an unconditional grant and that from an equally sized increase in the community's private income, than the mainstream theory. The jurisdiction, according to the mainstream approach, would choose the same allocation of resources in either of those two cases. In contrast, according to the bureaucracy model, if the jurisdiction receives an unconditional grant the local bureaucracy would try to spend all grant monies in the provision of the public good. Indeed, as mentioned above, the bureaucracy may end up increasing public spending in excess of the grant size. On the other hand, if the jurisdiction instead observes an equally sized increase in community private income, the local bureaucracy would not dare to increase tax collection by the size of the increase in community private income.

Therefore, the bureaucracy model prescribes that an unconditional grant would have a far larger expansionary impact on public spending than an equally sized increase in the community private income.

Public Policy Implications.

Intergovernmental grants are a set of policy instruments that may remedy some of the problems that a federal regime faces in the provision of public goods and services; e.g., spillovers, vertical fiscal imbalance, equity issues. The policy recommendations discussed below are drawn from the utility-maximization approach to intergovernmental grants.

A jurisdiction that does not internalize all the benefits or costs from its provision of a public good would not provide the socially optimal level of it. Categorical matching grants may induce local governments to optimally provide those public goods and services with interjurisdictional spillovers. This type of grant, through its matching formula, *de facto* reduces the relative price at which a community purchases the total benefit from a public good. If the *pigovian* price is set correctly —e.g., the grantor's share of total cost equates total benefits spilt over other jurisdictions by the public good—, then the local governments would provide the socially desirable level of the public good.

Vertical fiscal imbalance refers to lower layers of government having more spending responsibilities than financial resources, thus, there would be a need for monetary transfers from the central government to lower government levels. Revenue-sharing and block grants may be used as the policy instrument to accomplish such task.

Block grants may also be used for equity purposes by the central government. In a federal regime, horizontal equity requires that two individuals with the same ability to pay be treated the same way, regardless of the jurisdiction in which they reside. Even when two individuals with the same ability to pay consume the same bundle of public goods and services, they may not be treated equally if one individual lives in a richer jurisdiction than the other. In order to afford the same bundle of public goods and services as the rich jurisdiction, the poor one needs to exercise a higher fiscal effort. That is, the fiscal residua¹⁹ for individuals with the same ability to pay but residing in different jurisdiction may not be the same, as it should be according to horizontal equity. Fiscal equity may be improved by equalizing fiscal capacities across jurisdictions, which may be performed by increasing poor jurisdictions' purchasing power through block grants.

¹⁹ Fiscal residuum is the difference between the value of the public goods and services consumed and the tax payment.

2.6 THE “FLYPAPER EFFECT.”²⁰

The flypaper effect refers to the empirical finding that unconditional grants have a larger expansionary impact on local public spending than an equal sized increase in the community private income. This section presents an overview of the literature on the flypaper effect: empirical literature and theoretical models. The discussion of the flypaper effect is extended in chapter 5, where a new theoretical model is developed and tested.

Empirical Literature.

Consider the following types of grants-in-aid: open-ended matching, case A grants; unconditional, case B grants; and closed-ended, case C grants. Gramlich (1977) reviews the empirical literature on grants-in-aid and summarizes the findings as follows,

That case A grants generally result in somewhat less spending than the size of the grant, indicating that the price elasticity of demand for most services is probably somewhat less than unity

That case B grants result in some tax reduction and some expenditure increase, with the expenditure increase less than for case A grants, as would be predicted by the theory.

That case C grants, on the other hand, stimulate much more spending than central-government tax cuts in the long-run, indicating at a minimum the need for some revision in political theories that feature a harmony of interests between bureaucrats and voters.

²⁰ Arthur Okun, according to Hines and Thaler (1995), coined the term “flypaper effect” to reflect the empirical finding that a government transfer “sticks where it hits.”

That case C grants stimulate total spending roughly equal to the grant, generally slightly more spending than is stimulated by case A grants—either because they are given in areas where demand is more elastic, because they are large relative to existing expenditures, or because they come with effective effort-maintenance provisions. —Gramlich, 1977, p. 234.

The third finding above represents an “anomaly” in the effect of unconditional grants. Mainstream theory, as discussed in the previous section, prescribes that an unconditional grant and an increase in private resources of the same amount have the same effect on the recipient jurisdiction’s resource constraint and so on its allocation decision. In other words,

either measure should increase public spending by the income elasticity of demand, with the remainder going into increased private spending [Oates (1972)]. If a central-government tax cut of \$1 would raise local spending and taxes by \$0.10, central-government revenues sharing of \$1 would also raise local spending by \$0.10, lower local taxes by \$0.90, and raise total local revenues (taxes plus grants) also by \$0.10. As classical economists might say, revenue sharing is a veil for the tax cut —Gramlich, 1977, p.225.

In contrast, empirical findings suggest that unconditional grants have a far larger expansionary impact on the recipient jurisdiction’s public spending than an equal sized increase in private resources. Hines and Thaler (1995) conclude that, on average, a one dollar increase in unrestricted block grants would increase local public spending by roughly the same amount; however, a one dollar increase in the community’s private income would increase local public spending by five to ten cents.

A further issue is whether recipient governments react in the same way to either increases or decreases in unconditional grants; e.g., symmetric response. For instance, if a one dollar increase in the grant leads to a fifty cents increase in public spending, then a one dollar reduction in the grant would lead to a fifty cents reduction in public spending. Gramlich (1987) argues that the symmetric response to grants is not likely, because government programs develop clientele groups that would exercise political pressure to maintain their level of services. Gamkhar (2002) surveys the still developing literature on this issue, where all the reported empirical estimates does not support the asymmetric response to grants but for Gamkhar and Oates (1996)

Modeling the Flypaper Effect.

Gramlich (1977) suggests that the flypaper effect calls for a revision of the theoretical model used to analyze intergovernmental grants. In particular, the empirical evidence seems to support alternative models like the Niskanen-McGuire bureaucracy model discussed in the previous section. Indeed, several models have been developed in order to accommodate the flypaper effect in the theory of grants-in-aid —See Schwallie (1989), Quigley and Smolensky (1992), and Hines and Thaler (1995) for literature reviews.

Fiscal illusion is one proposed explanation to the presence of the flypaper effect —Courant, Gramlich, and Rubinfeld (1979); Oates (1979); Filimon,

Romer, and Rosenthal (1982). This literature assumes budget-maximizing bureaucrats at the local government level, who are able to conceal relevant information about the unconditional grants the jurisdiction receives; e.g., the amount of the grant or even its type. In such asymmetric information scenario, voters may perceive a reduction in the effective average price ²¹ they pay for the public good. Voters would further misinterpret the perceived reduction in the effective average price of the public good as a drop in its marginal price. Voters would then be willing to vote for a larger government budget than otherwise. In this sense, unconditional grants may create a fiscal illusion that induces communities to allocate more resources to the public sector than what they would otherwise.

Romer and Rosenthal (1978), on the other hand, argue that the flypaper effect may result in situations where budget-maximizing bureaucrats control the budgeting agenda; e.g., they set the budget level that is voted on in a local election. Assuming there exists an exogenous “reversion” level of public spending—e.g., the one that would take place if voters reject the bureaucrats’ proposed spending level—, bureaucrats may “force” voters to accept a budget level larger than the most preferred by the decisive voter if the reversion level is low enough. In this situation, bureaucrats may use all the grant monies to expand the provision of public functions.

²¹ The actual average price of public goods is $[(\text{local tax revenues} + \text{grant}) / \text{cost of the public goods}]$; with no knowledge of the unconditional grant, voters would observe an effective average price of $[\text{local tax revenues} / \text{cost of the public goods}]$.

The fiscal illusion and agenda control models both portray the flypaper effect as the outcome of inefficient behavior on behalf of the recipient jurisdiction. Quigley and Smolensky (1992), in contrast, argue that the flypaper effect is rather an efficient outcome when one internalizes the costs that the recipient government would incur to change its tax rates whenever the size of the unconditional grant changes.

Does the Flypaper Effect Exist?

Some literature suggests that the “existence” of the flypaper effect is due to specification errors in the models used to test for the presence of this phenomenon. The empirical literature that uses closed-ended matching grants to test for the existence of the flypaper effect may suffer from specification error. A closed-ended matching grant, as discussed in section 2.5, becomes *de facto* into an unconditional grant once the funding cap is met. Nonetheless, the recipient jurisdiction of a closed-ended matching grant does face a kinked resource constraint, as a result, the demand function would be non-linear which then requires the use of maximum likelihood estimation —Moffit and Nicholson (1982), Moffit (1984, 1986), Hausman (1985).

Megdal (1987) runs Monte Carlo experiments and finds that those models that treat closed-ended grants as if they were unconditional grants produce upward biased estimates of the marginal propensity to spend the grant, which then

lead to the erroneous conclusion that the flypaper effect exists. Moffitt (1984) finds also that the flypaper effect disappears when AFDC —Aid to Families with Dependent Children— transfers are modeled to produce a piece-wise resource constraint for the recipient jurisdictions.

Barnett, Levaggi and Smith (1991), in contrast, test the performance of a flypaper model against a competing model that correctly specifies the recipient government's budget constraint —e.g., the constraint becomes piece-wise linear in the case of a closed-ended matching grant—; nonetheless, they find that the flypaper model seems to outperform the competing model for the case of English local governments.

Empirical literature on grants commonly assumes that the size of the grants is exogenous to the recipient government, following O'Brien (1971) finding that the grant size and the recipient governments' spending level are not simultaneously determined. This assumption may be a source of specification error, too. Islam and Choudhury (1990) find that, for the case of provincial grants to municipalities in Ontario, the size of the —conditional or unconditional— grant and the recipient government's level of spending are simultaneously determined. Fisher (1979) argues that, provided revenue-sharing grants are allocated according to the recipient government's tax effort, these grants may induce the recipient government to further increase its tax collection —and so its public spending— in order to increase the size of the grant. The endogeneity problem is particularly

relevant for those studies that use matching grants to test the flypaper effect, since the larger the recipient's spending the larger the matching grant size.

In sum, there is yet no conclusive evidence that either supports or rejects the existence of the flypaper effect. This dissertation work, in chapter 5, develops and empirically tests a novel theoretical model to explain the existence of the flypaper effect when unconditional grants account for most of the recipient governments' budget. The revenue-sharing program in Mexico provides a natural laboratory to test the model.

CHAPTER 3: ANALYSIS OF THE MEXICAN FISCAL FEDERALISM

3.1. INTRODUCTION.

This chapter analyzes the fiscal federalism regime in order to improve the understanding of intergovernmental relations in Mexico and contribute to the current debate over the reform of the fiscal federalism regime in that country. The observed centralization of public spending responsibilities in Mexico departs from what the fiscal federalism literature prescribes as optimal, but this is not the case for the centralization of public revenue sources. Nonetheless, in Mexico the primary focus is on revenue decentralization.

The policy recommendations to increase financial resources to sub-national governments include increasing revenue-sharing transfers, allowing state surtaxes on federal revenue sources like the income tax and value-added tax, increasing state collection of own revenues, and the devolution of some tax bases. The implementation of these policies, however, may not be practical, have minimal budget impact, or alter the geographical allocation of resources such that it primarily benefits those states with more developed markets. Indeed, this chapter raises concerns about the potential efficiency losses and income redistribution from the above mentioned policy recommendations.

The next two sections describe the fiscal federalism regime and the system of federal transfers in Mexico. This is followed by an analysis of policy alternatives to reform the fiscal federalism regime in Mexico and then by concluding remarks.

3.2. MEXICO: A CENTRALIZED FISCAL REGIME.

Mexico is a Federal Republic with three layers of government: federal, state, and municipal. The Constitution establishes the intergovernmental assignment of public responsibilities, albeit in a broad sense. Intergovernmental agreements further specify the revenue sources and spending responsibilities across layers of government. The outcome of this institutional arrangement is a centralized fiscal regime.

The constitution assigns exclusive spending responsibilities and revenue sources to the federal and municipal governments.²² State governments may perform any public function that is not prohibited to them or exclusively assigned

²² Federal government has exclusive responsibility over national defense, international relations, international and interstate trade, monetary policy, regional development, among others. Municipal governments have exclusive responsibility over street cleaning, parks and public gardens, local police and fire protection, cemeteries, public markets, slaughterhouses, among others. On the other hand, federal government has exclusive faculty to collect revenues from international trade, natural resources, insurance and credit institutions, excise taxes —tobacco, alcoholic beverages, electric power—, among others. Municipal governments have exclusive faculty to collect property taxes; other sources include federal grants, user fees, lease/sell of own properties, as well as those revenue sources approved by local legislatures.

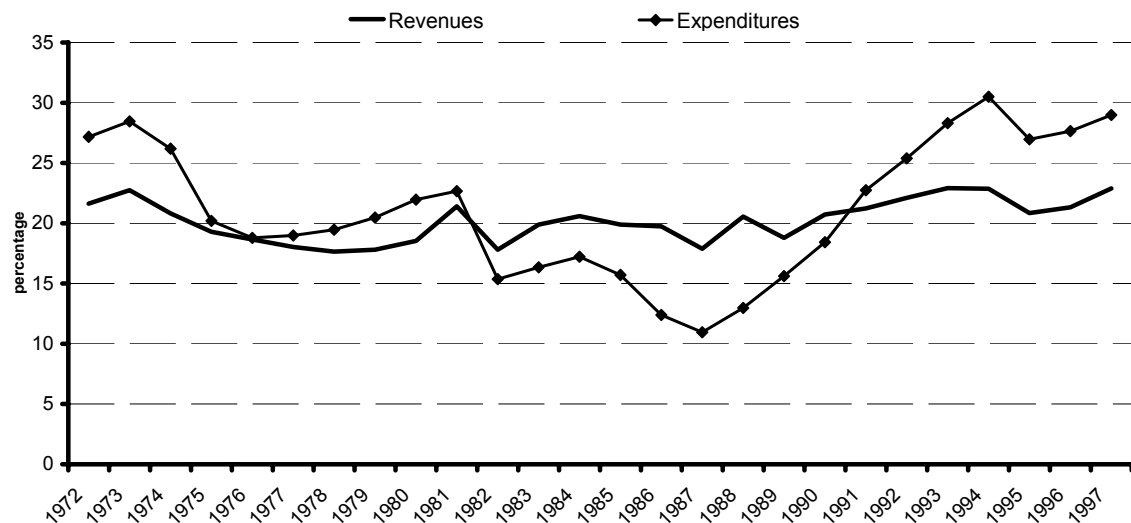
to another government level. The constitution explicitly states the concurrence in spending responsibilities like education, public health, city planning, and environmental protection. The Constitution also implicitly allows for tax concurrence when it grants the National Congress the faculty to collect all the revenues needed to finance the federal budget. Federal and sub-national governments have addressed fiscal concurrence through different coordination mechanisms over time.

Figure 3.1 shows that sub-national governments in Mexico have a low participation in both total government expenditures and revenues.²³ Over the period 1972-1997, on average the shares of sub-national governments in total government expenditures and revenues are 21.15 and 20.25 percent, respectively. Figure 3.2 shows that sub-national governments in Mexico have a greater fiscal role than those in centralized countries like Chile and France. The reverse is true when Mexico is compared to decentralized countries like Argentina, Brazil, Canada and the United States.²⁴

²³ Sub-national governments' revenues include tax and non-tax revenues, intergovernmental transfers and other grants.

²⁴ Surprisingly, the data shows that sub-national governments in Mexico have a larger role in public spending than sub-national governments in the United States. This result may be explained by the fact that central government expenditures include defense and interest payment, which are rarely decentralized and vary across countries.

Figure 3.1: Sub-national governments' share in total government revenues and expenditures, 1972-1997



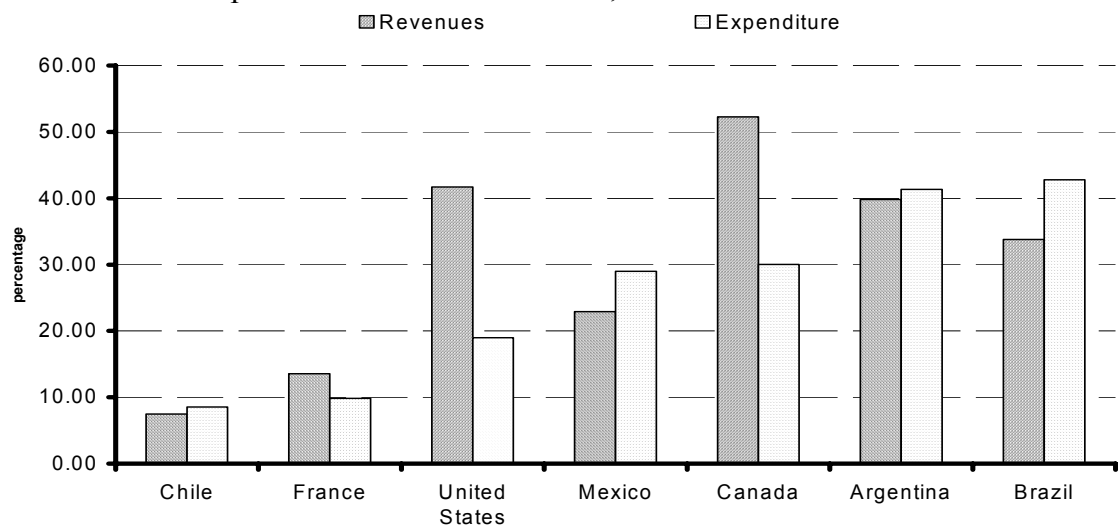
Source: Graph furnished by author with data from the World Bank.

The observed centralization of tax collection in Mexico follows the fiscal federalism literature.²⁵ The federal government collects revenues from mobile tax bases like income and consumption, whereas sub-national governments collect revenues from immobile tax bases, like land, and rely on benefit-taxation. The federal government also collects excise taxes on gasoline, tobacco, and alcoholic beverages, the consumption of which cause negative externalities. The decentralized collection of such taxes may suffer from tax competition too. Table 3.1 shows that the federal government collects revenues from the richest sources

²⁵ See discussion in chapter 2.

whereas sub-national governments rely more on non-tax²⁶ than on tax revenues, with the main source being revenue-sharing transfers.

Figure 3.2: Sub-national governments' share in total government revenues and expenditures: selected countries, 1997



Source: Graph furnished by author with data from the World Bank.

In contrast, the actual intergovernmental assignment of public spending in Mexico departs from what the fiscal federalism literature prescribes as optimal — see table 3.2. Mexico presents a centralized fiscal regime where the federal government is involved in functions that are better suited for sub-national governments, such as provision of water, housing, hospitals, culture, sewerage, streets, among others. Similarly, state governments are involved in functions that

²⁶ These include user-fees —*derechos*—; sell and lease of public assets and interest charges —*productos*—; and other revenues that include penalty and late fees —*aprovechamientos*.

are better suited for municipal governments like city planning, transit, and local trade regulation.

Table 3.1: Effective own revenues by level of government, 1999 (millions of current pesos)

	FEDERAL	%	STATE	%	MUNICIPAL	%
Total	674,348.1	100.00	143,309.3	100.00	49,139.5	100.00
Tax Revenues	521,682.4	77.36	7,037.3	4.91	6,584.1	13.40
Income Tax	216,123.4	32.05				
Value Added Tax	151,183.5	22.42				
Excise Taxes	106,703.7	15.82				
Ordinary Income			2,868.4	2.00		
Payroll			2,347.5	1.64		
Property			41.7	0.03	3,984.0	8.11
Transfer of Property			548.4	0.38	1,775.7	3.61
Vehicle ownership			178.7	0.12	51.4	0.10
Occupancy			323.0	0.23		
Commerce					732.8	1.49
Other	47,671.8	7.07	729.4	0.93	40.6	0.08
Non-Tax Revenues	152,665.7	22.64	17,031.0	11.88	8,823.4	17.96
Oil Fees	90,465.0	13.42				
Others	62,200.7	9.22				
Derechos (Fees)			6,054.9	4.23	3,733.5	7.60
Productos			6,319.9	4.41	1,575.3	3.21
Aprovechamientos			4,656.2	3.25	3,514.6	7.15
Revenue-Sharing Grants			119,241.0	83.21	33,732.0	68.65

Source: Data from Cuenta de la Hacienda Pública Federal, 1999; Finanzas Públicas Municipales y Estatales, 1996-1999.

Note: percentages may not add up to 100 due to rounding errors.

Indeed, the decentralization of some public functions took place during the previous decade. In 1992, the federal and sub-national governments agreed to the decentralization of elementary education. Yet, the federal government retains control over the nationwide education system: education programs, developing curricula, teachers' training and evaluation, as well as wages and benefits, among others. Sub-national governments receive earmarked federal transfers to meet their increased responsibilities in education. Municipal governments are responsible for the maintenance of school buildings and provision of equipment and education materials. On the other hand, since 1996 state governments are responsible for the public health services for the *open population*; that is, the segment of the population with no health insurance. The construction and maintenance of ranch roads also started a decentralization process in 1996.

Table 3.2: Functions undertaken by different levels.

Public Service	Regulatory Level	Providing Level	According to Framework	Public Service	Regulatory Level	Providing Level	According to Framework
National Defense	F	F	F	Culture	F, E, M	F, E, M	E, M
International Relations	F	F	F	Local Trade	F, E, M	F, E, M	M
International Trade	F	F	F	City Planning	F, E, M	F, E, M	M
Monetary Policy	F	F	F	Water Service	F, E, M	F, E, M	E, M
Interstate Trade	F	F	F	Sewerage	F, E, M	F, E, M	E, M
Natural Resources	F	F, E	F	Transit	E, M	E, M	M
Industrial Policy	F	F	F	Public Transportation	E, M	E, M	E, M
National Statistics	F	F	F	Libraries	M	M	E, M
Postal Service	F	F	F	Firemen	M	M	M
Federal and Border Police	F	F	F	Local Police	E, M	M	M
Special Police	F, E	F, E	F, E	Parks	M	M	M
Distribution	F	F	F	Streets	F, M	F, M	M
Regional Development	F	F, E, M	F, E, M	Waste Disp & Cleaning	M	M	M
Airlines and Trains	F	F, E	F, E	Public Lighting	E, M	E, M	M
Ecology	F, E	F, E, M	F, E, M	Air Pollution	M	M	M
Industry and Agriculture	F, E	F, E, M	F, E, M	Cemeteries	E, M	E, M	M
Education	F, E	F, E, M	F, E, M	Markets	M	M	M
Health	F	F, E, M	F, E, M	Slaughterhouses	M	M	M
Water use	F, E	F, E, M	E, M	Highways			
Housing	F, E	F, E	E, M	Interstate	F	F, E	F, E
Hospitals	F	F	E, M	State	F, E	F, E	E
National Parks	F, E	F, E	F, E				

Source: Gamboa (1996), p. 53.

Note: F, E, and M stand for federal, state, and municipal government levels.

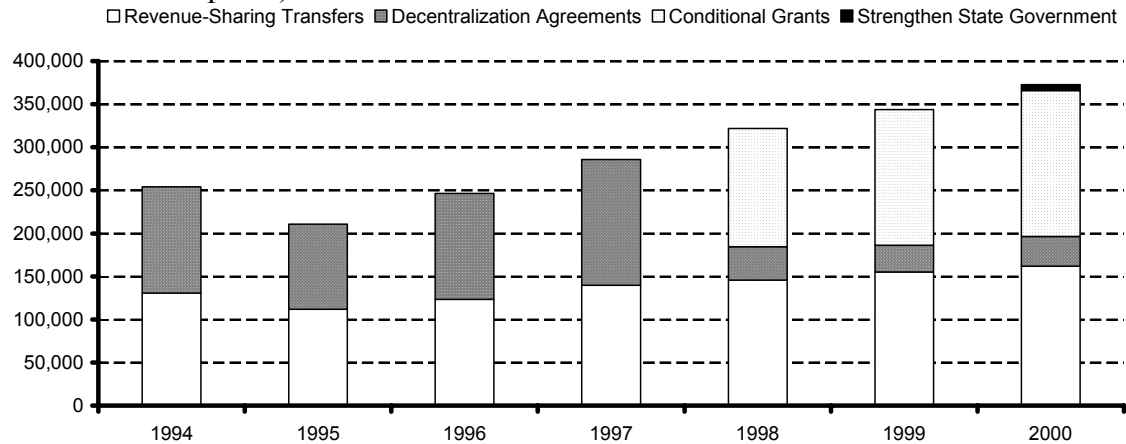
3.3. INTERGOVERNMENTAL TRANSFERS.

In Mexico, the federal government transfers funds to sub-national governments through revenue-sharing transfers (*participaciones*), conditional grants (*aportaciones*), decentralization agreements, and the program to strengthen state governments (PAFEF). According to the size of their funds, *participaciones* and *aportaciones* are the most important.²⁷ *Aportaciones* and PAFEF are the most recent programs dating from 1998 and 2000, respectively. Figure 3.3 shows the evolution of federal transfers over the period 1994-2000.²⁸ Notice that the *aportaciones* program replaced most of the funds transferred through decentralization agreements.

²⁷ *Participaciones* and *aportaciones* accounted for 44 and 48 percent of total federal transfers in 2000, respectively. Both programs were created under the Fiscal Coordination Act. —Ley de Coordinación Fiscal (2000).

²⁸ The drop in total transfers observed in 1995 is due to a 6.9 percent drop in real output Mexico suffered in that year.

Figure 3.3: Decentralized spending by type of transfer: 1994-2000 (millions of 2000 pesos)

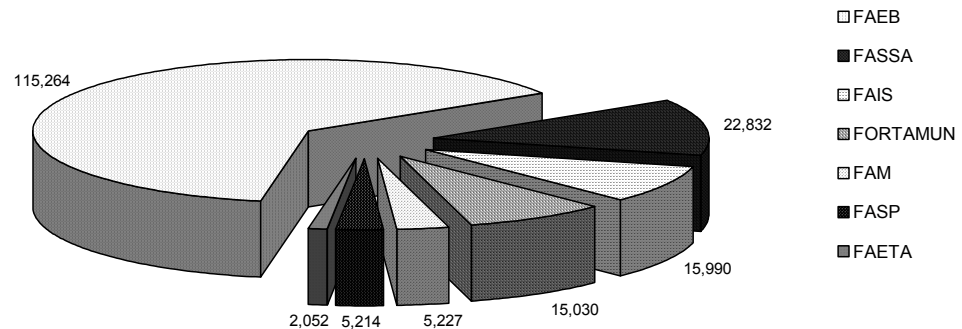


Source: Graph furnished by author with data from Secretaría de Hacienda y Crédito Público (SHCP).

Before 1998, federal and sub-national governments addressed the concurrence in spending responsibilities through bilateral expenditure coordination agreements. There was no nationwide system that clearly and objectively specified the mechanisms or programs for decentralization of public spending. In 1998, the Zedillo administration (1994-2000) established a system of conditional block grants called *Aportaciones Federales a Entidades y Municipios*,²⁹ in order to improve the decentralization of public resources. Figure 3.4 shows the different blocks of conditional grants.

²⁹ The *aportaciones* program is divided into seven funds according to the type of expenditure each serves: elementary education (FAEB); health services (FASSA); social infrastructure (FAIS);²⁹ public safety (FASP); multiple purposes (FAM) —commonly used to finance social assistance projects, school breakfasts, and school construction —; public technical education and for adults (FAETA); improvement of municipalities (FORTAMUN).

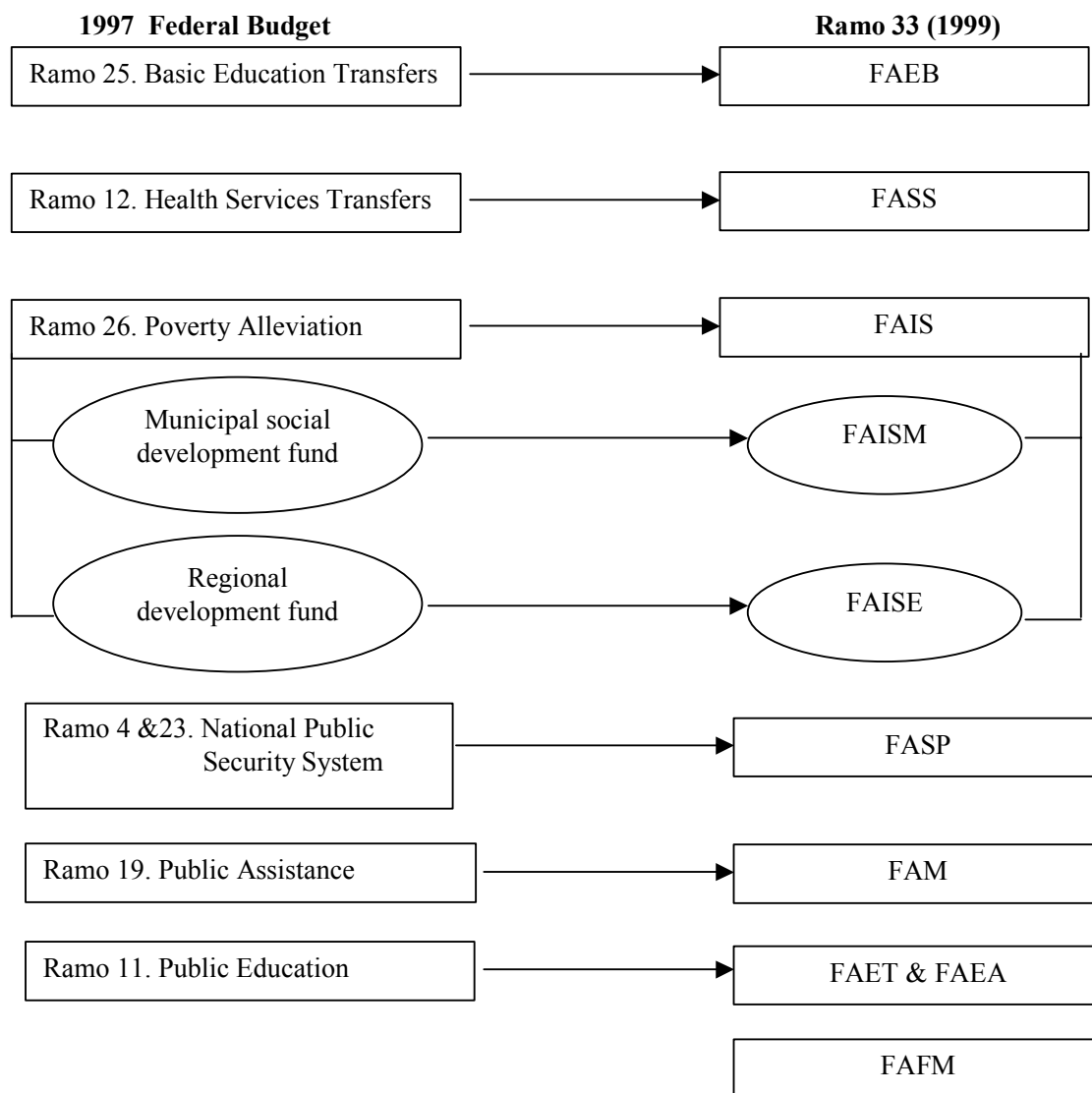
Figure 3.4: *Aportaciones* by fund, 2000 (millions of current pesos)



Source: Graph furnished by author with data from Cuenta de la Hacienda Pública Federal, 2000.

Sub-national governments do not regard *aportaciones* as own resources due to their conditional nature. Moreover, *aportaciones* convey programs formerly run by federal agencies —see figure 3.5. For instance, the *aportaciones* fund for elementary education amounted to 63.5 percent of total *aportaciones* monies in year 2000, and it is the channel the federal government uses to support the decentralized provision of elementary education. Similarly, the *aportaciones* fund for health services amounted to 12.6 percent of total *aportaciones* monies in 2000, and it is the channel the federal government uses to support the decentralized provision of health services. States complain that they have received more responsibilities without enough funds to meet them.

Figure 3.5: Where ramo 33 (*aportaciones*) came from.



Source: Courchene and Díaz-Cayeros (2000).

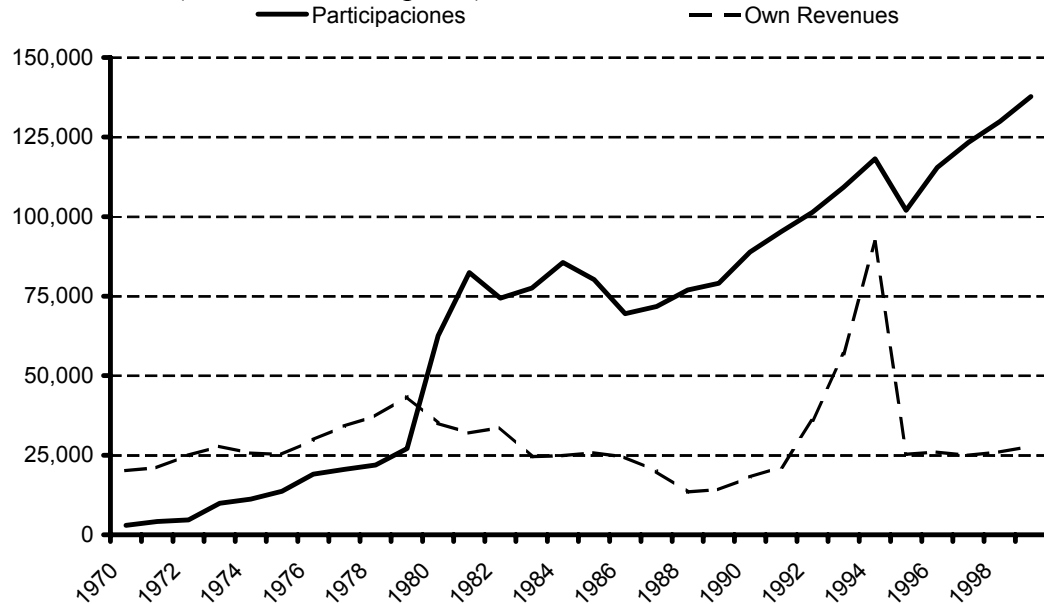
Federal and sub-national governments have addressed the issue of tax concurrence through tax coordination mechanisms.³⁰ The current National System of Fiscal Coordination (NSFC) dates from 1980. Following the *adhesion agreement* to the NSFC, the federal government has exclusive access to the most productive revenue sources and shares a portion —currently 20 percent— of its revenues with sub-national governments through revenue-sharing transfers.³¹ As expected, sub-national governments became financially dependent on *participaciones* after 1980 —see figure 3.6.³²

³⁰ See Astudillo-Moya (1999) and Martínez-Almazán (1988), for a description of the evolution of intergovernmental tax coordination mechanisms.

³¹ A state government may also sign an *administration coordination agreement* with the federal government, in which the former commits to act as a federal tax collector agent in exchange for an agreed compensation.

³² The abnormal behavior of state own revenues over the 1993-1995 period was due to the education grants states received after the decentralization of elementary education that began in 1993. Conditional transfers —including education grants— were recorded as state own revenues until 1994.

Figure 3.6: State government revenues: own revenues vs. *participaciones*, 1970-1999
(millions of 2001 pesos)



Source: Graph furnished by author with data from Instituto Nacional de Geografía e Informática (INEGI).

Given that states' adhesion was voluntary, the NSFC guaranteed state governments at least the real revenues they collected under the former tax coordination system. Furthermore, *participaciones* were initially distributed according to the revenues state governments received under the previous tax coordination system, which biased the distribution of revenue-sharing transfers in favor of wealthy and oil-producing states. Indeed, Aguilar-Villanueva (1996), Arellano-Cadena (1996a, b), and Colmenares-Páramo (1999), claim that this derivation mechanism perpetuated unusually high *participaciones* per capita for

oil-producing states Campeche and Tabasco as well as for those states with more developed markets.

The allocation of the general revenue-sharing fund (RSF) across state governments has evolved from a system solely based on state tax collection, to one that attempts to internalize local need for public goods and promote a redistribution of revenues that favor low-income states.³³ The concept state tax collection has also changed over time: in 1980, state revenues collected in 1978; from 1981 to 1987, state collection of own tax revenues; in 1988 and 1989, state collection of own tax revenues and state collection of the federal value added tax; and since 1990, state collection of federal assignable taxes —i.e., taxes on purchase of new automobiles, automobile registration, and excise taxes on production and services. Since 1994, increases in the *participaciones* fund are allocated in direct proportion to state population (45.17%) and state collection of federal assignable taxes (45.17%). The remaining share of the RSF (9.66%) is allocated among those states that receive the lowest *participaciones* per capita from the previous two criteria; e.g., compensating criterion.³⁴

The issue with the tax collection criterion is that wealthy states have benefited the most from it. These states may collect more tax revenues not necessarily due to higher tax effort but rather as a result of having more developed

³³ Aguilar-Villanueva (1996), Arellano-Cadena (1996 a, b) and Hernández-Arreortúa (1997) discuss the evolution of the NSFC in more detail.

³⁴ Chapter 4 discusses the evolution of the revenue-sharing distribution formula in more detail.

markets. In fact, the population and compensating criteria were added to the revenue-sharing formula in order to mitigate its built-in bias that favored wealthy and oil-producing states. Modifications to the *participaciones* system, however, have been made on the margin. As a result, the regressive bias effects from the derivation principle and tax collection criterion remain nowadays.

3.4. ANALYSIS.

This section evaluates policy recommendations for the reform of the Mexican fiscal federalism regime. According with the discussion in section 3.2, one may conclude that Mexico possesses a centralized fiscal regime. Literature on Mexican fiscal federalism³⁵ proposes the decentralization of both spending functions and revenue sources. Decentralization of public spending, as discussed above, is a valid policy action as higher levels of government perform functions that are better suited for lower levels of government. In contrast, the observed centralization of revenue collection follows what the fiscal federalism literature prescribes as optimal.

Nonetheless, in Mexico the primary focus is on the decentralization of revenue sources. This may be due to the fact that there is a consensus as to what public functions should be devolved, but this is not the case regarding how to increase revenues to sub-national governments. The claim that sub-national

³⁵ See Aguilar-Villanueva (1996), Arellano-Cadena (1996a, b), Astudillo-Moya (1999), Díaz-Cayeros (1996), Flores-Hernández (1996), Sempere and Sobarzo (1996 a, b), among others.

governments suffer from a lack of resources to finance its spending responsibilities —especially after the devolution of some public functions during the 1990s— is another factor that explains the focus on revenue decentralization.

The claims for fiscal decentralization in Mexico are in part based on the assumption that it is a Pareto improving policy.³⁶ Nonetheless, one should not make such assessment *a priori*. For instance, should one then presume that Mexico would be better off having a more decentralized fiscal regime like Argentina or Brazil? Or should one presume that France and Chile would be better off having a more decentralized fiscal regime like Mexico? Decentralized provision of public functions is desirable on the grounds that tastes and needs vary across jurisdictions within a country. Following the same argument, a less decentralized fiscal regime may be desirable as tastes and needs vary across countries.

Analysts also support the decentralization of revenues following the decentralization of spending responsibilities. If both spending and revenues are decentralized, then sub-national governments and their constituency would be aware of the link between revenue collection and public spending, that is, they would internalize both the benefits and costs from public decisions. Such fiscal correspondence would make sub-national governments more accountable and responsive to their local constituency.

³⁶ Arellano-Cadena (1996a) lists the centralization in both revenue collection and spending, as one of three reasons to seek profound changes in the current Mexican fiscal federalism regime.

The fiscal correspondence argument is, however, normative in nature. It assumes the existence of an effective democratic system where policymakers are responsive to the demands of their constituency, which is hardly the case of Mexico where democratic and judicial institutions are weak and there is no re-election to public office. Even worse, policymakers may hold an elected office without being actually elected. For instance, out of the 500 seats in the House of Representatives, the people elect 280 and political parties select the remaining 220 according to a formula that depends on the total number of votes each party gets. Similar processes apply to the Senate, state legislatures, and city councils. Moreover, both the House and Senate are lead by individuals selected by political parties. The future of policymakers does not depend on the constituency they serve but on their political party.

Regarding the policy options to increase revenues to sub-national governments, these include: increasing *participaciones* —e.g., the revenue-sharing fund, RSF—; increasing state collection of own revenues, devolution of revenue sources, and tax concurrence.

Sub-national governments support increasing *participaciones* and tax concurrence. The National Conference of Governors proposed a gradual increase of the RSF from 20 to 45 percent of federal tax collection.³⁷ On the other hand,

³⁷ See editorial by Ricardo Monreal, then Governor of the state of Zacatecas, which appeared in “Milenio Diario” on October 30th, 2002.

the state government of Nuevo León (2001) proposed a reduction in the —federal— value added tax (VAT) rate from 15 to 12 percent, in order to make room for a 3 percent state sales tax. Similarly, this state proposed that —federal— income tax rates be broken into two segments, such that 80 and 20 percent of a given rate become the federal and state segments respectively. Sub-national governments want to increase their revenues without having to face the political cost from revenue collection. In 2002, for instance, state governments had the authority to levy a general sales tax of up to 3 percentage points in addition to the 15 percent VAT rate, but no state levied this surtax.

Analysts reject the option of increasing revenues-sharing transfers since “... an increasing dependency from the federal government is exactly what should be avoided” —Sempere and Sobarzo, 1996b, p. 39, author’s translation. Arellano (1996a) even suggests that the National System of Fiscal Coordination harms the sovereignty of sub-national governments, given the financial dependency of sub-national governments with respect to *participaciones*.

Díaz-Cayeros and McLure (2000) propose that all states levy a 3 percent payroll tax rate; the devolution of automobile registration and excise taxes on alcoholic beverages and tobacco products; the creation of a dual federal/state VAT where states receive revenues from 3 percentage points of the VAT; and the transfer of 50 percent of the revenues collected from excise taxes on motor fuels. Astudillo-Moya (1999) proposes imposing a state surtax of up to 3 percentage

points on excise taxes and transferring 50 percent of revenues collected from the income taxes and VAT to state and municipal governments, respectively. Sempere and Sobarzo (1996 a, b) propose reducing the revenue-sharing fund by half and distributing it according to state population, in exchange state governments would be allowed to levy a state surtax on personal income —the federal government would reduce its tax rate to allow for a maximum surtax rate.

Decentralization of revenue collection is constrained by the fact that the broader and more productive revenue sources are mobile —taxes on personal and corporate income—, difficult to administer by sub-national governments —VAT—, reserved to the federal government by the constitution —charges on oil production, excise taxes on tobacco and alcohol products, among others—, or have minimal budget impact —payroll tax and automobile registration. Furthermore, the devolution of tax bases would trade away the efficiency gains from a centralized tax collection. On the other hand, states with more developed markets would benefit the most from state surtaxes on income and consumption.

The National System of Fiscal Coordination is blamed for the lack of revenues sub-national governments suffer since it prevents them from using the most productive sources. The NSFC has increased the revenues to sub-national governments, but it is argued that these are still insufficient. As a result, the reform of the fiscal federalism regime in Mexico would necessarily involve a revision of the NSFC, which in turn requires a complete understanding of the

status quo. For instance, being able to answer the following questions: which are the actual determinants of the distribution of revenue-sharing transfers across states?, how do recipient governments react to revenue-sharing transfers?, why do recipient governments react to *participaciones* the way they do? Answers to these questions are provided in the following two chapters.

Panel data econometric analyses in chapter 4 show that nominal determinants —state collection of assignable federal taxes per capita, state population, and the redistribution mechanism— are not effective determinants of the distribution of *participaciones* per capita across states.³⁸ Individual effects —state specific effects, in particular— are the main explanatory variables for the distribution of *participaciones* per capita across states. In particular, the effect of state collection of federal assignable per capita on the distribution of *participaciones* per capita is statistically not significant. On the other hand, the revenue-sharing formula does not redistribute *participaciones* per capita to those states that need them the most; e.g., states with low levels of development. The effect of state gross product per capita on *participaciones* per capita is positive and statistically significant. As a result, increasing *participaciones* as a manner of increasing revenues to state governments would benefit states with more developed markets the most.

³⁸ State collection of federal assignable taxes per capita and state population —and a constant term— explain only 11.78 percent of the variation in *participaciones* per capita over the period 1994-1999.

The econometric analysis in chapter in chapter 5, on the other hand shows that state collection of own revenues is insensitive to changes in both revenue-sharing transfers and state gross product. This finding implies that this government level makes no decision as to the optimal allocation of resources between private and public sectors. Regarding recipient response to *participaciones*, although these are unconditional transfers, recipient governments do not treat them as fungible resources since these represent most of their revenues. Increasing *participaciones* would increase state public spending by almost the same amount, regardless of the constituency's need for private goods and services. In this sense, increasing *participaciones* may not be a desirable policy to transfer more resources to sub-national governments.

The above discussion shows that the analysis of the reform of the Mexican fiscal federalism regime is not complete. Other policy options ought to be explored, like a system in which revenue collection remains centralized whereas spending is decentralized in an asymmetric fashion, which would avoid forgoing the benefits from centralized tax collection. Furthermore, in order to minimize efficiency losses at the provision level, public functions would be devolved only to those sub-national governments that meet minimum standards in the provision of the devolved functions. Financial resources would then follow through conditional grants from the federal government. To the extent that the federal government unwillingly devolves public functions and thus revenues, it will be in its best interest to enforce the minimum requirement standards. This yardstick

competition would induce sub-national governments to improve their performance.

3.5 CONCLUDING REMARKS.

Mexico observes centralization in public spending and revenue collection. Centralization of spending responsibilities departs from what the literature prescribes as optimal, but the observed centralization in revenue collection does not. Nonetheless, in Mexico the main concern is how to increase revenues to sub-national governments. Policy recommendations include increasing *participaciones*, increasing state collection of own revenues, allowing state surtax on federal revenue sources, like income tax and VAT, and tax devolution.

The implementation of such policy alternatives may not be practical —e.g., dual federal and state VAT or allowing sub-national governments collect proceeds from oil—, may have minimal budget impact —e.g., increasing sub-national governments' own revenues—, or may cause a redistribution of resources that would favor those states with more developed markets —e.g., state surtax on income taxes or VAT. Even more, such policies would trade away the efficiency of centralized revenue collection. In particular, the insensitiveness of state governments to changes in *participaciones* points to the welfare losses that may occur from increasing them; e.g., state governments would not act as to allocate optimally resources between the public and private sectors.

This chapter shows that the analysis of the reform of the Mexican fiscal federalism regime is not complete yet. The regime has observed too many changes over the last three decades. A thorough analysis of the Mexican fiscal federalism regime must be completed before it undergoes yet another reform.

CHAPTER 4: THE DETERMINANTS OF THE ALLOCATION OF REVENUE-SHARING TRANSFERS

4.1 INTRODUCTION.

This chapter presents a quantitative analysis of the determinants of the distribution of revenue-sharing transfers —also called *participaciones*— among state governments in Mexico. Cross-sectional and panel data models are estimated with that purpose. An analysis of the different proposals for the reform of the current fiscal federalism regime in Mexico appears in chapter 3, which concludes that a thorough analysis of the *status quo* is yet to be completed. The main goal of this and the next chapter, thus, is to improve the understanding of the current intergovernmental arrangement in Mexico, which is a necessary first step in order to elaborate policy proposals for its reform.

The goal of this chapter is to evaluate the effect of the modification to the revenue-sharing formula, made early in the 1990s, on the interstate distribution of revenue-sharing grants per capita. —The *participaciones* formula determines the level of *participaciones* a state gets, however, this chapter focuses on *participaciones* per capita.— That is, whether state collection of assignable federal taxes and state population indeed determine the distribution of revenue-sharing grants across states, as well as whether such distribution is contingent on

the aggregate income level of the recipient state. This chapter includes also a detailed description of the revenue-sharing grant system.

The current system of revenue-sharing transfers was built on a derivation mechanism that favored those states with larger total revenues; e.g., oil producing states as well as those with more developed markets. Several modifications to the *participaciones* formula were made during the 1980s decade although those modifications were aimed at increasing state collection of own revenues, which might have favored states with more developed market again. A major modification to the revenue-sharing grants system was phased out over the period 1990-1994. Since 1990, the revenue-sharing formula includes state tax collection of federal assignable taxes but also state population and a redistribution mechanism. This chapter tests the effectiveness of such major modification to the *participaciones* system. That is, whether the determinants included in the revenue-sharing formula are effective determinants in the distribution of *participaciones* per capita across states.³⁹

The next section presents a detailed description of the revenue-sharing grants system, which is followed by a section with a descriptive analysis of the distribution of *participaciones* among state governments. The last two sections present the econometric analysis and concluding remarks.

³⁹ Arellano-Cadena (1996 b) performed an *ad hoc* cross-sectional analysis to test whether certain regressors determine the distribution of *participaciones* in 1991. He found that states with larger per capita state domestic product received larger per capita *participaciones* in 1991, whereas other variables such as a poverty index and a political dummy variable were not statistically significant.

4.2 THE SYSTEM OF REVENUE-SHARING TRANSFERS.

National System of Fiscal Coordination (NSFC).⁴⁰

In Mexico, federal and sub-national governments have participated in bilateral tax coordination mechanisms in order to overcome the “loopholes” in the Constitution with respect to the intergovernmental assignment of revenue sources—see chapter 3. These tax coordination mechanisms have been voluntary and conveyed the agreement that certain revenue sources were to be exploited by the federal government only, whereas state governments would get a share of the federal collection.⁴¹ A federal sales tax⁴² served as the cornerstone of the intergovernmental tax coordination system that was in place over the period 1947-1979. There was, however, no nationwide uniform tax coordination agreement before 1979. The revenue sources agreed upon varied across states.

The current tax coordination system was created in 1980 as part of the fiscal reform of 1979, which replaced the federal sales tax for a federal value added tax (VAT).⁴³ The purpose of this fiscal reform was to increase the

⁴⁰ *Sistema Nacional de Coordinación Fiscal.*

⁴¹ See Martínez-Almazán (1988), Astudillo-Moya (1999), and Colmenares-Páramo (1999) for more on the evolution of intergovernmental tax coordination mechanisms.

⁴² *Impuesto Sobre Ingresos Mercantiles*, ISIM.

⁴³ *Impuesto al Valor Agregado*, IVA.

efficiency and productivity of tax collection.⁴⁴ State governments signed an *agreement of adhesion* with the federal government to join the NSFC, in which they surrendered most of their authority to raise their own revenues.⁴⁵ In return, the federal government agreed to share a portion of its revenues with state governments through revenue-sharing transfers.

The size of the general revenue-sharing fund (RSF)⁴⁶ is set as a proportion of a specified pool of federal revenues (FR)⁴⁷ that includes the revenues from all federal taxes as well as those from fees on oil extraction and mining excluding devolutions for these concepts.⁴⁸

Evolution of the NSFC.

Originally, the NSFC included two funds: the general revenue-sharing fund and the financial complementary fund (FCF).⁴⁹ In 1980, the revenue-sharing and financial complementary funds amounted to 16.89 and 0.37 percent of the pool of federal revenues, respectively.⁵⁰ The size of the revenue-sharing fund was

⁴⁴ The total fiscal burden (revenue collection by all levels of government) in Mexico amounted to 19.88 percent of the GDP in 1979. It increased to 22.55 percent of the GDP in 1980. (Flores-Hernández and Caballero de la Rosa, 1996, p.157.)

⁴⁵ Each state government may also sign an agreement of administrative coordination with the federal government, in which the former commits to act as a federal tax collector agent in exchange for an agreed compensation.

⁴⁶ *Fondo General de Participaciones*.

⁴⁷ *Recaudación Federal Participable*.

⁴⁸ See Fiscal Coordination Act, 2000.

⁴⁹ *Fondo Financiero Complementario*.

⁵⁰ The Municipal Development Fund (MDF) — *Fondo de Fomento Municipal* — was added to the NSFC in 1981. Municipal governments receive *participaciones* directly through the MDF, and

set so that all states got at least the level of total real revenues they received under the former tax coordination system. All states, as a result, voluntarily joined the NSFC. The revenue-sharing fund, furthermore, was distributed among state governments according to the total revenues they received in 1978. The *participaciones* system, thus, was set up following a derivation mechanism. The complimentary fund, albeit its small size, aimed at increasing the *participaciones* share of states with low development levels; that is, it was allocated among those states that received low levels of *participaciones* from the general fund.

Analysts —Aguilar-Villanueva (1996), Arellano-Cadena (1996a, b), and Colmenares-Páramo (1999)— claim that the effect of the derivation mechanism on the distribution of *participaciones* remains nowadays. Oil-producing states Campeche and Tabasco, for instance, currently receive extraordinary large revenue-sharing transfers. In the late 1970s oil prices were unusually high; as a result, oil-producing states enjoyed extraordinary high levels of revenues, which were perpetuated in the NSFC through the derivation mechanism. States with more developed markets benefited from the derivation principle too, since these had large public revenues in 1978. The current system of intergovernmental revenue-sharing transfers, therefore, was set up under a biased distribution mechanism that favors wealthy and oil-producing states.

indirectly through their corresponding state government. State governments are mandated to transfer at least 20 percent of the total *participaciones* they receive to their corresponding municipal governments. The MDF is formed with the revenues from the surtax on general exports and the added fees on oil extraction. Those municipalities that coordinate in *derechos* with the federal government receive 67 percent of the MDF, whereas the other 33 percent is allocated among all municipalities.

Table 4.1: Evolution of the general revenue-sharing fund, RSF.

Year	% of the FR that form the <i>RSF</i>	% of the <i>RSF</i> Assigned According to Population	% of the <i>RSF</i> Assigned According to Tax Effort	% of the <i>RSF</i> Assigned According to Compensating Criterion
1980	16.89		100	
1981	16.94		100	
1982	17.44		100	
1983	16.98		100	
1984	16.98		100	
1985	16.98		100	
1986	16.98		100	
1987	17.48		100	
1988	17.38		100 (30% VAT)	
1989	17.50		100 (30% VAT)	
1990	18.76		100	
1991	18.62	18.05	72.29	9.66
1992	18.62	27.10	63.24	9.66
1993	19.12	36.15	54.19	9.66
1994-2001	19.62 and 20 in 1997	45.17	45.17	9.66

Source: Hernández-Arreortúa (1997). Author's translation.

The NSFC has evolved over time.⁵¹ The evolution of the revenue-sharing fund, in terms of its size and distribution determinants, is shown in table 4.1.⁵² The second column shows the increase in the revenue-sharing fund, as a proportion of the pool of federal revenues, over time. A major modification to the NSFC took place over the period 1990-1994, which aimed at reducing the bias built in the distribution of *participaciones* among states while keeping the

⁵¹ See Aguilar-Villanueva (1996), Arellano-Cadena (1996 a, b), Colmenares-Páramo (1999), and Hernández-Arreortúa (1997).

⁵² The modifications to the revenue-sharing formula are detailed in the following section.

incentives for state fiscal effort. The revenue-sharing and complimentary funds merged in 1990, as a result, the RSF increased its size to 18.76 percent of the FR.

The formula factors that determine the distribution of revenue-sharing transfers changed too. The distribution of *participaciones* has evolved from a system based on tax collection solely to one that internalizes also state population and a revenue redistribution mechanism—see third to fifth columns. The issue with the tax collection criterion is that states with more developed markets are potentially the most benefited from it. Such states may collect larger tax revenues because of having wealthier tax bases, as opposed to exerting higher tax effort. The addition of the population and redistribution criteria to the revenue-sharing formula, therefore, aimed at mitigating the bias built in the NSFC that favors wealthy and oil-producing states. This major modification was face out over the 1990-1994 period in order to have a smooth transition and thus minimize the opposition to it.

The revenue-sharing fund is currently distributed among state governments as follows: 45.17% according to state population, 45.17% according to state collection of federal assignable taxes,⁵³ and 9.66% is distributed among those states with the lowest levels of *participaciones* per capita from the other two criteria.

⁵³ Federal assignable taxes include taxes on purchase of new automobiles; ownership of automobile; and excise taxes on production and services.

Evolution of the Revenue-Sharing Formula.

The current revenue-sharing system, as mentioned above, was set up according to a derivation mechanism. In 1980, the first year under the NSFC, the amount of revenue-sharing transfers state i received (P_{1980}^i) was calculated as follows,

$$P_{1980}^i = \left[\frac{TR_{1978}^i}{\sum_{i=1}^{32} TR_{1978}^i} \right] RSF_{1980} \quad (1)$$

where TR_{1978}^i stands for state i 's total revenues received in 1978 and RSF_{1980} stands for the size of the general revenue-sharing fund in 1980. States with larger revenues in 1978 —e.g., oil-producing states and states with more developed markets— received larger revenue-sharing transfers in 1980.

The revenue-sharing formula was modified several times in the 1980s decade with the objective of encouraging state governments' fiscal effort. Such modifications, however, were made on the margin; e.g., formula modifications applied to the change in the size of the general revenue-sharing fund only. Therefore, one might question the effectiveness of such modifications in increasing state governments' fiscal effort.

The *participaciones* formula, from 1981 to 1987, solely rewarded state government collection of own revenues. In 1982 and 1983, the amount of *participaciones* a state received was determined by the following formula,

$$P_t^i = P_{t-1}^i + \left[\frac{\left(\frac{P_{t-1}^i}{R_{t-1}^i} \right) \left(\frac{R_t^i}{\sum_i R_t^i} \right)}{\sum_i \left(\frac{P_{t-1}^i}{R_{t-1}^i} \right) \left(\frac{R_t^i}{\sum_i R_t^i} \right)} \right] [RSF_t - RSF_{t-1}] \quad (2)$$

where R_t^i stands for state i 's collection of own revenues in year t . This revenue-sharing formula explicitly states the dependence of the current year *participaciones* level on its previous year level. The derivation mechanism and its inequity effects on the distribution of *participaciones*, as a result, were perpetuated through this autoregressive formula.

The revenue-sharing formula (2) was modified in 1983 and 1984, but such modifications were minor in the sense that the lags were adjusted only. The revenue-sharing formula that was in effect in 1983 was the following,

$$P_t^i = P_{t-1}^i + \left[\frac{\left(\frac{P_{t-2}^i}{R_{t-2}^i} \right) \left(\frac{R_t^i}{\sum_i R_{t-1}^i} \right)}{\sum_i \left(\frac{P_{t-2}^i}{R_{t-2}^i} \right) \left(\frac{R_{t-1}^i}{\sum_i R_t^i} \right)} \right] [RSF_t - RSF_{t-1}] \quad (3)$$

Similarly, the revenue-sharing formula that applied over the period 1984-1987 was the following,

$$P_t^i = P_{t-1}^i + \left[\frac{\left(\frac{P_{t-2}^i}{R_{t-4}^i} \right) \left(\frac{R_{t-3}^i}{\sum_i R_{t-3}^i} \right)}{\sum_i \left(\frac{P_{t-2}^i}{R_{t-4}^i} \right) \left(\frac{R_{t-1}^i}{\sum_i R_{t-3}^i} \right)} \right] [RSF_t - RSF_{t-1}] \quad (4)$$

In 1988, the revenue-sharing formula experienced a significant modification. State governments collected the federal value added tax before 1990; then, in order to induce state governments to increase their effort in collecting the VAT, the revenue-sharing formula was modified such that it rewarded those states with higher VAT revenue collection. The revenue-sharing formula that applied in 1988 and 1989 was the following,

$$P_t^i = [30\% \text{ VAT}_t^i] + P_{adj,t-1}^i + \left[\frac{\left(\frac{P_{adj,t-2}^i}{R_{t-4}^i} \right) \left(\frac{R_{t-3}^i}{\sum_i R_{t-3}^i} \right)}{\sum_i \left(\frac{P_{adj,t-2}^i}{R_{t-4}^i} \right) \left(\frac{R_{t-3}^i}{\sum_i R_{t-3}^i} \right)} \right] [RSF_t - RSF_{t-1}] \quad (5)$$

where VAT_t^i stands for state i 's collection of the VAT in year t , whereas $P_{adj,t-s}^i$ stands for the revenue-sharing transfers state i would had obtained — s years before the current year t — from an adjusted general revenue-sharing fund; e.g., subtracting 30 percent of VAT revenues from the revenue-sharing general fund. Under this new *participaciones* formula, state governments appropriated directly 30 percent of the VAT revenues they collected. In 1988 and 1989, thus, the *participaciones* formula rewarded state collection of both own revenues and VAT.

One might expect that the modifications to the revenue-sharing formula made during the 1980s decade had the outcome of increasing the bias in the interstate distribution of these transfers. That is, states with more developed markets would collect larger amounts of own revenues and/or VAT revenues than the rest of states.

The revenue-sharing grant system, as mentioned before, experienced a major reform early in the 1990s decade with the two-fold goal of reducing the

bias in the distribution of *participaciones* among states while inducing state governments to exert high levels of fiscal effort. As a result of such reform, now the distribution of the revenue-sharing fund among states currently depends on three criteria: state collection of assignable federal taxes, state population, and a redistribution mechanism. Tax collection and population criteria each determine the distribution of 45.17 percent of the revenue-sharing fund, whereas the redistribution determines the distribution of the remaining 9.66 percent.

The formula that determines the distribution of the revenue-sharing fund, RSF, according to the tax collection criterion is given by,

$$P_t^i = (CP_t^i)(RSF_t) \quad (6)$$

where,

$$CP_t^i = CP_{t-1}^i \left[\frac{\left(\frac{A_{t-1}^i}{A_{t-2}^i} \right)}{\sum_{i=1}^{32} CP_{t-1}^i \left(\frac{A_{t-1}^i}{A_{t-2}^i} \right)} \right] \quad (6a)$$

where A_t^i stands for state i 's collection of assignable federal taxes in year t . This new fiscal effort coefficient of *participaciones*, like the ones used in the 1980s, has an inertial component; e.g., its current year value depends on its previous year value. This new coefficient of *participaciones* is, following the above discussion, likely to convey the bias built-in the distribution of revenue-sharing transfers

during the 1980s, albeit this coefficient determines only partly (45.17 percent) the distribution of the *participaciones* general fund.

Regarding the population criterion, the Fiscal Coordination Act (2000) states that 45.17 percent of the revenue-sharing fund is allocated among state governments in direct proportion to the size of state population. The official figures for state population are those reported by the National Institute of Statistics, Geography and Information Systems.⁵⁴ On the other hand, with regards to the redistribution component, the Fiscal Coordination Act (2000) states that 9.66 percent of the revenue-sharing fund is allocated among state governments in an inverse proportion to the *per capita participaciones* each state receives from the fiscal effort and population criteria.

The reform of the revenue-sharing system early in the 1990s decade might have modified the distribution pattern of the revenue-sharing fund, to the extent that states with larger population are not the ones with more developed markets or if the redistribution component is effective. The main goal of this chapter is to test whether this holds true, but the focus is on revenue-sharing per capita.

⁵⁴ Instituto Nacional de Estadística, Geografía e Informática, INEGI.

4.3 DESCRIPTIVE ANALYSIS.

This section presents a descriptive analysis of the distribution of revenue-sharing transfers among states over the period 1994-1999. The determinants of the distribution of revenue-sharing transfers among states, as mentioned above, include state collection of federal assignable taxes, population, and a redistribution component. Thus, the relevant variables for this study include: *participaciones*, G ; state collection of federal assignable taxes, *Assigna*; state collection of own revenues, L_1 ; state domestic product, L ; state population in millions, *Pop*; index of *marginación*, *marginación*.⁵⁵ Nominal variables: G , L_1 , and L , are measured in thousands of 1999 Mexican pesos (MX \$) and in per capita terms. The descriptive statistics for these variables are reported in table 4.2.⁵⁶

⁵⁵ The National Population Council (CONAPO) publishes an index of *marginación* that measures the availability of basic public services and demographic variables across states. The basic public services include access to education, sewerage, and electricity. The demographic information includes proportion of rural population, proportion of communities with small population, among others. The years of measurement are limited: 1990, 1995, and 2000. The index of *marginación*, thus, reflects the degree of development in each state. That is, the larger the index the lower the level of development; therefore, this index may be used to evaluate whether the allocation of revenue-sharing transfers in fact has a redistributive component.

⁵⁶ A more detailed definition of variables appears in chapter 5, table 5.1. The data sources are listed there too. The source for *Assigna* is Informes, see references.

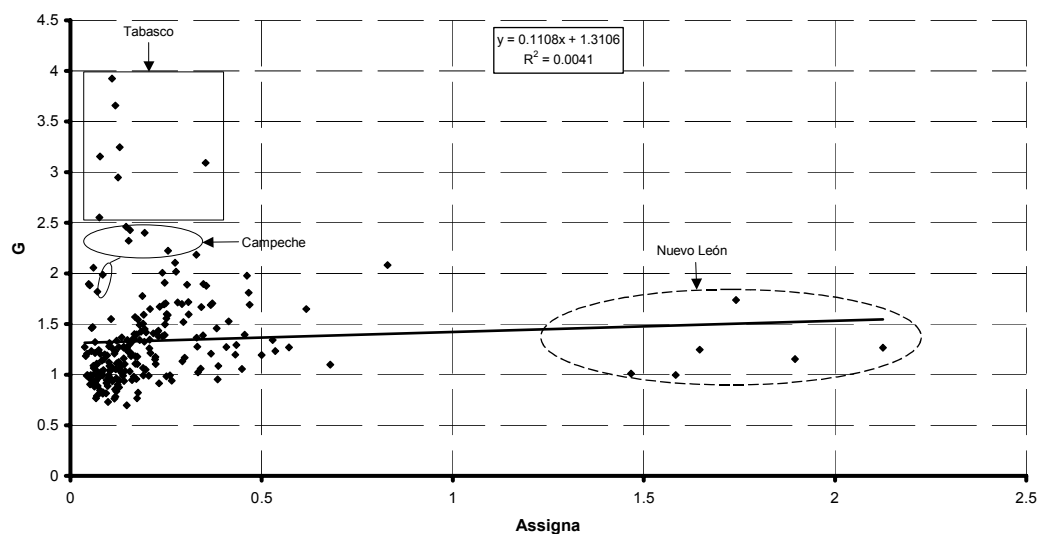
Table 4.2: Descriptive statistics.

Descriptive Statistics							
	<i>G</i>	<i>Gr</i>	<i>assigna</i>	<i>L₁</i>	<i>L</i>	<i>population</i>	<i>margina</i>
Mean	1.3362	1.2935	0.2313	0.1938	37.3934	2.7306	0.0633
Standard Error	0.0341	0.0337	0.0197	0.0083	1.0804	0.1582	0.0656
Median	1.2065	1.1791	0.1549	0.1590	32.3646	2.1846	-0.1887
Standard Dev	0.5011	0.4960	0.2889	0.1218	15.8785	2.3243	0.9638
Sample Var	0.2511	0.2460	0.0835	0.0148	252.1273	5.4025	0.9289
Kurtosis	6.6836	6.2472	21.4745	3.3749	-0.3713	6.1773	-0.3930
Skewness	2.2189	2.1634	4.3451	1.6903	0.7881	2.2331	0.5575
Range	3.2291	3.2381	2.0879	0.6624	58.7581	12.4772	3.8582
Minimum	0.6960	0.6870	0.0374	0.0295	16.5676	0.3559	-1.4960
Maximum	3.9251	3.9251	2.1253	0.6919	75.3258	12.8331	2.3622
Count	216	216	216	216	216	216	216
Covariance Matrix							
	<i>G</i>	<i>Gr</i>	<i>assigna</i>	<i>L₁</i>	<i>L</i>	<i>population</i>	<i>margina</i>
<i>G</i>	0.2499						
<i>Gr</i>	0.2279	0.2449					
<i>assigna</i>	0.0092	0.0064	0.0831				
<i>L₁</i>	0.0119	0.0112	0.0180	0.0148			
<i>L</i>	2.9277	2.8302	2.2439	1.3341	250.9600		
<i>population</i>	-0.4004	-0.4018	0.0032	-0.0282	-10.0219	5.3775	
<i>margina</i>	-0.0606	-0.0625	-0.1235	-0.0553	-9.4733	0.1833	0.9246
Correlation Matrix							
	<i>G</i>	<i>Gr</i>	<i>assigna</i>	<i>L₁</i>	<i>L</i>	<i>population</i>	<i>margina</i>
<i>G</i>	1						
<i>Gr</i>	0.9213	1					
<i>assigna</i>	0.0639	0.0448	1				
<i>L₁</i>	0.1963	0.1861	0.5137	1			
<i>L</i>	0.3697	0.3610	0.4914	0.6931	1		
<i>population</i>	-0.3454	-0.3502	0.0047	-0.1000	-0.2728	1	
<i>margina</i>	-0.1261	-0.1314	-0.4457	-0.4737	-0.6219	0.0822	1

Revenue-sharing transfers per capita are positively correlated with state per capita collection of federal assignable taxes, but the correlation level is rather low, 0.0639. On the other hand, however, *participaciones* per capita do not increase with state population; e.g., the correlation between these two variables is -0.3454. Furthermore, the redistribution component appears to be not effective,

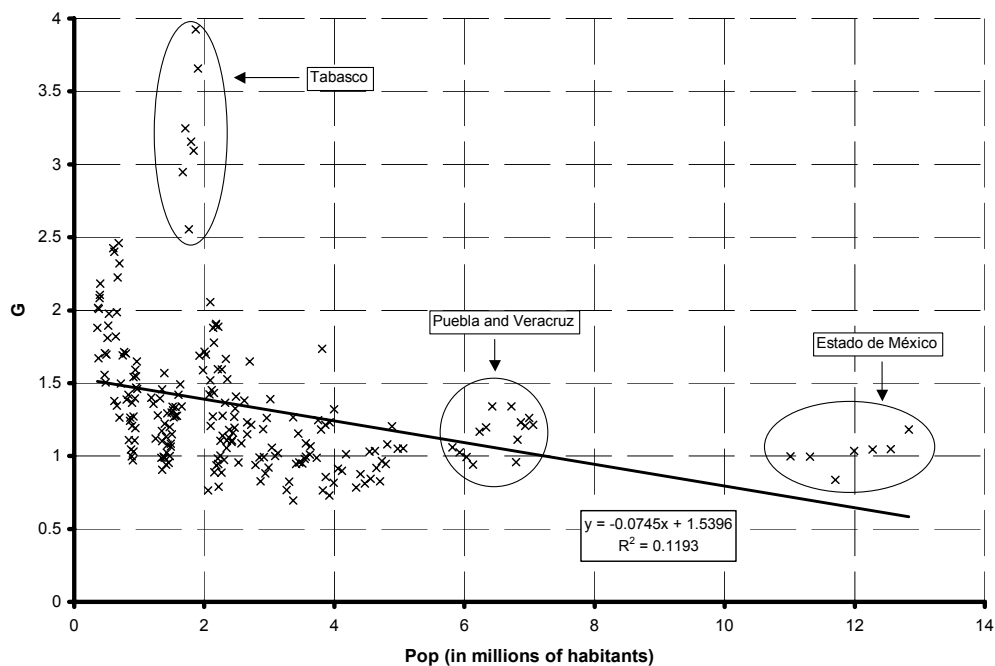
since *participaciones* per capita do not increase with the index of *marginación*; e.g., the correlation between G and *margin* is -0.1261.

Figure 4.1: G vs. *Assigna*: panel data 1993-1999.



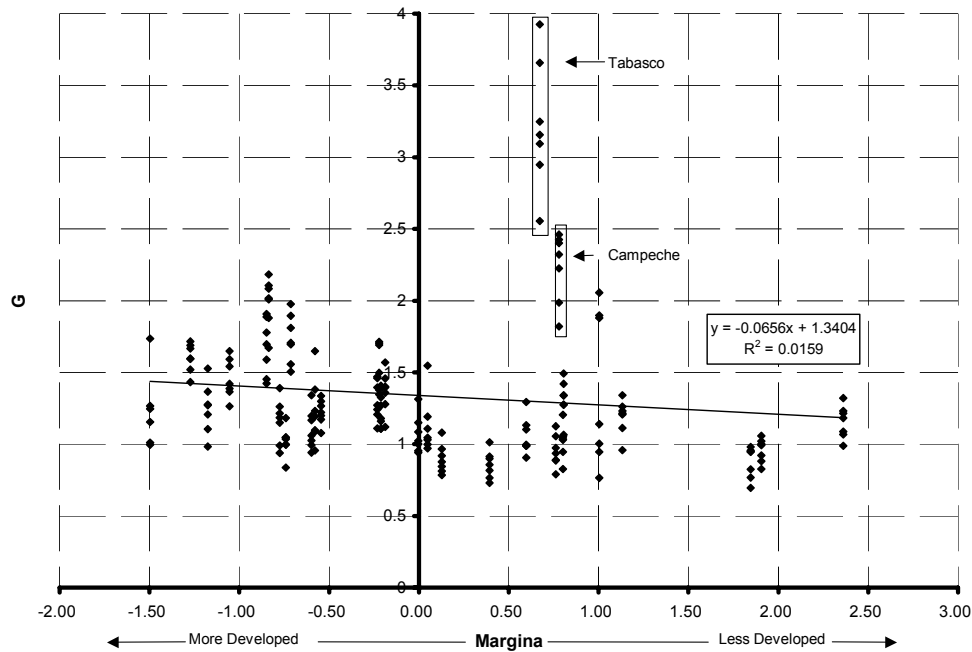
In order to have a better understanding of the relationship between the distribution of *participaciones* and its determinants, figures 4.1 to 4.3 offer a pictorial representation of these relationships. In particular, these figures point out the relevance of state-specific effects. The low correlation between per capita *participaciones* and state per capita collection of federal assignable taxes seems to be caused by outlier observations, as it is shown in figure 4.1.

Figure 4.2: G vs. Pop : panel data 1993-1999.



Similarly, figures 4.2 and 4.3 show that state specific affects have an impact on the estimated correlation between *participaciones* and state population and *participaciones* and the index of marginación, respectively. The negative correlation between G and Pop and between G and $Margina$ would be stronger if one disregards outlier observations.

Figure 4.3: G vs. $Margina$: panel data 1993-1999.



In sum, based on this descriptive analysis, it is not clear that the —nominal— factors included in the revenue-sharing formula in fact determine the interstate distribution of *participaciones* per capita. There is some evidence that the system of revenue-sharing transfers does reward state governments' collection of assignable federal taxes. There is, however, evidence that the revenue-sharing system favors states with smaller population and higher development level.

4.4 ECONOMETRIC ANALYSIS.

This section presents econometric analyses to evaluate the effectiveness of the factors included in the revenue-sharing formula. The objective is to determine whether the modification made to the *participaciones* formula early the 1990s has been effective, in terms of altering the distribution of *participaciones* per capita among states. —Although the revenue-sharing formula determines the total amount of revenue-sharing transfers assigned to each state, this dissertation work focuses on the interstate distribution of *participaciones* per capita.— If nominal determinants of revenue-sharing transfers were indeed effective, one might expect that a state would receive larger *participaciones* per capita the larger its collection of assignable federal taxes is or the larger its population is. Also, if the redistribution component of the *participaciones* formula has been effective, one might expect that states with lower development levels would receive larger *participaciones* per capita.

In order to have some insight about the determinants of *participaciones* per capita before and after the formula modification, cross-sectional analyses are performed for the years 1989 and 1999. Then, a panel data analysis for the period 1994-1999 is performed in order to capture unobserved heterogeneity across states and over time.

Cross-Sectional Analyses: 1989 and 1999.

Cross-sectional analyses specify econometric models for the distribution of *participaciones* among states, according to the revenue-sharing formula that was currently used. The 1989 cross-sectional analysis, therefore, involves regressing *participaciones* per capita (*G*) against state collection of own revenues per capita in 1988 (*OwnRev88*) and a dummy variable for oil-producing states Campeche and Tabasco (*Doil*). The 1999 cross-sectional analysis, on the other hand, involves regressing *G* against state collection of federal assignable taxes per capita in 1998 (*Assigna98*), state population (*Pop*), and *Doil*. These regression equations for 1989 and 1998 are labeled *Model89* and *Model99*, respectively.

Extended versions of the above regression models are also considered. Extended regression models for 1989 and 1999 both add as explanatory variables state domestic product per capita (*PIBE*) and state index of marginación (*Margina*). The variable *PIBE* is included to evaluate whether the *participaciones* formula indeed rewarded state fiscal effort instead of simply assigning these transfers to those states with larger tax bases. The variable *Margina* is included in order to evaluate whether the *participaciones* per capita a state receives depended on the state level of development.⁵⁷ The extended econometric model for 1989 further adds *Pop* to make it comparable to the 1999 extended regression. The

⁵⁷ Recall that the NSFC was initially set up following a derivation mechanism, which might had introduced a bias in the distribution of *participaciones* that favors states with high levels of development —as well as oil-producing states. An objective of the modification made to the revenue-sharing formula was to revert such bias.

extended regression equations for 1989 and 1999 are labeled *Extended89* and *Extended99*, respectively.

Estimation results from the four cross-sectional regression analyses are reported in table 4.3.

Table 4.3: Cross-sectional estimates: 1989 and 1999. Dependent variable, *G*.

Variable	<i>Model89</i>		<i>Extended89</i>		<i>Model99</i>		<i>Extended99</i>	
	Coefficient	Std Error	Coefficient	Std Error	Coefficient	Std Error ²	Coefficient	Std Error ²
<i>Constant</i>	0.4991 ***	0.1154	1.1091 ***	0.2485	1.4702 ***	0.0838	1.7099 ***	0.2359
<i>OwnRev88</i>	2.6950 ***	0.5173	2.3948 ***	0.5510				
<i>Doil</i>	1.4698 ***	0.2666	1.9121 ***	0.3270	1.5359 ***	0.5040	1.7209 ***	0.4320
<i>Margina</i> ¹			-0.1685 *	0.0887			-0.2243 **	0.0818
<i>PIBE</i>			-0.0145 **	0.0066			-0.0049	0.0063
<i>Pop</i>			-0.0524 *	0.0274	-0.0532 **	0.0211	-0.0512 ***	0.0118
<i>Assigna98</i>					0.41707 ***	0.1357	0.2235	0.1439
<i>R</i> ²	0.7120		0.7809		0.6813		0.7725	
Adj <i>R</i> ²	0.6914		0.7370		0.6459		0.7271	
d.f.	28		25		27		25	
Std Error Reg	0.3594		0.3318		0.3095		0.2718	
D.W.	1.6908		1.6146		1.8410		2.1812	
Br/Pagan Het	4.36		2.20		26.87		24.62	

Note: Estimates statistically different from zero at one (***), five (**), and ten (*) percent significance level.

¹ Cross-section analyses for years 1989 and 1999 use index of *marginación* in 1990 and 1995, respectively.

² White heteroscedasticity robust covariance matrix.

Parameter estimate for *OwnRev88* is statistically significant different from zero in both *Model89* and *Extended89*. The revenue-sharing formula in 1989, therefore, rewarded those states with larger collection of own revenues, even after state gross product is accounted for. Parameter estimates for *Doil*, *Margina*, *PIBE*, and *Pop*, are statistically significant different from zero, too. The statistical significance of the parameters of variables *Doil* and *Margina* reflects the lasting

effect of the derivation principle upon which the NSFC was set up in 1980. In other words, the oil producing states Campeche and Tabasco commanded extraordinary large *participaciones* per capita, whereas states with higher levels of development received larger *participaciones* per capita than states with lower levels of development.

In 1989, also, states with larger population levels received smaller *participaciones* per capita than states with smaller population. Surprisingly, state gross product was negatively correlated with the distribution of *participaciones* per capita in 1989. This last result seems to be at odds with the positive correlation between a state development level and *participaciones*.⁵⁸

Estimation results from the 1999 cross-sectional analysis, when compared to those from the 1989 cross-sectional analysis, do not support the effectiveness of the nominal determinants of *participaciones*. That is, the determinants of the distribution of revenue-sharing transfers per capita are pretty much the same in either year, despite de modification to the *participaciones* formula early in the 1990s. State population, for instance, remained a significant determinant of the distribution of *participaciones* per capita in 1999. Even more, as in 1989, in 1999 states with lager population received larger *participaciones* per capita. Similarly, the effect of the derivation principle remained in 1999, that is, both *Doil* and

⁵⁸ The sign of this coefficient is “corrected” in the panel data analysis below.

Margina are significant determinants that favor oil-producing states and those with higher levels of development, respectively.

The main difference between the estimation results from the 1989 and 1999 cross-sectional analyses is with respect to the effect of state collection of federal assignable taxes and state gross product. The effect of the 1998 state collection of federal assignable taxes per capita on the distribution of *participaciones* per capita is significant and positive in *Model99*; however, it becomes statistically insignificant in *Extended99*, when the effect of state gross product per capita is accounted for. On the other hand, the effect of *PIBE* on the distribution of revenue-sharing transfers is statistically insignificant. As a result, there is not conclusive evidence as to whether the revenue-sharing formula rewarded states according to their collection of federal assignable taxes or simply assigned more *participaciones* per capita to states with larger tax bases.

The reform of the NSFC made early the 1990s, according to the above cross-sectional analyses, have been ineffective in terms of altering the distribution of *participaciones* per capita across states. Such reform, in particular, has failed in reverting the bias built in the SCNF, which favors oil-producing states as well as states with more developed markets.

Panel Data Analysis: 1994 - 1999.

The analysis is now extended to a panel data that includes the thirty-one states over the period 1994-1999. The goal is to improve the 1999 cross-sectional analysis by providing more robust results. The panel data analysis allows for the inclusion of unobserved heterogeneity across states as well as relevant factors that change over time. State specific effects would account for the heterogeneity observed in the descriptive analysis from section 4.3. Time affects, on the other hand, would account for increases in the revenue-sharing fund and the creation of a nationwide system of conditional grants.⁵⁹

The regression equation labeled *Model 1*, following the revenue-sharing formula, involves regressing *participaciones* per capita against state collection of assignable federal taxes per capita in the previous year (*Lag Assigna*) and state population (*Pop*). An extended regression equation, *Model 2*, further adds as control variables state gross product per capita (*PIBE*) and the index of *marginación* (*Margina*). The estimation of these regression models is performed using two-way fixed effects and random effects panel data techniques. The software NLOGIT v. 3.0.11 is used for that purpose. Table 4.4 reports the estimation results. Ordinary least squares estimates are reported also for comparison purpose only. Parameters estimates of state specific and time effects are not reported in table 4.4.

⁵⁹ See Aportaciones in chapter 3.

Table 4.4: Panel data estimates, 1994-1999. Dependent variable, *G*.

Variable	Model 1		Model 2	
	Coefficient	Std Error	Coefficient	Std Error
	<i>OLS without Specific Effects</i>		<i>OLS without Specific Effects</i>	
<i>Constant</i>	1.5407 ***	0.0604	1.0647 ***	0.1297
<i>Lag Assigna</i>	0.0866	0.1223	-0.1631	0.1372
<i>Pop</i>	-0.0759 ***	0.0149	-0.0548 ***	0.0150
<i>Margina</i>			0.0578	0.0455
<i>PIBE</i>			0.0125 ***	0.0030
R^2	0.1274		0.2116	
Adj R^2	0.1178		0.1941	
Std Error Reg	0.4740		0.4530	
d. f.	182		180	
	<i>FEM with State & Time Effects</i>		<i>FEM with State & Time Effects</i>	
<i>Constant</i>	1.4438 ***	0.3627	0.9973 **	0.4695
<i>Lag Assigna</i>	0.1500	0.1408	0.1790	0.1420
<i>Pop</i>	-0.0459	0.1302	-0.0525	0.1302
<i>Margina</i>			Fixed Parameter	
<i>PIBE</i>			0.0122	0.0082
R^2	0.9246		0.9258	
Adj R^2	0.9057		0.9058	
Std Error Reg	0.1550		0.1549	
d. f.	147		145	
	<i>REM with State & Time Effects</i>		<i>REM with State & Time Effects</i>	
<i>Constant</i>	1.5199 ***	0.1335	1.0282 ***	0.2400
<i>Lag Assigna</i>	0.1398	0.1245	0.1159	0.1267
<i>Pop</i>	-0.0731 **	0.0321	-0.0561 *	0.0317
<i>Margina</i>			0.0897	0.0934
<i>PIBE</i>			0.0118 **	0.0049
F-test	$F_{(36,147)} = 43.19 (0.0000)$		$F_{(36,145)} = 38.75 (0.0000)$	
Hausman Test	$\chi^2_{(2)} = 0.06 (0.9698)$		Could not invert VC matrix	

Estimates statistically different from zero at one (***), five (**), and ten (*) percent significance level.

Panel data estimation sharply improves the goodness of fit when compared to the OLS results. Individual state and time effects are statistically significant according to F-tests. Furthermore, at least for *model 1*, the Hausman-test concludes that the random effects specification performs better than the fixed effects specification.

Panel data estimates show that the revenue-sharing formula does not reward state fiscal effort but simply assigns larger *participaciones* per capita to states with larger tax base. That is, the parameter estimate for the variable *Lag Assigna* is statistically insignificant across model specifications, whereas the coefficient estimate of *PIBE* is positive, and statistically significant across model specifications but for the fixed effects specification. This result does not contradict the equivalent result from the 1999 cross-sectional analysis.

Panel data estimates show also that states with larger population receive smaller *participaciones* per capita. The parameter estimate of *Pop* is negative, and statistically significant across model specifications but for the fixed effects specification. The same population effect was already present before the modification to the revenue-sharing formula early in the 1990s, as it is shown in the 1989 cross-sectional analysis above.

On the other hand, the panel data analysis does not produce empirical evidence that the revenue-sharing grants system has a redistributive component,

since parameter estimates of *Margina* are not statistically significant across model specifications. Panel data coefficient estimates of *Margina* “correct” the estimates from the 1999 cross-sectional analysis, where such estimates are negative and statistically significant.

Finally, it must be noticed that individual effects —state specific effects, in particular— are the main explanatory variables for the distribution of *participaciones* per capita across states. State collection of federal assignable taxes and state population determine the distribution of 90.34 percent of the revenue-sharing fund across states, according to the revenue-sharing formula. Nonetheless, *Lag Assigna* and *Pop* —and a constant term— explain only 11.78 percent of the variation in *participaciones* per capita. The relatively large explanatory power of individual effects would point to the need of internalizing the derivation principle followed when setting up the NSFC,⁶⁰ as well as the bargaining power states had at the time of each major modification to the revenue-sharing formula.

In sum, in terms of *participaciones* per capita, the panel data estimates show that the modification made to the revenue-sharing formula early in the 1990s has not been effective in rewarding state fiscal effort or redistributing *participaciones* to those states which need them the most —e.g., states with low levels of development.

⁶⁰ That is, the derivation principle may still be determining the distribution of revenue-sharing transfers across states.

4.4 CONCLUDING REMARKS.

The revenue-sharing grants system in Mexico is formula based and was built on a derivation principle that favored those states with larger total revenues in 1978; e.g., oil producing states Campeche and Tabasco as well as states with more developed markets. Several modifications to the revenue-sharing formula were made during the 1980s decade, which aimed at increasing state collection of own revenues and thus might have benefited further states with more developed market. A major modification to the revenue-sharing grants system was phased out over the period 1990-1994. Since 1990, the revenue-sharing formula includes state tax collection of federal assignable taxes but also state population and a redistribution mechanism. This chapter tests the effectiveness of such major modification to the *participaciones* system. That is, whether the determinants included in the revenue-sharing formula are effective determinants in the distribution of *participaciones* per capita across states.

Econometric analyses, overall, produce no evidence that the factors included in the revenue-sharing formula indeed determine the distribution of *participaciones* per capita across states. In particular, panel data estimates show that the modification made to the revenue-sharing formula early in the 1990s has not been effective in rewarding state fiscal effort or redistributing *participaciones* to those states which need them the most —e.g., states with low levels of development.

On the other hand, individual state and time effects appear as the main determinants in the distribution of revenue-sharing transfers across states. One hypothesis is that individual state effects refer us back to the derivation principle upon which the system was built. Similarly, the bargaining power states had at the time of each major modification to the revenue-sharing formula might have determined the outcome of these modifications, the effects of which might still be present. Internalizing the derivation principle and the states' bargaining power would be natural extensions to this chapter.

CHAPTER 5: STATE RESPONSE TO REVENUE-SHARING TRANSFERS IN MEXICO

5.1 INTRODUCTION.

This chapter estimates the response of state governments in Mexico to the revenue-sharing transfers —called *participaciones*— they receive from the federal government. A first goal is to test whether state governments treat *participaciones* as lump-sum transfers; e.g., a “flypaper effect” test. If such is not the case, a further goal is to test two non-nested hypotheses that might explain the presence of the flypaper effect in the Mexican case. One explanation is that the flypaper effect is due to the mechanism used to distribute revenue-sharing transfers, which creates a fiscal illusion that induces recipient governments to allocate more resources to the public sector than otherwise. This chapter, on the other hand, presents a novel explanation for the presence of the flypaper effect: this phenomenon is expected to occur when intergovernmental grants account for most of the recipient government’s budget; e.g., recipient government would spend most of the grant monies it receives simply because it has no other source of revenues to finance a minimum provision level of local public goods.

The overall goal of this chapter is, following the discussion from the previous two chapters, to improve the understanding of the current intergovernmental arrangement in Mexico, which is a necessary first step in order

to elaborate policy proposals for its reform. For instance, mainstream literature on grants-in-aid prescribes what would be the response of a recipient locality to unconditional grants; e.g., revenue-sharing grants. Nonetheless, as it is discussed below, the actual response of state governments in Mexico to *participaciones* remains an empirical issue.

This paper tests the traditional approach to intergovernmental grants-in-aid —Bradford and Oates (1971 a, b), Oates (1972), Musgrave and Musgrave (1980)—, which prescribes that unconditional grant programs have income effect only. Since recipient governments may use unconditional grants at their own discretion, an increase in such transfers would have the same impact on a locality's resource constraint as an equal increase in its private resources; e.g., a locality's marginal propensity to consume locally provided public goods out of unconditional transfers and out of private income equals each other. Thus, the same allocation decision should result in either case. Quoting Gramlich (1977, p. 225): “If a central-government tax cut of \$1 would raise local spending and taxes by \$0.10, central-government revenue sharing of \$1 would also raise local spending by \$0.10, lower local taxes by \$0.90, and raise total local revenues (taxes plus grants) also by \$0.10. As classical economists might say, revenue sharing is a veil for the tax cut.”

However, there is extensive empirical literature that reports the existence of the so-called “flypaper phenomenon” that contradicts the traditional theory

—see Gramlich (1977), Schwallie (1989), Quigley and Smolensky (1992), and Hines and Thaler (1995), for reviews of this literature. The flypaper effect relates to the empirical findings that unconditional grants have a larger expansionary impact on public spending than what is predicted by the mainstream literature on grants-in-aid. The flypaper effect refers then to an over-allocation of local resources to the public sector, an anomaly.

The revenue-sharing grants system, as discussed in chapter 3, is a cornerstone in the intergovernmental fiscal arrangement in Mexico that has been subject of debate and analysis due to its possible reform. In fact, there is a consensus about the need to reform the current fiscal federalism regime. Concerns about the current intergovernmental fiscal arrangement are due to the lack of resources sub-national governments face to finance their public functions. Revenue-sharing transfers are the main source of revenues for sub-national governments. In 1999, state governments receive *participaciones* for an amount that is over 5 times larger than their own revenues.

Following the mainstream fiscal federalism literature, one might expect that the revenue-sharing transfers create *perverse incentives* to reduce recipient governments' collection of own revenues, which would increase the financial problems state governments in Mexico already suffer. In contrast, from a policy-making perspective it is unlikely that states would treat *participaciones* as fungible resources since these are practically their only source of public revenues.

Therefore, the effect of *participaciones* on the behavior of recipient state governments is an empirical issue.

This dissertation work does not test the two non-nested hypotheses mentioned above, because they involve models with non-linearities and the models require complex estimation processes. Non-nested models could be tested against each other using the J test proposed by Davidson and Mac Kinnon (1981). However, the literature is limited to testing non-nested linear vs. linear models and non-nested linear vs. log-linear models. The most this dissertation work does, as it is discussed next, is to argue the validity of each hypothesis based on the feasibility of the econometric estimates from the corresponding derived model.

Econometric estimates show that state governments in Mexico do not treat *participaciones* as lump-sum transfers. Indeed, state governments in Mexico spend almost all the revenue-sharing transfers they receive. A fiscal illusion explanation for this result would imply that state governments *perceive* that revenue-sharing transfers drive the price of state public spending to zero. In other words, state governments know that they receive unconditional grants; nonetheless, they somehow perceive that *participaciones* are conditional matching grants with a matching requirement close to zero. Even more, econometric estimates show that *participaciones* produce a negative income effect, which is a surprising result given that these are revenue-sharing transfers.

In sum, a fiscal illusion explanation for the observed response of state governments to *participaciones* seems unlikely.

Regarding the alternative explanation this dissertation work proposed, when one internalizes the possibility that state collection of own revenues falls short from satisfying a minimum provision level of state public goods, then the response of state governments to *participaciones* is contingent on whether or not the minimum provision level has been met. As one might expect, when state own revenues and *participaciones* are not enough to meet the minimum provision level, one observes a super flypaper effect; e.g., the state government “reacts” to *participaciones* by increasing its collection of own revenues. When the minimum provision level is binding, however, the recipient state government is not reacting to the revenue-sharing transfers but to the minimum provision level. On the other hand, when state own revenues and *participaciones* are more than enough to meet the minimum provision level of the state public good, one still observes a flypaper effect but of lesser magnitude; e.g., the recipient state government passes some revenue-sharing monies onto its constituents.

This dissertation work does not prove *ex ante* the existence of the minimum provision level of the local good. Instead, the employed maximum likelihood estimation method would determine whether the data support the existence of such minimum provision level. Nonetheless, there is no evidence that the federal government imposes the minimum provision level onto state

governments. That is, the Fiscal Coordination Act does not impose conditions as to how revenue-sharing transfers ought to be spent by recipient governments, nor has this author found any reference in the literature that points to the federal government *unofficially* imposing the requirement that recipient governments ought to spend all the revenue-sharing transfers. Instead, the minimum provision level might result from fact that state governments collect critically low levels of own revenues, which are far from enough to provide even basic state public goods and services.

The next section presents the theoretical models for the response of state governments to revenue-sharing transfers. Section 5.3 then presents the descriptive statistics of the panel data set. Sections 5.4 and 5.5 presents the derived econometric models and their estimation results, respectively. Finally, section 5.6 presents an analysis of the results and section 5.7 concludes.

5.2 MODEL SPECIFICATIONS.

This section presents three theoretical models that would be used to estimate the state governments' response to *participaciones*.⁶¹ The generic estimating equation⁶² is an *ad hoc* way of estimating the recipients' response to grants, which is considered here mainly for comparison purpose. The McGuire

⁶¹ See chapter 2 for a literature review on the effect of grants on the behavior of recipient governments.

⁶² I borrow this term from Case *et al* (1993).

model, on the other hand, allows for the estimation of both (i) state government response to *participaciones* and (ii) *perceived* income- and price-changing components of *participaciones*. The McGuire model would allow us to consider the possibility that the flypaper effect is due to fiscal illusion. State governments in Mexico spend *participaciones* beyond what the mainstream literature prescribes as optimal, because they have the *perception* that such transfers reduce the price of state public spending. Finally, an alternative model is developed to explain the presence of the flypaper effect in Mexico, which internalizes the fact that *participaciones* make up for more than eighty percent of state governments' budget. As a result, a recipient state government would have no option but to allocate most of the revenue-sharing transfers to the provision of state goods and services.

The Generic Estimating Equation Approach.

A straightforward method to evaluate a recipient government's response to grants —Gramlich (1969), O'Brien (1971), Weicher (1972), Bowman (1974), Feldstein (1975), Case *et al* (1993)— is to regress local government's expenditures against local income, received grants, and other exogenous determinants that may include economic, demographic, and political characteristics of the recipient locality. Such a generic estimating equation may result from a utility-maximizing behavior by the local decision-maker —see

Gramlich (1969), or below where a generic estimating equation is derived from the alternative model when the minimum provision level is not binding.

Grant Decomposition into Income and Price Components.

Fiscal illusion implies that, in addition to their expected income-changing component, unconditional grants would have a price-changing component, too. The source of the fiscal illusion may be due to factors such as information asymmetry between bureaucrats and voters, or the mechanism employed to distribute the revenue-sharing grants across recipient governments.

There is a literature —Courant, Gramlich, and Rubinfeld (1979); Oates (1979); Filimon, Romer, and Rosenthal (1982)—⁶³ that explain the existence of the flypaper effect as a result of voters who, unaware of the type and size of the grants their community receives, perceive a reduction in the *effective average* price they pay for public spending, which they further misinterpret as a reduction in the marginal price of public spending. In such setting, even unconditional grants may create a price illusion that leads a recipient jurisdiction to allocate more resources to the public sector than what they would otherwise.

On the other hand, Fisher (1979) argues that, provided revenue-sharing grants are allocated according to the recipients' tax effort, these grants may

⁶³ See also the discussion on the flypaper effect in chapter 2.

induce recipients to increase their tax collection —and so public spending— beyond what would be deemed desirable, in an attempt to increase their allotment of *free grant monies*. In order to better understand this argument, one must differentiate between lump-sum transfers and unconditional grants, which the literature treats as synonymous. By definition, a lump-sum transfer does not affect the recipients' behavior *at all*. The amount of a lump-sum transfer allocated to a recipient government is unrelated to its characteristics and behavior, both before and after the grant is awarded. Similarly, unconditional grant programs do not alter the recipient's behavior afterwards. For instance, revenue-sharing grants are general revenues for the recipient government. Nonetheless, the amount of a revenue-sharing transfer a recipient gets may depend on its characteristics —tax base— and pre-grant behavior —tax effort.⁶⁴

Mc Guire Model.⁶⁵

Grants alter a recipient jurisdiction's allocation of resources through their effect on the jurisdiction's resource constraint. The literature on grants analyzes their budget effect by decomposing it into income and price effects. Following this tradition, McGuire develops a model that allows for grants to have an *effective* structure that includes these two components. The *nominal legal*

⁶⁴ In Mexico, as discussed in chapter 4, the distribution of revenue-sharing transfers is formula-based, which includes as determinants the recipient government collection of federal assignable taxes —not own revenues—, state population, and includes a redistribution mechanism.

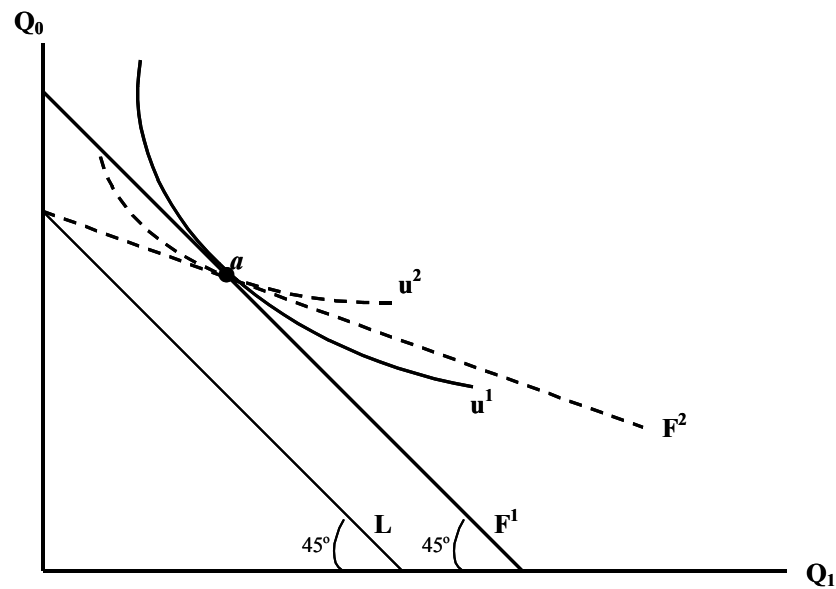
⁶⁵ This section follows McGuire (1975, 1978, 1979) —McGuire henceforth. Although McGuire developed his model for the case of conditional non-matching grants, its application to unconditional grants is straightforward as it is discussed below.

restrictions attached to a grant are not relevant since the model acknowledges the possibility that recipient governments may get around such restrictions.⁶⁶ “Moreover, the hypothesis is only that the federal-local system works *as if* it consisted of a pure income plus a pure price component.” (McGuire, 1975, p, 124.)

Given an observed after-grant allocation, McGuire model estimates both the grant’s structure and locality’s preference mapping that best support it. Consider the after-grant allocation of resources between composite private (Q_0) and public (Q_1) goods denoted by \mathbf{a} in figure 5.1, where L denotes the pre-grant local resources constraint. Such allocation could be the outcome of one of the following alternatives: (i) a lump-sum grant that increases the resource constraint from L to F^1 and a map of local preferences that includes indifference curve u^1 ; (ii) an open-ended matching grant that transforms the resource constraint from L to F^2 and a map of local preferences that includes indifference curve u^2 ; (iii) a highly policed conditional grant that transforms its resource constraint from L to the discontinuous budget constraint F in figure 5.2; or (iv) a grant that have both income- and price-changing components, like the case shown in figure 5.3.

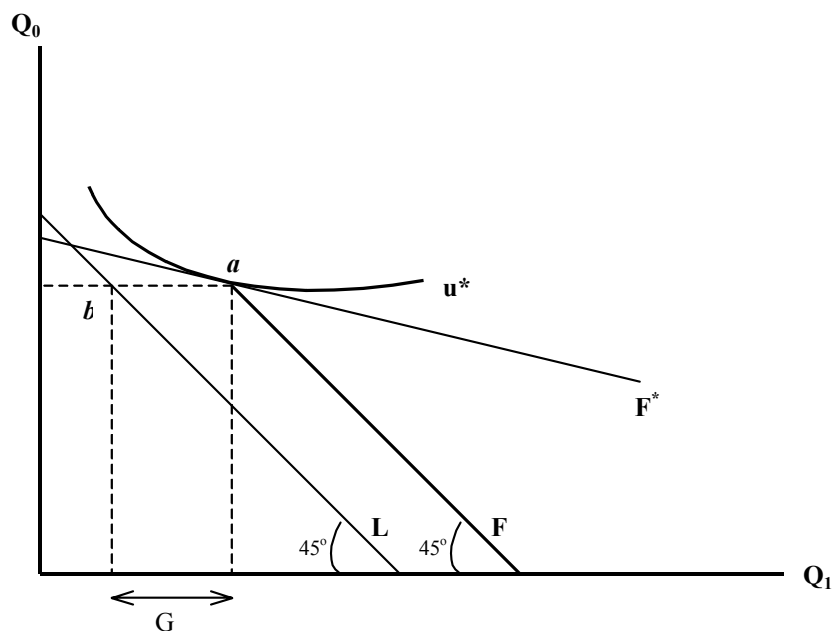
⁶⁶ For instance, local bureaucrats may convert part of the monies they received from conditional grant programs into fungible resources or general revenues, which they can spend at their discretion. Quoting McGuire (1975): “Possibly the greatest opportunity for defeating intended conditional effects occurs in cases where grants are supposed to apply only to increases in local output over current levels. By understating or reducing normal funding to the subsidized programs, by using a project which would be undertaken in any case as the vehicle for securing a matching grant, by redefining budget categories, or by judicious allocation of overhead costs, local officials may, in effect, convert the grant to a pure income supplement.” (McGuire, 1975, p. 121)

Figure 5.1: Alternative pairs of grant structures and preference mapping.



Notice that McGuire model can only *approximate* the case of a highly policed conditional grant —see figure 5.2. Estimates of the McGuire model would show a price change although it did not occur. In other words, the budget line F^* does not actually exist. As a result, the McGuire model does not estimate the actual relative price of the composite state public good; instead, the model simply estimates a *perceived effective* price that best support the observed allocation of state resources under the assumption that the grant's budget effect is decomposed into income- and price-changing components.

Figure 5.2: A two-part grant structure approximation of a response to a conditional grant.



McGuire assumes an economy with two layers of government, where the central government transfers resources to the local government in the form of *conditional grants*. A jurisdiction allocates its fungible resources between the provision of a private good, Q_0 , and a public good, Q_1 . Let p_0 and p_1 denote the price of Q_0 and Q_1 , respectively. Suppose both goods are provided at constant average cost, and the units of Q_0 and Q_1 are defined so that the cost of one unit of each good is normalized to 1; e.g., $p_0 = p_1 = 1$. As a result, the quantity provided of the private and public goods equals the spending level on each of them. Define L as the total local own resources level, whereas L_0 and L_1 are the local own

resources the recipient jurisdiction allocates to the provision of Q_0 and Q_1 , respectively. The locality's preferences and resource constraint determine the observed consumption of Q_0 and Q_1 .

The local bureaucracy behaves as to maximize a Stone-Geary utility function,⁶⁷ subject to total local fungible resources, F .⁶⁸ As a result, the locality's allocation decision is the outcome of the following optimization problem,

$$\begin{aligned} \underset{\{Q_0, Q_1\}}{\text{Max}} \quad & u = (Q_0 - \gamma_0)^{1-\beta} (Q_1 - \gamma_1)^\beta \\ \text{subject to} \quad & F = p_0 Q_0 + p_1 Q_1 \end{aligned} \tag{1}$$

Here, γ_0 and γ_1 are parameters that may be interpreted as minimum consumption levels of the private and public goods, respectively; β is another parameter representing the jurisdiction's propensity to consume the public good out of local fungible resources.

The first-order conditions for this problem render the following system of expenditure equations,

$$p_1 Q_1 = \beta F - \beta p_0 \gamma_0 + (1 - \beta) p_1 \gamma_1 \tag{2}$$

⁶⁷ Although McGuire refers to local bureaucrats, his model follows the utility-maximizing approach where the local bureaucracy is the decision-maker. See the discussion on intergovernmental grants-in-aid in chapter 2.

⁶⁸ F differs from L when the local jurisdiction receives fungible resources from outside, say, the central government.

$$p_0 Q_0 = F - p_1 Q_1 \quad (3)$$

Assume the locality receives a *conditional* grant of size G . Assume further that *all* grant monies are spent on the provision of the public good only. Nonetheless, local bureaucrats may convert some of the conditional grant monies into fungible resources by substituting local own resources away from the provision of the public good. Thus, a grant's *nominal legal* restrictions may not be *effective*. The locality pre-grant resource constraint, L , is exogenous but the after-grant allocation of local own resources between the private (L_0) and the public good (L_1) is not.

The grant's *effective income-changing* component refers to the amount of conditional grant monies the recipient jurisdiction converts into fungible resources G_f , which is not observable. As a result, some structure must be imposed to the model in order to estimate G_f . *For instance*, the income-changing component may be positively related to the size of the grant as follows,⁶⁹

$$G_f = \phi G \quad (4)$$

⁶⁹ "Alternative hypothesis might include (1) taking G_f to be a constant, (2) taking ϕ to be some function of G on grounds that a big grant may be more or less easily converted to fungible money, or (3) taking ϕ to be some function of L on grounds that a grant of given size is less visible in the accounts of a rich than a poor recipient. Given the diversity of state-local governments a next logical step in this model would be to incorporate variable ϕ ." (McGuire, 1978, footnote 4, p. 30. Variables in bold shows change in notation according to this paper.) In the econometric model, ϕ is not a constant but a function of a set of exogenous variables and thus varies across states.

As a result, the locality's after-grant fungible resources would be given by,⁷⁰

$$F = L + \phi G \quad (5)$$

The grant's *perceived effective price-changing* component is derived next. Notice that the recipient locality spends $L_I + G_f$ out of its fungible resources on the provision of the public good. Nonetheless, the local consumption of the public good is given by,

$$Q_I = L_I + G \quad (6)$$

Thus, there is a mismatch between the amount the locality spends on the public good and its provision level, which reduces the *perceived* price of the public good. The after-grant *perceived effective price* of the public good is given by,⁷¹

$$p = \frac{L_I + \phi G}{L_I + G} = 1 + \frac{(\phi - 1)G}{L_I + G} = 1 + (\phi - 1) \left[\frac{G}{L_I + G} \right] \quad (7)$$

⁷⁰ "It might be argued that it is inconsistent to assume that G_f is a fixed proportion of G and at the same time equivalent to a fixed, unconditional income supplement. But although such an hypothesis would be inconsistent for a single individual who foresaw, understood, and responded for the entire federal grant package at once, it is in no way inconsistent for a decision group. Moreover, the hypothesis is only that the federal-local system works *as if* it consisted of a pure income plus a pure price component." (McGuire, 1975, p. 124. Variable in bold shows change in notation according to this paper.)

⁷¹ This way of modeling the after-grant price of the aided good is standard in the literature. See Courant, Gramlich, and Rubinfeld (1979); Oates (1979); Filimon, Romer, and Rosenthal (1982).

After substituting (5), (6), and (7) in (2) and rearranging terms, the resulting equations system of local expenditures is,⁷²

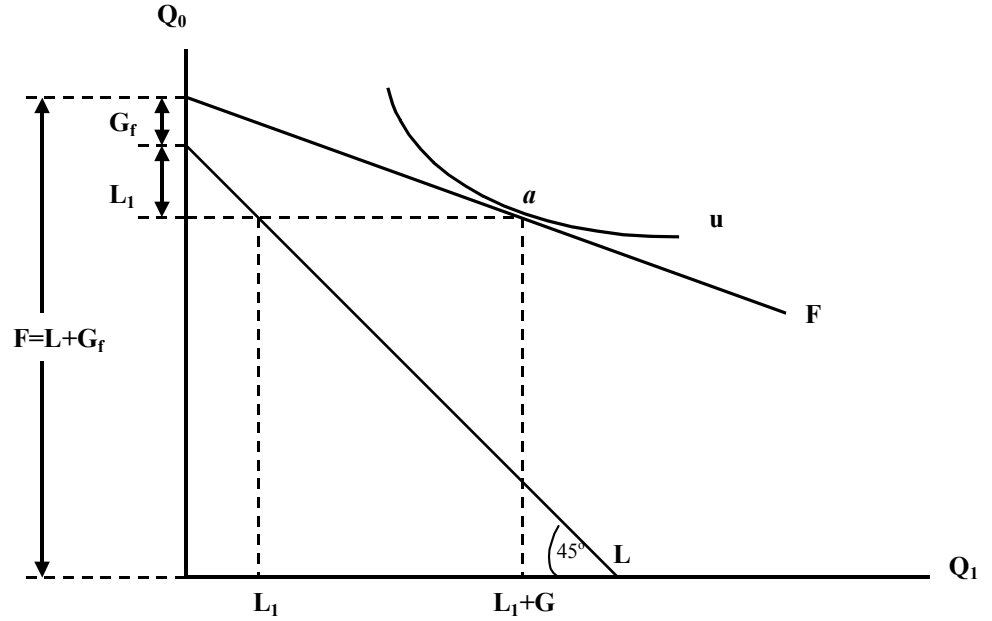
$$L_1 = [(1 - \beta)\gamma_1 - \beta\gamma_0] + \beta L + (\beta - 1)\phi G + (1 - \beta)(\phi - 1)\gamma_1 \left[\frac{G}{L_1 + G} \right] \quad (8)$$

$$L_0 = L - L_1 \quad (9)$$

Figure 5.3 shows a graphical representation of the locality's allocation problem. Here, the observed after-grant allocation \mathbf{a} is most likely the outcome of a grant with a structure that includes both income- and price changing components, and a local preference mapping that includes indifference curve \mathbf{u} . The income-changing component is shown as an initial parallel shift of the locality's resources constraint by the amount G_f . The price-changing component is shown by a counter clockwise pivot of the resource constraint, which reflects a lower after-grant price of the public good.

⁷² The price equation (7) and the public expenditures equation differ from McGuire in that McGuire treats the term $q = [G/(L_1 + G)]$ as an exogenous variable. McGuire acknowledges the estimation problem from treating q as exogenous: " $q \equiv G/(L_a + G)$ is negatively correlated with the error term; hence the estimated coefficients will be biased" —McGuire, 1975, footnote 18, p.127. Nonetheless, McGuire model is usually estimated assuming q exogenous —McGuire (1978, 1979), Zampelli (1986), Peña (2001).

Figure 5.3: Grant decomposition into income and price components.



Recipient Response to Grants.

Following the system (8)-(9), a recipient jurisdiction allocates its fungible resources in fixed proportions $(1-\beta):\beta$ to the provision of private and public goods, respectively. In particular, equation (8) determines the level of own revenues local bureaucrats collect to finance the provision of Q_1 . The impact of a grant increase of \$1 on state collection of own revenues is given by,

$$\frac{\delta L_1}{\delta G} = (\beta - 1)\phi + (1 - \beta)(\phi - 1)\gamma_1 \left[\frac{L_1}{(L_1 + G)^2} \right] \quad (10)$$

Notice that expression (10) determines the *participaciones* monies that a recipient jurisdiction transfers to its residents through cuts in local taxes. Thus, $(\delta L_1/\delta G)$ is expected to be negative and equal in absolute value to the portion of G that is allocated to the provision of the private good. Therefore, the increase in local public spending caused by a \$1 increase in *participaciones* is given by,

$$1 + \frac{\delta L_1}{\delta G} \quad (11)$$

On the other hand, the increase in local public spending —financed with local own resources— caused by an increase in state private resources of \$1 is given by,

$$\frac{\delta L_1}{\delta L} = \beta \quad (12)$$

If *participaciones* were truly unconditional transfers, then it would be the case that $\phi=1$.⁷³ As a result, the impact of *participaciones* on state public spending is given by,

$$1 + \frac{\delta L_1}{\delta G} = 1 + (\beta - 1) = \beta \quad (13)$$

⁷³ From the price-equation (7), if $\phi=1$ the after-grant *perceived* price of the public good will remain at its pre-grant level; e.g., $p=1$.

Therefore, if *participaciones* are in fact lump-sum transfers, a \$1 increase in *participaciones* will have the same impact on state collection of own revenues as a \$1 increase in state private resources.

Non-Fungibility of Revenue-Sharing Grants.

Revenue-sharing transfers are practically the only source of revenues for state governments in Mexico. *Participaciones* account for over eighty percent of state government revenues. Therefore, it is unlikely that state governments would treat *participaciones* as fungible resources. Otherwise, public spending would be minimal since most —90 to 95 per cent, following Hines and Thaler (1995)— of the revenue-sharing monies would find their way back to private agents through cuts in state taxes. The literature on grants-in-aid does not address explicitly the issue of the relevance of grants-in-aid in the budget of the recipient government. The alternative model developed below explains the presence of the flypaper effect when grants-in-aid account for most of the recipient's budget.

The setting and definition of variables is similar to McGuire. Assume a two-tiers government structure where the central government provides *unconditional* grants-in-aid (G) to local governments. As a result, the recipient locality's after-grant fungible resources are given by $F = L + G$.⁷⁴ Local fungible resources are allocated to the consumption of composite private (Q_0) and public

⁷⁴ In terms of the McGuire model, we are forcing $\phi = 1$. That is, we are forcing the unconditional grant to have income-changing effect only.

(Q_1) goods. Assume the local decision-maker's preferences are determined by the following Stone-Geary utility function: $u = (Q_0 - \gamma_0)^{1-\beta} (Q_1 - \gamma_1)^\beta$. Let L denotes local own fungible resources, from which L_0 and L_1 are allocated to the consumption of Q_0 and Q_1 , respectively. Assume further that, from an accounting recording perspective, G is indeed allocated to the provision of Q_1 ; thus, grant monies may be transferred to private economic agents through a reduction in local taxes, L_1 . Let p_0 and p_1 denote the price of Q_0 and Q_1 , respectively. Assume further that Q_0 and Q_1 are produced at constant marginal cost and their unit of measure is such that the cost of producing one unit of either composite good is 1. Alternatively, $p_0 = p_1 = 1$. Moreover, $L_0 = Q_0$ and $L_1 = Q_1 - G$.

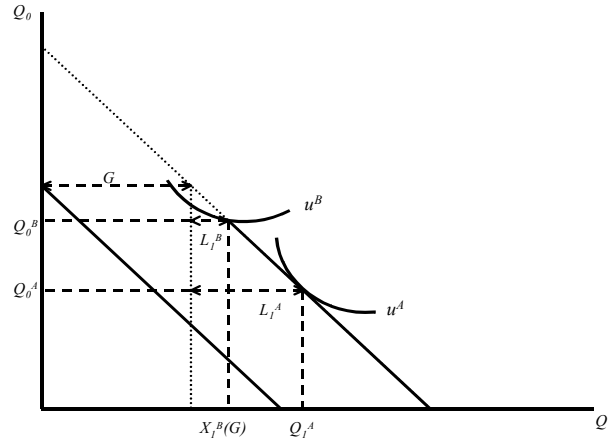
Assume that the local government *perceives* there exists a minimum level of the public good it should provide, $X_1(\cdot)$. This *perceived* target level might be due to the local constituency's expectation to consume a minimum level of the local public good, the local bureaucracy's desire to manage a minimum budget level, among other possible determinants. This dissertation work does not prove *ex ante* the existence of the minimum provision level of the local good. Instead, the maximum likelihood estimation method would determine whether the data support the existence of such minimum provision level.

In such case, the local policy-maker faces the following decision problem,

$$\begin{aligned}
& \max_{Q_0, Q_1} u(Q_0 - \gamma_0)^{1-\beta} (Q_1 - \gamma_1)^\beta \\
& s.t. \quad Q_0 + Q_1 \leq L + G \\
& \quad \quad Q_1 \geq X_1(.)
\end{aligned} \tag{14}$$

Assuming local preferences are non-satiabile locally, the budget constraint binds at the optimum. The minimum public good output level constraint may or may not bind at the optimum. The pictorial representation of this problem is shown in figure 5.4.⁷⁵ Tangency point A shows that if the minimum provision level of the public good is not binding, the unconditional grant would have income effect only, as the mainstream theory predicts. Otherwise, the allocation decision would be the result of a corner solution as shown by point B.

Figure 5.4: Recipient's response to a lump-sum transfer under a minimum provision level.



⁷⁵ The figure shows the case $X_1^B(G) > G$, but it is also possible that $X_1^B(G) \leq G$.

The recipient jurisdiction's response to a lump-sum grant is determined by the first order conditions to the optimization program (14). If the perceived minimum output level restriction does not bind, case A, the first order conditions render the following demand for the public good:⁷⁶

$$Q_1 = (1 - \beta)\gamma_1 - \beta\gamma_0 + \beta(L + G) \quad (15)$$

One can translate this demand equation in terms of local resources allocated to the provision of the public good. After substituting $Q_1 = L_1 + G$ and rearranging terms, one obtains the following —generic estimating— expenditure equation for the public good:⁷⁷

$$L_1 = (1 - \beta)\gamma_1 - \beta\gamma_0 + \beta L - (1 - \beta)G \quad (16)$$

Otherwise, case B, the first order conditions render the following equation:

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$$\left(\frac{\beta}{1 - \beta} \right) \left(\frac{L + G - X_1(.) - \gamma_0}{X_1(G) - \gamma_1} \right) = \frac{\lambda - \mu}{\lambda} < 1 \quad (17)$$

⁷⁶ As stated above, $p_0 = p_1 = 1$.

⁷⁷ The expenditure equation for the private good would then be given by $L_0 = L + G - L_1$.

⁷⁸ The Lagrange multipliers for the resource and minimum provision level constraints are λ and μ , respectively.

In this corner solution case, the local government makes no decision as to the allocation of the locality's resources to the provision of both local public and private goods. The perceived minimum output level constraint would determine the locality's provision level of the public good; e.g., $Q_1 = X_1(.)$. As a result, the provision level of the private good would be determined by $Q_0 = L + G - X_1(.)$.

In terms of local resources allocated to the provision of the public good, this allocation decision is exogenously determined by both the *participaciones* level and the minimum output level restriction: $L_1 = \hat{L}_1(.) = X_1(.) - G$.⁷⁹ Therefore, if there exists a binding minimum provision level for the public good, $X_I(.)$, there would also exist a minimum level of own resources the jurisdiction must allocate to the provision of the public good, $\hat{L}_1(.)$.

In sum, we have that the recipient government would allocate local resources to the provision of the public good according to the following decision rule,

$$L_1(G) = \max\{\hat{L}_1(.), (1 - \beta)\gamma_1 - \beta\gamma_0 + \beta L + (\beta - 1)G\} \quad (18)$$

⁷⁹ The allocation of local resource to the provision of the private good would be exogenously determined, too. That is, $L_0 = Q_0 = L + G - X_I(.)$.

5.3 DESCRIPTIVE STATISTICS.

Data Set.

The state response to *participaciones* is estimated under alternative econometric models, all of which use a panel data set that includes the 31 Mexican states over the seven years period 1993-1999. The definition of variables and their corresponding descriptive statistics are presented in tables 5.1 and 5.2, respectively.⁸⁰ Nominal variables are measured in *per capita* terms and in thousands of 1999 Mexican pesos (MEX\$, henceforth). Regarding the data set, the Federal District —Mexico City— is excluded from the sample because *de facto* it is both a state and a city in fiscal terms, and so it would only provide outlier observations. The 1997 observation for the state of Nuevo León is excluded from the sample, too. In 1997, Nuevo León made a *one time and for all* sale of assets to repay part of its debt, which is recorded as a sharp increase in the state's own revenues and so it represents an outlier observation in the sample.⁸¹ Therefore, the sample size is of 216 observations.

⁸⁰ This table includes variables that will be used in later estimates.

⁸¹ Excluding 1997, for the sample period, Nuevo León spent on average MEX\$ 0.48288 per person, to finance the provision of state goods and services. The corresponding standard deviation is MEX\$ 0.09685. In contrast, in 1997 Nuevo León reports $L_I = \text{MEX\$ } 1.13599$.

Table 5.1: Definition of variables.

Financial variables	
<i>L</i>	state gross output.
<i>L₁</i>	state governments' collection of own revenues: state taxes, derechos and productos. (Aprovechamientos are excluded because until 1994 these budget item includes conditional grants, but since 1995 these are recorded as transferencias. See discussion on aportaciones in chapter 3.)
<i>G</i>	level of participaciones received by state government.
<i>fedinv</i>	federal investment within a state.
Socio-economic variables	
<i>margina</i>	index that measures the availability of basic public services and demographic variables across states; it aims at measuring state needs for public services —alternatively, it measures state development level—: the larger the index the larger the need for basic public services.
<i>sewerage</i>	proportion of the state population who live in a place with no sewerage and toilet, in 1995;
<i>rural</i>	proportion of the state population who live in a community with less than 5,000 habitants, in 1995.
<i>schools</i>	number of elementary and secondary schools in each state (in thousands);
<i>density</i>	state's population density (thousands per square kilometer);
<i>population</i>	state's population (in millions).
<i>fair_tax</i>	citizens' perception of state taxes in 1996; scale from 0 (very high) to 10 (fair).
Dummy variables	
<i>Doil</i> :	1 if Campeche or Tabasco (oil producer states), and 0 otherwise.
<i>M#</i> :	1 if #, 0 otherwise; where # = {2, 3, 4, 5} level of marginación: M2, low; M3, medium; M4, high; M5, very high. The larger the level of marginación, the larger the need for basic public services
Data Sources	
INEGI(1): <i>L</i> .	
INEGI(2): <i>L₁</i> , <i>G</i> .	
CONAPO (1): <i>margina</i> , <i>sewerage</i> , <i>rural</i> , <i>schools</i> , <i>density</i> .	
CONAPO (2): <i>population</i> .	
Serrano and Sandoval (1997): <i>fair_tax</i> .	

Table 5.2: Descriptive Statistics.

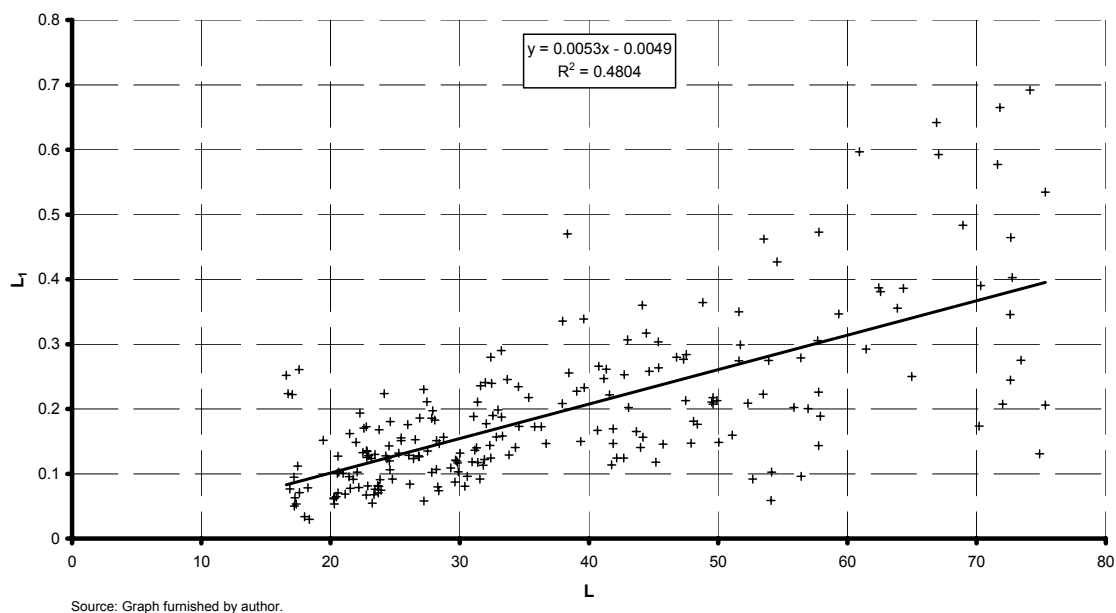
Descriptive Statistics										
	L_1	L	G	<i>invfed</i>	<i>density</i>	<i>population</i>	<i>margin</i>	<i>fair_tax</i>	<i>sewerage</i>	<i>rural</i>
Mean	0.1938	37.3934	1.3362	1.6511	0.0857	2.7306	0.0633	4.9389	0.1487	0.3589
Standard Error	0.0083	1.0804	0.0341	0.1631	0.0074	0.1582	0.0656	0.0556	0.0081	0.0108
Median	0.1590	32.3646	1.2065	1.0277	0.0465	2.1846	-0.1887	4.8000	0.1284	0.3532
Standard Deviation	0.1218	15.8785	0.5011	2.3970	0.1093	2.3243	0.9638	0.8174	0.1192	0.1587
Sample Variance	0.0148	252.1273	0.2511	5.7455	0.0120	5.4025	0.9289	0.6682	0.0142	0.0252
Kurtosis	3.3749	-0.3713	6.6836	23.4853	9.4346	6.1773	-0.3930	-0.6098	0.6777	-1.0611
Skewness	1.6903	0.7881	2.2189	4.5827	2.8948	2.2331	0.5575	-0.0194	1.0836	0.1795
Range	0.6624	58.7581	3.2291	18.7548	0.5931	12.4772	3.8582	3.0000	0.4781	0.5731
Minimum	0.0295	16.5676	0.6960	0.0009	0.0048	0.3559	-1.4960	3.3300	0.0046	0.0826
Maximum	0.6919	75.3258	3.9251	18.7557	0.5980	12.8331	2.3622	6.3300	0.4827	0.6558
Count	216	216	216	216	216	216	216	216	216	216
Covariance Matrix										
	L_1	L	G	<i>invfed</i>	<i>density</i>	<i>population</i>	<i>margin</i>	<i>fair_tax</i>	<i>sewerage</i>	<i>rural</i>
L_1	0.0148									
L	1.3341	250.9600								
G	0.0119	2.9277	0.2499							
<i>invfed</i>	0.0234	13.7862	0.6881	5.7189						
<i>density</i>	-0.0015	-0.3878	-0.0078	-0.0518	0.0119					
<i>population</i>	-0.0282	-10.0219	-0.4004	-1.4601	0.1536	5.3775				
<i>margin</i>	-0.0553	-9.4733	-0.0606	0.4022	-0.0162	0.1833	0.9246			
<i>fair_tax</i>	0.0213	4.2116	0.0481	-0.1191	-0.0029	-0.4800	-0.3210	0.6651		
<i>sewerage</i>	-0.0053	-0.7435	-0.0092	0.0465	-0.0019	-0.0248	0.0879	-0.0327	0.0142	
<i>rural</i>	-0.0108	-1.7898	-0.0054	0.0337	-0.0026	-0.0097	0.1336	-0.0438	0.0118	0.0251
Correlation Matrix										
	L_1	L	G	<i>invfed</i>	<i>density</i>	<i>population</i>	<i>margin</i>	<i>fair_tax</i>	<i>sewerage</i>	<i>rural</i>
L_1	1									
L	0.6931	1								
G	0.1963	0.36967	1							
<i>invfed</i>	0.0806	0.36390	0.5756	1						
<i>density</i>	-0.1119	-0.22442	-0.1426	-0.1986	1					
<i>population</i>	-0.1000	-0.27281	-0.3454	-0.2633	0.6072	1				
<i>margin</i>	-0.4737	-0.62190	-0.1261	0.1749	-0.1541	0.0822	1			
<i>fair_tax</i>	0.2154	0.32599	0.1179	-0.0611	-0.0322	-0.2538	-0.4094	1		
<i>sewerage</i>	-0.3640	-0.39453	-0.1546	0.1634	-0.1456	-0.0898	0.7687	-0.33730	1	
<i>rural</i>	-0.5600	-0.71376	-0.0678	0.0890	-0.1478	-0.0265	0.8777	-0.33934	0.6279	1

Variables of Interest.

The goal is to test the flypaper effect for the case of the Mexican revenue-sharing grants system. The variables of interest then are state collection of own revenues (L_1), state gross output (L), and *participaciones* (G). In particular, we

focus on the effect of L and G on L_I . The financial dependency of state governments on revenue-sharing transfer is clear when one observes that, at the sample means, *participaciones* (MEX\$ 1.34) are almost seven times larger than state collection of own revenues (MEX\$ 0.19).

Figure 5.5: State collection of own revenues vs. state domestic product: panel data 1993-1999 (thousands of 1999 Mexican pesos)

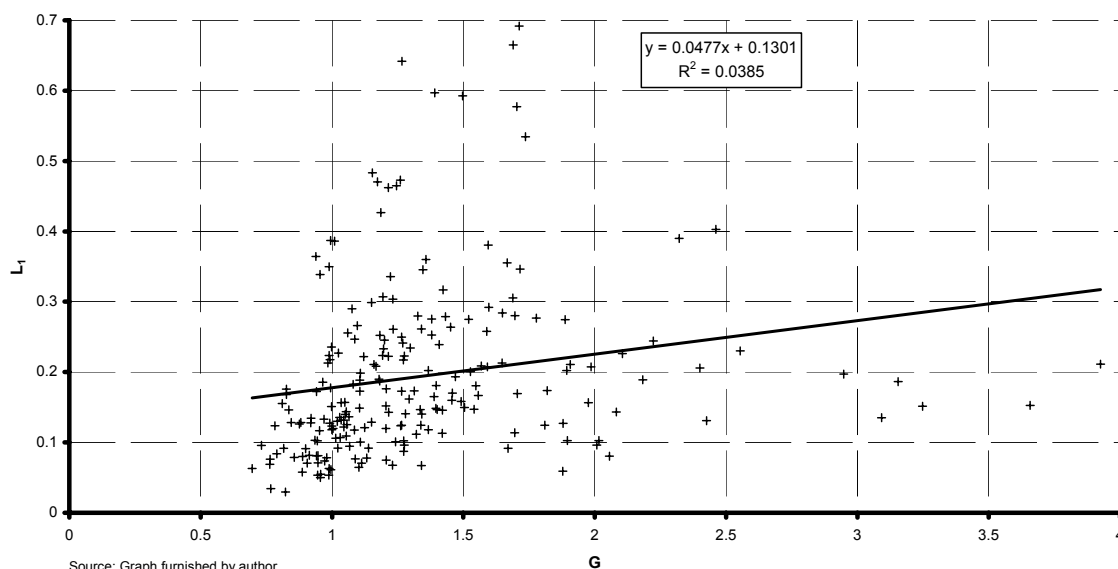


Source: Graph furnished by author.

Figures 5.5 and 5.6 depict the relationships of interest. State collection of own revenues, as one might expect, is positively related with state gross output. Furthermore, L explains forty eight percent of the variation in L_I . On the other hand, the positive relationship between state collection of own revenues and *participaciones* contradicts the mainstream literature, which treats revenue-

sharing transfer as a *veil for the tax cut*. In other words, the literature prescribes that recipient government would use some of the revenue-sharing monies to provide cuts in state taxes. As a result, revenue-sharing grants are expected to cause a drop in state collection of own revenues.

Figure 5.6: State collection of own revenues vs. *participaciones*: panel data 1993-1999 (thousands of 1999 Mexican pesos)



The above descriptive analysis thus points to the presence of the flypaper effect for the Mexican system of revenue-sharing transfers. However, these inferences cannot be definitive. For instance, the positive correlation between L_1 and G ignores the effect that other determinants have on L_1 . Econometric analysis is necessary to sort out the actual relationship between these two variables.

Control Variables

In addition to the regressors of interest: G and L , econometric models include also economic and demographic variables with the goal of capturing the heterogeneity across states and over time. Indeed, panel data estimation techniques—fixed and random effects—are used whenever it is possible.

The expected effect of the added control variables is discussed next. The federal government's investment spending by state (*invfed*) is included to account for the public goods provided by the federal government. If federal and state spending are substitute, the larger *invfed* the lower the need for state spending. The citizens' perception about the fairness of state taxes (*fair_tax*) is included to account for the ease at which state governments collect taxes. If citizens perceive state taxes as fair—e.g., larger levels of *fair_tax*—, it would be easier for the state government to collect the revenues needed to finance state public spending. On the other hand, one might expect that the larger the population density (*density*), economies of scale in the provision of public goods would be exploited and so there would be less need for state spending. Also, the larger the proportion of state population without sewerage (*sewerage*), the larger the need for more state spending.

In some cases, estimation problems prevent us from using panel data estimation techniques. This is an issue of concern because, as the estimation results from the generic-estimating equation shows below, state effects are statistically significant. In order to capture unobserved heterogeneity across states, these are grouped in terms of their index of marginación.⁸² That is, states with similar needs for state public goods would be grouped together. A state needs for public goods may be very low (*M1*), low (*M2*), medium (*M3*), high (*M4*), or very high (*M5*). Dummy variables are used to determine to which group a state belongs. State group dummies, as shown below, are statistically significant.

5.4 ECONOMETRIC MODELS.

This section presents the econometric models that are derived from the theoretical models discussed in section 5.2. It also includes a discussion on estimation issues for the alternative model. All three econometric models have the goal of estimating the effect of *participaciones* and state private resources on the level of state public spending. In particular, the objective is to estimate the state marginal propensity to consume the public good out of *participaciones* (MPCG) and out of state private resources (MPCL). The mainstream fiscal federalism

⁸² The National Population Council (CONAPO) publishes an index of marginación that measures the availability of basic public services and demographic variables across states. The basic public services include access to education, sewerage, and electricity. The demographic information includes proportion of rural population, proportion of communities with small population, among others. The years of measurement are limited: 1990, 1995, and 2000. The index of marginación, thus, reflects the degree of development in each state. That is, the larger the index the lower the level of development; therefore, this index may be used to evaluate whether the allocation of revenue-sharing transfers in fact has a redistributive component.

literature, as discussed before, prescribes that $MPCG = MPCL$ for the case of revenue-sharing transfers.

All three econometric models are single equation models. Simultaneity bias is not likely to be present. A possible bias source would be a feedback effect from state collection of own revenues to *participaciones*. Empirical literature on grants commonly assumes that the size of the grant is exogenous to the recipient government, following O'Brien (1971) finding that the grant size and the recipient governments' spending level are not simultaneously determined. In contrast, Islam and Choudhury (1990) find the opposite for the case of provincial grants to municipalities in Ontario. In the Mexican case, the simultaneous determination of grants and local spending would imply that state governments increase their collection of own revenues in order to increase their allotment of *participaciones*. However, during the period of study, the revenue-sharing formula includes state collection of assignable taxes as a determinant not state collection of own revenues. Furthermore, the McGuire model produces very close estimates—to the ones shown below—when it is estimated using a system of two equations: an expenditure equation, like the one shown below; and a *participaciones* equation, like the one estimated in chapter 4 using panel data.⁸³

Another potential source of simultaneity bias would be a feedback effect from state collection of own revenues to state gross domestic product, which is an

⁸³ The alternative model cannot be estimated under a system of equations specification.

issue the empirical literature on grants-in-aid has not addressed yet. In any case, in Mexico state collection of own revenues is relatively so small that it would hardly have a significant impact on state gross product. At the sample means, state collection of own revenues amounts to 0.52 per cent of state gross product. Nonetheless, a possible simultaneity bias cannot be ruled out and thus this issue is a potential shortcoming of the following analysis.

Generic Estimating Equation.

The generic estimating equation approach defines an *ad hoc* econometric model that regresses local government's expenditures on the public good against the locality's aggregate income, grants received, and other exogenous determinants. The resulting econometric model is the following:

$$L_1 = \alpha_0 + \alpha_1 L + \alpha_2 G + \alpha_3 invfed + \alpha_4 sewerage + \alpha_5 density + \alpha_6 fair_tax + \varepsilon$$

McGuire Model.

The McGuire model determines the non-linear—in both parameters and variables—econometric model below. This econometric model follows from the public good expenditure equation (8). The econometric model allows for ϕ to vary across states⁸⁴ and includes socio-economic and dummy variables as controls.

⁸⁴ The model was estimated assuming ϕ constant, but results showed specification problems.

$$\begin{aligned}
& L_1 - (1 - \beta)\gamma_1 + \beta\gamma_0 - \beta L - (\phi_0 + \phi_1 \text{margina} + \phi_2 G)(\beta - 1)G - \\
& (1 - \beta)[(\phi_0 + \phi_1 \text{margina} + \phi_2 G) - 1]\gamma_1 \left(\frac{G}{L_1 + G} \right) - \\
& \theta_1 \text{sewerage} - \theta_2 \text{density} - \theta_3 \text{invfed} - \theta_4 \text{fair_tax} - \theta_6 M2 - \theta_7 M3 - \theta_8 M4 - \theta_9 M5 - \\
& \theta_{10} D94 - \theta_{11} D95 - \theta_{12} D96 - \theta_{13} D97 - \theta_{14} D98 - \theta_{15} D99 = \varepsilon_{L_1}
\end{aligned}$$

Alternative Model.

The alternative model determines, according to the public spending decision rule (18), an econometric switching regime model. This paper estimates three nested specifications of the alternative model, which will be labeled *Switch n* for $n = \{1, 2, 3\}$. The *Switch 1* model imposes the restrictions: (i) $\text{MPCG} = \text{MPCL}$ and (ii) the minimum public spending level, \hat{L}_1 , is a constant parameter to be estimated. *Switch 1* is written as follows, where the constant term $\alpha = (1 - \beta)\gamma_1 - \beta\gamma_0$ and ε_1 and ε_2 are the error terms for regimes 1 and 2, respectively.

$$L_1(G) = \max\{\hat{L}_1 + \varepsilon_1, \alpha + \beta L + (\beta - 1)G + \varepsilon_2\}$$

On the other hand, the *Switch 2* model lifts the restriction on the parameters of L and G .

$$L_1(G) = \max \{\hat{L}_1 + \varepsilon_1, \alpha + \beta L + \gamma G + \varepsilon_2\}$$

Finally, the *Switch 3* model lifts the restriction that the minimum spending level is a constant parameter, and it further adds a vector of control variables \vec{Z}_1 y \vec{Z}_2 in both regimes.

$$L_1(G) = \max \{\alpha_1 + \delta_1 \vec{Z}_1 + \varepsilon_1, \alpha_2 + \beta L + \gamma G + \delta_2 \vec{Z}_2 + \varepsilon_2\}$$

A Note on the Estimation of the Alternative Model.

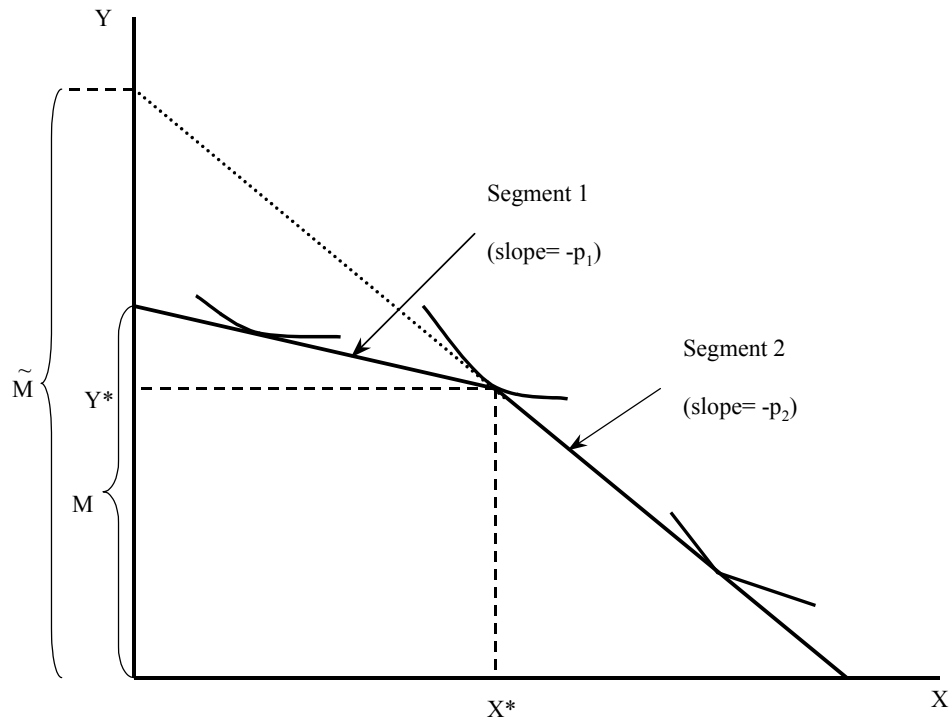
Switching regime models have been used to estimate the response of recipient jurisdictions to *closed-ended matching grants* —Moffit(1984), Megdal (1987), Barnett, Levaggi, and Smith (1991).⁸⁵ Consider the case depicted in figure 5.7, for instance, the federal government subsidizes the local provision of the public good at the rate σ up to a maximum spending level denoted by X^* . It is assumed that the pre-grant prices of public and private goods are normalized to one. If the local governments provides X^* or less units of the public good, then, the unit price the locality would pay for the public good would be $p_1 = (1-\sigma)$. On the other hand, if the local government provides more than X^* units of the public good, the locality would pay p_1 for the first X^* units of the public good and $p_2 = 1$ for units of the public spending in excess of X^* . The price of the private good

⁸⁵ Moffit and Nicholson (1982) use a switching regime model to estimate the effect of insurance unemployment, where unemployment benefits run out after a certain period and so the unemployed individual faces a kinked budget constraint. Moffit (1986) survey the application of maximum likelihood method to the estimation of kinked demand models.

remains unchanged for any provision level, since the grant subsidizes the public good only.

Therefore the optimization problem the recipient jurisdiction faces is to allocate its resources between the private and public goods subject to a kinked budget constraint. In nature, this is the same setting as in our alternative model. However, in the switching regime model shown in figure 5.7, the legal requirements attached to the *closed-ended matching grant* determine both the kink point (X^*) and the slope of the two segments of the budget constraint (p_1 and p_2). In contrast, in our alternative model both the *perceived* provision constraint and the price of the public good for provision levels below the minimum are unknown. We know only that, once the *perceived* minimum provision level of the public good is met, the grant does not alter the price of the public good. The alternative econometric model then is a switching regime model with unknown sample separation; e.g., one ignores whether a particular observation exceeds the *perceived* minimum provision level for the public good.

Figure 5.7: Piecewise-linear convex budget set.



Source: Megdal (1987)

As a result, the estimation of our alternative econometric model is rather challenging. Quoting Maddala (1986, p. 1642):

There are two major problems with the model with unknown sample separation, one conceptual and the other statistical. The conceptual problem is that we are asking too much from the data when we do not know which observations are on demand function and which are on the supply function—in our case: below, on, or above the perceived minimum provision level—... The statistical problem is that the likelihood functions for this class of models are usually unbounded unless some restrictions (usually unjustifiable) are imposed on the error variances.

5.5 ESTIMATION.

This section presents separately the econometric estimates for the three econometric models outlined in the previous section. The main objective is to estimate the state marginal propensity to consume of the public good out of revenue-sharing grants (MPCG) and out of state private resources (MPCL). The comparison of estimates for MPCG and MPCL across econometric models as well as the analysis of results will be presented in the next section.

Generic Estimating Equation.

The generic estimating equation is estimated using ordinary least squares (OLS), two-way state and year fixed effects (FE), and two-way state and year random effects (RE). Estimation results are reported in the table 1.⁸⁶ Hypothesis testing is used to discriminate among model alternatives. The outcome from a F-test shows that the two-way fixed effects are jointly statistically different from zero at a one percent level of significance. On the other hand, the outcome from a Hausman specification test is that one can reject the null hypothesis of random effects at one percent significance level. The panel aspect of the data, state effects primarily,⁸⁷ determines estimation results.

⁸⁶ Estimation is performed using the software LIMDEP Version 8.

⁸⁷ The one-way state fixed effects reports an adjusted $R^2 = 0.7799$, whereas the two-way state and year fixed effects reports an adjusted $R^2 = 0.7924$.

Table 5.3: Generic estimating equation. Dependent variable, L_I .

Variable	Parameter Estimates				
	OLS		FE	RE	
L	0.0059 *** <i>0.0005</i>		0.0024 <i>0.0026</i>	0.0052 *** <i>0.0008</i>	
G	0.0101 <i>0.0151</i>		0.0413 <i>0.0270</i>	0.0136 <i>0.0193</i>	
$invfed$	-0.0110 *** <i>0.0034</i>		0.0082 <i>0.0055</i>	-0.0027 <i>0.0040</i>	
$sewerage$	-0.0411 <i>0.0613</i>		
$density$	0.0166 <i>0.0569</i>		-2.5775 *** <i>0.6762</i>	-0.0141 <i>0.1077</i>	
$fair_tax$	-0.0097 <i>0.0079</i>		
constant	0.0317 <i>0.0468</i>		0.2563 <i>0.1200</i>	** -0.0140 <i>0.0383</i>	
R^2	0.5200		0.8330		
Adjusted R^2	0.5062		0.7925		

F-test: FE vs. OLS

$F_{(30,178)} = 8.764$

significance level = 0.0000

Hausman test: FE vs. RE

$\chi^2_{(5)} = 24.97$

significance level = 0.000051

Note: Standard errors of parameter estimates appear in italic font.

Significance levels: 1%, ***, 5%, **, 10%, *.

Mc Guire Model.

McGuire model is estimated using Generalized Method of Moments (GMM) due to its non-linearity, in both variables and parameters.⁸⁸ Although

⁸⁸ TSP Version 4.5 is used to estimate this model.

there is evidence of the relevance of state specific effects, estimation problems prevent the inclusion of state dummy variables.⁸⁹ Instead, dummy variables for state group effects are included in the McGuire model. Also, year dummies and other control variables are included in the regression model.⁹⁰ Estimation results are reported in table 2. Parameter estimates are heteroscedastic-robust. Instruments include, in addition to the exogenous variables in the equation, the following variables: *rural*, *education*, *population*, and *Doil*. These added instruments include state specific information and are correlated with the explanatory variables. According to the J-test of over-identifying restrictions, one cannot reject the null hypothesis that these restrictions are met at ten percent confidence level.

⁸⁹ When state dummy variables are added to the model, it could not be estimated due to singularity of the data or derivatives

⁹⁰ These control variables, including the state group dummies, are discussed in section 5.3.

Table 5.4: McGuire model. Dependent variable, L_I .

Variable / Parameter	Estimate	Standard Error
β	0.0016 ***	0.0004
γ_1	1.4589 ***	0.0922
γ_0	58.2672 ***	12.3054
ϕ_0	-0.1222 ***	0.0272
ϕ_1	0.0349 ***	0.0125
ϕ_2	0.0131	0.0088
<i>sewerage</i>	-0.0287 **	0.0150
<i>density</i>	0.0321 **	0.0189
<i>invfed</i>	-0.0017	0.0015
<i>high tax</i>	0.0030	0.0022
<i>M2</i>	0.0051	0.0060
<i>M3</i>	0.0352 ***	0.0119
<i>M4</i>	0.0404 ***	0.0129
<i>M5</i>	0.0429 ***	0.0126
<i>D94</i>	-0.0003	0.0059
<i>D95</i>	-0.0074	0.0060
<i>D96</i>	0.0008	0.0063
<i>D97</i>	0.0052	0.0064
<i>D98</i>	0.0081	0.0069
<i>D99</i>	0.0081	0.0082

Test of overidentifying restrictions = 0.880764

P-value = 0.644

Degrees of freedom = 2

Number of observations = 216

E'PZ'E = 0 .004078

Sum of squared residuals = 0.1363

Variance of residuals = 0.0007

Std. error of regression = 0.0264

Durbin-Watson = 0.8177 [<.000]

Notes:

Significance Levels: 1%, ***; 5%, **; 10%, *.

Standard Errors computed from heteroscedastic-consistent matrix (Robust-White).

Assumes COVOC matrix is optimal - Hansen Theorem 3.

State group effects, as expected, are statistically significant: the larger the need a state has for basic public goods, the larger its collection of own revenues. On the other hand, time effects are statistically not significant. The variables *sewerage* and *density* are statistically significant but have the wrong sign, in contrast, *invfed* and *fair_tax* have the correct sign but are statistically not significant.

Alternative Model.

The alternative econometric model determines a switching regime model with unknown sample separation. This section presents estimation results for the three nested specifications of the alternative model: *Switch 1*, *Switch 2*, and *Switch 3*.⁹¹

All three *Switch* models converged and their estimates are reported in table 5.5. Starting values for the parameters of L and G were set at 0.1 and -0.9, respectively; e.g. $MPCL = MPCG$.⁹² Estimation problems prevent the inclusion of individual effects. The nested *Switch* models do not converge when they include state and/or year dummy variables. The goal of *Switch 3*, thus, is to capture heterogeneity across states. *Switch 3* model, following the notation from section 5.4.3, includes the following set of controls variables $Z_1 = \{L, G\}$ and $Z_2 = \{invfed, density, fair_tax, M2, M3, M4, M5\}$. For instance, *Switch 3* allows for the minimum level of state public spending to vary across states depending on the state domestic product and received *participaciones*. Similarly, the dummy variables $M2$ to $M5$ intend to capture state group effects.

⁹¹ The software LIMDEP version 8 is used to estimate the switching regime model with unknown sample separation.

⁹² Following Hines and Thaler (1995), for \$1.00 increase in private income, \$0.10 would be allocated to the provision of the public good. Similarly, for \$1.00 increase in grants, \$0.10 would be allocated to the provision of the public good whereas \$0.90 would be devolved to private agents through cuts in taxes.

Table 5.5: Alternative model. Dependent variable, L_I .

Variable	Switch 1		Switch 2		Switch 3	
	Coefficient	Std Error	Coefficient	Std Error	Coefficient	Std Error
	RHS for Regime 1		RHS for Regime 1		RHS for Regime 1	
constant	0.1421	0.0067 ***	0.1101	0.0101 ***	0.0436	0.0158 ***
L					0.0015	0.0004 ***
G					0.0296	0.0147 **
	RHS for Regime 2		RHS for Regime 2		RHS for Regime 2	
constant	-0.4039	0.1664 **	-0.1308	0.0632 **	-0.2070	0.1671
L	0.0364	0.0027 ***	0.0129	0.0015 ***	0.0131	0.0015 ***
G	-0.9656	0.0027 ***	-0.2221	0.0487 ***	-0.1790	0.0819 **
invfed					-0.1199	0.0452 ***
sewerage					-1.8005	0.6195 ***
density					0.0969	0.1693
fair tax					0.0228	0.0276
M2					0.1853	0.0596 ***
M3					0.3672	0.1088 ***
M4					0.1932	0.2760
M5					0.0472	1.9007
Rho	-0.9832	0.0252 ***	-0.7945	0.0983 ***	-0.3850	0.2711
Sigma(2)	-7.28E-06	0.0052	0.0664	0.0072 ***	0.0543	0.0041 ***
Sigma(1)	-7.32E-06	0.0469	0.1384	0.0163 ***	0.1099	0.0120 ***
Iterations completed						
	48		27		40	
Log Likelihood						
	246.61		270.90		295.19	
Wald Test: Model (1) vs. Model (2) ---1 linear restriction---						
Chi-square: 235.91, Sig. Level = 0.0000						
Wald Test: Model (2) vs. Model (3) ---10 linear restrictions---						
Chi-square: 88.95, Sig. Level = 0.0000						

Notes: sigma(x), standard error of regression for regime(x); rho, correlation between regression regimes.
 *** significant at 1 percent level; ** significant at 5 percent level; *significant at 10 percent level.

Wald tests were performed to discriminate among the nested *Switch* models, with the result that the unrestricted *Switch 3* model outperforms the other two *Switch* specifications. Furthermore, *Switch 1* and *Switch 2* models are rather

instable models, in the sense that some changes in the initial conditions would cause the estimation process to not converge or render unfeasible parameters. As a result, the analysis of the alternative model would focus on *Switch 3* specification.

State group effects, as expected, are statistically significant. The variable *invfed* is statistically significant and has the expected sign; *sewerage* is statistically significant but has the wrong sign; *density* and *fair_tax* are not statistically significant.

5.6 ANALYSIS.

Estimation results, in sum, show that in Mexico money sticks where it hits first. The marginal propensity to consume of state public goods out of income is close to zero whereas the average propensity to consume of state public goods out of *participaciones* is close to one. These results are aligned with other estimates in the literature. The fact that state governments in Mexico do not treat *participaciones* like fungible resources implies that one should not be concerned about the possibility that these transfers induce state governments to reduce their collection of own revenues. On the other hand, the insensitive behavior of state governments to changes in either state domestic product or *participaciones*, would imply that they make no decision as to the optimal consumption of public versus private goods.

Table 5.6: Estimates of MPCL and MPCG.

	Generic Estimating Equation			McGuire Model	Alternative Model		
	OLS	FE	RE		Switch 1	Switch 2	Switch 3
MPCL	0.0059 ***	0.0024	0.0052 ***	0.0016 ***	0.0364 ***	0.0129 ***	0.0131 ***
MPCG	1.0101	1.0413	1.0136	0.9694 ***	0.03444 ***	0.7779 ***	0.821 **

Note: Significance levels: 1%, ***; 5%, **; 10%, *. The MPCG in the case of the McGuire model was estimated at the sample means of G and L_1 , according to equation (11). The standard error for the MPCG estimate was generated using the ANALIZ command from TSP v. 4.5.

Estimates of the marginal propensity to consume local public goods out of state domestic product and out of *participaciones* are reported in table 5.6. Regarding the MPCL, the outcome from FE generic estimating equation is that state governments do not increase their collection of own revenues when state domestic product increases.⁹³ The outcome from the McGuire model, on the other hand, is that an increase of one thousand pesos in state domestic product would induce state governments to increase their collection of own revenues by one peso and sixty cents. Finally, the outcome from the *Switch 3* alternative model is that, once a minimum spending level is met, an increase of one thousand pesos in state domestic product would induce state governments to increase their collection of own revenues by thirteen pesos and ten cents. State governments do not react to changes in the level of local resources.

Now, with regards to the MPCG, the outcome from FE generic estimating equation is that state governments do not reduce their collection of own revenues

⁹³ The estimate of MPCL is statistically not different from zero.

when state domestic product increases.⁹⁴ The outcome from the McGuire model, on the other hand, is that an increase of one thousand pesos in *participaciones* would induce state governments to reduce their collection of own revenues by thirty pesos and sixty cents. Finally, the outcome from the *Switch 3* alternative model is that, once a minimum spending level is met, an increase of one thousand pesos in *participaciones* would induce state governments to reduce their collection of own revenues by one hundred and seventy nine pesos. State governments, at best, react mildly to changes in *participaciones*.

These results are aligned with other estimates in the literature. Hines and Thaler (1995) report that estimates of the marginal propensity to consume public goods out of income fall within the range 0.05 – 0.10, whereas estimates of the marginal propensity to consume public goods out of unconditional grants are close to 1.0. As discussed in the introduction, this dissertation work does not test the two non-nested McGuire and Alternative models. The most this dissertation work does is to judge each model based on the feasibility of its econometric estimates.

A possible explanation for the presence of the flypaper effect in the Mexican revenue-sharing grants system would be that these transfers create a fiscal illusion that leads recipient governments to perceive a lower price of local public goods.⁹⁵ Estimates from the McGuire model includes the estimate of the

⁹⁴ The estimate of MPCG is statistically not different from zero.

⁹⁵ See discussion in section 5.2.

perceive price of the local public good, $p = 0.0371$.⁹⁶ The fiscal illusion argument would, then, imply that state governments perceive that *participaciones* reduce the price of local public goods from 1.0 to 0.0371. On the other hand, the McGuire model also provides an estimate of the income-changing component, $\phi = -0.1025$.⁹⁷ The two-components grant structure that best support the observed allocation of resources between private and public goods would, thus, imply that revenue-sharing transfers are *effectively* open-ended matching grants with a very low matching requirement and have a negative income-income changing component. These results are highly suspicious.

For instance, the very low estimate of the after-*participaciones* effective price of local public goods may not necessarily imply that *participaciones* drive this price to zero. Instead, due to the manner this price is estimated—see equation (7)—, the very low estimate of such price may be reflecting the fact that *participaciones* finance almost completely state public spending. On the other hand, as it is discussed in section 5.2, McGuire model would misestimate the after-grant price of the public good in the case of a highly policed conditional grant—which is equivalent to the case where there exists a minimum provision level of the local public good that the recipient government should meet.

⁹⁶ The perceived price is calculated, at the sample means of G and L_I , from equation (7). The standard error of this estimate could not be estimated due to singularity of the data or derivatives.

⁹⁷ The standard error of this estimate is 0.0163, which was calculated using the ANALYZ command from TSP v. 4.5. Thus, the estimate of ϕ is statistically different from zero at one percent confidence level.

Another issue that raises concern about how well the McGuire model fits the Mexican case is that the estimate of β , 0.0016,⁹⁸ is upward biased; e.g., magnifies the flypaper effect. In other words, the estimate of β should meet the following condition:

$$\beta = \frac{Q_1 - \gamma_1}{Q_0 + Q_1 - \gamma_0 - \gamma_1}$$

However, when the right-hand side term is estimated at the sample means, it renders an estimate of β equal to -0.0032. In sum, McGuire model does not seem to be an appropriate specification to evaluate the response of Mexican state governments to *participaciones*.

An alternative explanation for the presence of the flypaper effect in the Mexican revenue-sharing grants system is that state governments have no option but to spend most of the *participaciones* monies since these represent for more than eighty per cent of their budget. Alternatively, state governments perceive that there exists a minimum provision level of local public goods that they should meet. —See discussion in section 5.2. For provision levels of the public good below its *perceived* minimum level, state governments would react to *participaciones* by spending all these monies in the provision of the public good. On the other hand, for the provision of the public good in excess of its *perceived* minimum level, state governments would react to *participaciones* by providing

⁹⁸ This parameter estimate is statistically different from zero at one percent confidence level.

some tax cuts. Even more, if *participaciones* are truly lump-sum transfers, it must be the case that $MPCL = MPCG$ once the minimum provision level of the local public good has been met.

Estimation results from *Switch 3* show that the behavior of recipient governments depends on whether a minimum level of public spending has been met. If the minimum public spending level is binding —Regime 1—, $MPCL = 0.0015$ and $MPCG = 1.0296$. On the other hand, if the minimum public spending level is not binding —Regime 2—, $MPCL = 0.0131$ and $MPCG = 0.8210$. Nonetheless, in either case, $MPCL$ and $MPCG$ are not equal to each other. As a result, the alternative model does not fully explain the presence of the flypaper effect in the Mexican revenue-sharing grants system. However, the alternative model does partially explain the *observed* flypaper effect, in the sense that it shows that the flypaper effect is of a smaller size than one might conclude from the generic estimating equation or the McGuire model.

When a state government is not able to meet a minimum public spending level, this government would spend all the *participaciones* monies in the provision of the local public good. In fact, for each MEX \$1.0 this government receives, it would spend MEX \$ 1.0296. There would then exist a super flypaper effect. That is, *participaciones* would *induce* recipient governments to increase their collection of own revenues. As a matter of fact, recipient governments would collect more own revenues because they need to provide a minimum level of the

local public goods instead of being their reaction to the *participaciones* they receive.

On the other hand, once a minimum public spending level is met, a state government would use part of the *participaciones* monies to provide some tax cuts. For each MEX \$1.0 the state government receives of *participaciones*, it would reduce local taxes in the amount of MEX \$0.1790, whereas the remaining would be allocated to the provision of local public goods.

5.7 CONCLUDING REMARKS.

State governments in Mexico get to spend practically all the *participaciones* monies they receive. The *veil for the tax cuts* characterization the fiscal federalism theory attaches to unconditional transfers does not hold for the Mexican revenue-sharing grants. The finding that state governments in Mexico do not treat *participaciones* like fungible resources implies that one should not be concerned about these transfers reducing state collection of own revenues — which would further increase the financial problems of state governments—; therefore, making policy recommendations based on the literature treatment of this type of transfers would not be correct.

Empirical evidence shows that in Mexico money sticks where it hits first, literally. Overall, the marginal propensity to consume of state public goods out of

income is close to zero whereas the average propensity to consume of state public goods out of *participaciones* is close to one. These results are aligned with other estimates in the literature.

However, the insensitive behavior of state governments to changes in either state domestic product or revenue-sharing transfers implies that such governments make no decision as to the optimal consumption of public *versus* private goods. The federal government, through the revenue-sharing grants system, effectively makes such decision. State governments behave as if the federal government exogenously determines their budgets. The insensitiveness of state governments in Mexico is expected to render a sub-optimal allocation of resources. That is, the system of revenue-sharing transfers determines an allocation of state resources —between private and public sectors— that would hardly match the preferences and needs of each state.

The insensitiveness of states to increases in state GDP is hardly due to the revenue-sharing grant program solely, which restricts the faculty of state governments to raise revenues from the most productive revenue sources. Díaz-Cayeros and McLures (2000) discuss budget areas where state governments can still increase their collection of own revenues. Also, in 2002 state governments had the faculty of levying a state sales tax of up to 3 percentage points —in addition to the federal value-added tax rate of fifteen percent—, but no state levied such tax. States propose, instead, the break down of the value added tax

rate in two segments: 12 percentage points would be the federal segment and 3 percentage points would be the state segment. All states would benefit from this proposal, but states with more developed markets would benefit the most.

The current intergovernmental fiscal arrangement *per se* does not fully explain the irresponsible behavior of state governments to changes in state domestic product. State bureaucrats want to increase their budget, but without the responsibility of collecting the revenues to finance it.

The irresponsible behavior of state governments to changes in the received level of *participaciones*, on the other hand, cannot be satisfactorily explained through a fiscal illusion argument. The fiscal illusion argument, as the McGuire model estimates show, would require that state governments treat *participaciones* as open-ended matching grants with a very low matching requirement. In particular, the price of local public goods would be driven to zero.

Estimates from the alternative model show that, to some extent, state governments do not react to increases in the *participaciones*—by providing tax cuts—due to the fact that these are practically their only source of revenues. Probably, state governments find optimal to spend *participaciones* monies instead of collecting their own revenues simply because it is politically risk-free. That is, it is the federal government's responsibility to collect public revenues whereas state governments get the credit for their spending. As a result, state governments

would have the incentive to request more *participaciones* than new tax collecting responsibilities. In this sense, the current revenue-sharing grants system may still be creating perverse incentives.

Thus, a possible extension for this research paper is to evaluate, within a principal-agent framework, the incentives that the Mexican revenue-sharing grants system creates.

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