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Two Essays on Public Economics: The Consequences of Fiscal Decentralization on Poverty and Inequality, and The Second Best Solution to The Public Expenditures' Problem

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Two Essays on Public Economics:

THE CONSEQUENCES OF FISCAL DECENTRALIZATION ON POVERTY AND INEQUALITY,

and

THE SECOND BEST SOLUTION TO THE PUBLIC EXPENDITURES' PROBLEM

by
Cristian F. Sepulveda

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy
in the
Andrew Young School of Policy Studies
of
Georgia State University

GEORGIA STATE UNIVERSITY
2010

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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

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ABSTRACT

Two Essays on Public Economics:

THE CONSEQUENCES OF FISCAL DECENTRALIZATION
ON POVERTY AND INEQUALITY,
and
THE SECOND BEST SOLUTION TO
THE PUBLIC EXPENDITURES' PROBLEM

by
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March, 2010

Committee Chair: Dr. Jorge L. Martinez-Vazquez

Major Department: Economics

This dissertation consists of two independent essays on public economics. The first essay studies the consequences of fiscal decentralization on poverty and income inequalities. We describe the possible channels through which fiscal decentralization might affect poverty and income inequalities, and provide a review of the available literature addressing different aspects of the problem. We also carry out an empirical analysis with data of a large number of countries at different stages of development, for the period 1971-2000; and conclude that fiscal decentralization has significant effects on poverty and income inequalities. In particular, fiscal decentralization helps to reduce poverty as long as the share of sub-national expenditures is not greater than one third of total government expenditures. Fiscal decentralization can also help to reduce income inequalities, but only if the general government represents a significant share of

the economy (twenty percent or more). These findings are important because they suggest, contrary to the traditional public finance theory, that sub-national governments can play an important role in the reduction of poverty and income inequalities.

The second essay studies the second best solution to the public expenditures' problem. We revisit the problem of determining the optimal combination of public and private goods in the presence of a proportional labor income tax. By allowing the tax base to vary with the taxpayers' behavioral responses to taxation, we derive the "effective" budget constraint faced by a benevolent and omniscient government, which describes the set of affordable combinations of public and private goods. We show that the optimal solution to the government problem corresponds to the point of tangency between the effective budget constraint and the highest attainable social indifference curve. The traditional normative prescription for public expenditures under a second-best scenario does not satisfy this condition, and therefore it provides a suboptimal solution. We also show that under the proposed analytical framework we can predict the flypaper effect, an empirical regularity that has for long challenged the conventional theory.

INTRODUCTION

This dissertation consists of two independent essays on public economics, one on the consequences of fiscal decentralization on poverty and income inequalities and another on the second best solution to the public expenditures' problem.

The first essay analyzes the possible effects of fiscal decentralization on poverty and income inequality. Even though fiscal decentralization, poverty, and the distribution of income have, separately, been the subject of extensive theoretical and empirical research. Indeed, most democracies around the world are by now either decentralized or engaged on fiscal decentralization reforms. However, there are very few studies analyzing the ways fiscal decentralization can affect poverty and income inequalities, and we still know very little about the sign and magnitude of these causal relationships. In this paper we first provide a review of the available literature addressing different aspects of the problem, and describe the possible channels through which fiscal decentralization might affect poverty and income inequalities. We distinguish between direct and indirect effects of fiscal decentralization on poverty and income inequalities. We define direct effects as those where poverty or income inequalities are altered by changes that the fiscal decentralization process impose on public policies or on the behavior of relevant economic agents. For instance, a movement towards fiscal decentralization will likely change the tax mix and the composition of public expenditures. In contrast, indirect effects are defined as those effects of fiscal decentralization in certain socio-economic factors that that in turn can influence poverty and the distribution of income.

The paper describes several possible direct and indirect effects of fiscal decentralization on poverty and income distribution, and review the existing theoretical and empirical literature to conclude that the overall or net effect is undetermined. It the end, the effect of fiscal decentralization on poverty and income inequality would seem to be, essentially, an empirical question. We carry out an empirical analysis with data of a large number of countries at different stages of development, for the period 1971-2000; and conclude that fiscal decentralization has significant effects on poverty and income inequalities. In particular, fiscal decentralization helps to reduce poverty as long as the share of sub-national expenditures is not greater than one third of total government expenditures. Fiscal decentralization can also help to reduce income inequalities, but only if the general government represents a significant share of the economy (twenty percent or more). These findings are important because they suggest, contrary to the traditional public finance theory, that sub-national governments can play an important role in the reduction of poverty and income inequalities.

The second essay is theoretical, and focuses on the problem of determining the optimum amount of government expenditures in a second best scenario. Our original intention was for this essay to be a complement of the first one. Our goal was to analyze the relationship between accountability and revenue collections, and show that governments that are not responsive to taxpayers' preferences induce greater non-compliance and, as a consequence, are more limited in the amount of tax revenues and they are able to collect as well as in their ability to carry out their expenditure policies. While developing the formal arguments, however, we realized that the selected theoretical framework, developed by the traditional literature about the marginal cost of public funds, does not allow us to represent (diagrammatically) the marginal welfare costs of irresponsive government behavior. An investigation on the causes of this limitation of the

traditional theory led us to change the focus of this essay, which turned to be the very concept of the marginal cost of funds, used by the traditional literature to represent the welfare costs of taxation under a second best scenario where economic distortions are present.

The second essay revisits the problem of determining the optimal combination of public and private goods in the presence of a proportional labor income tax. By allowing the tax base to vary with the taxpayers' behavioral responses to taxation, we derive the "effective" budget constraint faced by a benevolent and omniscient government, which describes the set of affordable combinations of public and private goods. We show that the optimal solution to the government problem corresponds to the point of tangency between the effective budget constraint and the highest attainable social indifference curve. The traditional normative prescription for public expenditures under a second-best scenario does not satisfy this condition, and therefore it provides a suboptimal solution to the public expenditures' problem. In this essay we formally characterize the second best solution to the government problem and develop an analytical framework that allows for the normative and positive aspects of the public expenditures' problem to be fully integrated. In order to show this, we use our analytical framework to explain the flypaper effect, an empirical regularity that has for long challenged the conventional theory. The flypaper effect is observed whenever a transfer to the government increases public expenditures more than an equivalent transfer to the individuals in the same jurisdiction. The traditional theory uses the notion of fiscal illusion to explain this empirical finding, arguing that intergovernmental taxpayers "confuse" the taxpayers, who misperceive the costs of public goods. In our framework, however, intergovernmental transfers appear as directly reducing the marginal costs of public funds, such that the flypaper effect is not the result of confusion or illusion, but instead of a rational behavioral response to the intergovernmental transfer policy.

ESSAY I: THE CONSEQUENCES OF FISCAL DECENTRALIZATION ON POVERTY AND INEQUALITY

Introduction

After a worldwide movement towards decentralization that has lasted more than thirty years, the reduction of poverty and inequalities remain as essential policy objectives in most countries, and a particularly relevant concern in developing economies. However, the effects of decentralization on poverty and income distribution inequalities have not received much attention in the economics literature. To date, there has been little theoretical discussion addressing this matter and the available empirical studies are remarkably scarce.

The purpose of this paper is to contribute to a better understanding of the potential effects of decentralization on poverty and inequality. We focus on two main tasks. First, we review the relevant literature and provide a comprehensive conceptual framework describing the different channels through which decentralization might affect poverty and income inequality. Second, we use a panel data set encompassing a large number of countries to estimate the direction and economic significance of these influences.

Decentralization is not a policy goal *per se*, but instead a national strategy pursued in order to reorganize the operation of the public sector and make it more efficient and accountable to the needs and preferences of the population. However, even though the extent of effective decentralization can be regarded as a decision variable that is subject to the political process, the political process itself depends on a wide array of socio-economic and historical factors.

Therefore, as in the cases of poverty and income inequality, the observed degree of decentralization can also be regarded as an outcome reached within the socio-economic framework where public policies are implemented.

In this context, it is difficult to isolate the potential effects of decentralization as a policy strategy from other policy strategies, including those of reducing poverty and income inequality. A first necessary step consists of defining precisely what we mean by these three concepts. In this paper we focus on *fiscal* decentralization, as opposed to administrative and political decentralization, and consequently concentrate our analysis on the effects that the decentralization of expenditure responsibilities and taxing powers might have on poverty and income inequality. In turn, both poverty and inequality in income distribution are consistently defined as within-country phenomena with a national scope. In particular, we focus on the overall level of poverty, not only on "the poverty of the poorest," and on the distribution of income among households at the national level, as opposed to alternative approaches focusing on within sub-national jurisdiction or inter-regional differences.

Our conceptual framework distinguishes between direct and indirect effects of fiscal decentralization on poverty and income inequalities. Direct effects are those in which poverty or income inequalities are altered because of changes that the fiscal decentralization process impose on public policies or on the behavior of relevant economic agents. For example, a movement towards fiscal decentralization will likely change the tax mix and the composition of public expenditures, which in turn might affect tax and expenditure incidence and, in addition, might induce the migration of individuals searching for better standards of living. In contrast, the indirect effects are transmitted by a number of socio-economic factors that are likely to be affected by the fiscal decentralization process, and that in turn can influence poverty and the

distribution of income. Important examples that have received special attention in the literature are economic growth and the size of government.

Given the complexity of the linkages between fiscal decentralization, poverty and income inequality, the identification of the sign and magnitude of the impact of fiscal decentralization represents a significant challenge, requiring the use of econometric techniques addressing the issue of reverse causation. Moreover, the results obtained in this exercise might closely mirror the coherence of fiscal decentralization reforms and depend on whether the reduction of poverty and income inequality is indeed a public policy priority in each country. At the end, the effect of fiscal decentralization on poverty and income inequality would seem to be, essentially, an empirical question. What we hope to accomplish in this paper is to unveil to what degree, on average, fiscal decentralization processes have contributed to the amelioration, or else aggravation, of poverty levels and inequality in the distribution of income across a large sample of countries over recent years. Since many countries, especially those in the developing world, are simultaneously embarked in active policies involving the reduction of poverty and inequalities, as well as in fiscal decentralization reforms, it is important to clarify the extent to which these policy strategies are complementary or do seem to work against each other. For this task, we analyze a panel of countries at different stages of development with data, arranged in five-year averages, for the period 1971-2000. In the empirical analysis, we follow the previous literature and measure fiscal decentralization by the share of sub-national expenditures over total public expenditures. Similarly, we measure poverty by the headcount ratio, the poverty gap, and the Human Development Index; and income inequality by the Gini coefficient.

Even though the level of poverty and the relative inequality in the distribution of income are concepts that are related in several ways, in this paper we opt for analyzing the impact of

fiscal decentralization on poverty and inequality separately. We first analyze the effect of fiscal decentralization on poverty. Our results indicate that this effect is significant and non linear. At lower levels of fiscal decentralization the impact is to reduce poverty, but higher ("excessive") levels of fiscal decentralization can actually work to increase the poverty level. In our sample of countries, the effect of fiscal decentralization on poverty is optimized at the point where sub-national expenditures represent approximately one-third of total government expenditures. This result correspond the net impact of a complex list of direct and indirect effects of decentralization pulling in different directions, and as such it cannot be easily interpreted. It is as if some level of decentralization can bring citizens access to basic services instrumental for poverty reduction, but that at higher levels of decentralization the fiscal resources left at the central level may be too scarce for implementing effective national anti-poverty programs.

Next, we turn to analyze the effect of fiscal decentralization on income inequality. Our results show that fiscal decentralization has a statistically significant effect in determining the extent of income inequalities, but that the sign and magnitude of this effect depends on the overall size of the government sector within the economy. Given the level of aggregation of our estimates and the complexity of the direct and indirect effects through which decentralization may affect the distribution of income, we cannot be sure of how the net effect comes about. But, it is as if for situations where the share of the government sector is relatively low, under 20 percent, decentralization works to increase income inequality perhaps because more funds are available to sub-national governments from more redistributive central government programs. For shares of the government sector in the economy over 20 percent, fiscal decentralization works to decrease income inequality, perhaps due to the type of expenditure programs that can be implemented at

the sub-national level in combination with the fact that central government budgets are large enough to implement sizable redistributive programs among sub-national governments.

These findings do not necessarily fit well with the traditional normative approach dating back to Musgrave (1959) about the minimum role to be played by sub-national governments in redistributive policies. In practice, based on our empirical results for a sample of countries, it would appear that in a fiscally decentralized economy the sub-national governments can play a significant role in poverty reduction and the accomplishment of redistributive goals for income distribution.

The rest of the paper is organized as follows. In Section 2 we briefly review the concepts and measurements of decentralization, poverty and income inequality. In Section 3 we discuss a conceptual framework and the different channels by which fiscal decentralization can affect poverty and income distribution. In Section 4 we analyze the previous empirical literature and identify some of the determinants of poverty and income inequality. In Section 5 we present the econometric estimations and results. Section 6 concludes.

Decentralization, Poverty and Inequalities: Alternative Concepts and Measurement Issues

Even though fiscal decentralization, poverty and income distribution have been the subjects of extensive academic research and political debate, the three concepts are very broad and complex, and there is no consensus about their precise meaning and proper measurement. In this section we briefly review the most important measures used in the literature for each one of these concepts and justify our selection of the particular measurements we will use in the analysis. The

discussion in this section is also utilized to identify more precisely the problems this paper aims to examine.

The literature describes the concept of decentralization as comprising three different but interdependent dimensions; the political, the administrative, and the fiscal dimensions.[1] Political decentralization consists of devolving decision making powers to locally elected officials, who are accountable to their own constituencies. Administrative decentralization refers to the transfer of decision making powers on planning and management of the public function regarding issues such as hiring decisions and the setting of salaries. Fiscal decentralization refers to the transfer of decision making powers over the assignment of revenue-raising authority and expenditure responsibilities to the sub-national governments. In practice, it is difficult to think of a meaningful level of fiscal decentralization process without the presence of effective levels of political and administrative decentralization. As already mentioned, the focus in this paper is on fiscal decentralization, but to the extent that the other two dimensions of decentralization may be lacking we should expect more diffused or weaker effects of fiscal decentralization.

A typical concern in the context of empirical analysis is whether the measures of fiscal decentralization, usually based on accounting executions of the general budgets, can capture the degree of autonomy or discretion that characterizes the devolution of decision making power to sub-national governments. The empirical literature has traditionally used the share of sub-national expenditures (or revenues) over consolidated public expenditures (or revenues) as a proxy for the degree of fiscal decentralization.[2] This share does not provide information on the level of

[1] See Rondinelli (1981) for an early discussion on these three dimensions of decentralization.
[2] The share of sub-national expenditures over consolidated public expenditures is usually computed with data from the Government Financial Statistics (GFS) of the IMF.

expenditures or tax autonomy enjoyed at the sub-national level, and therefore it does not properly measure the extent of fiscal decentralization.[3]

Even though we agree about the limitations associated with this measure of fiscal decentralization, lacking any better alternative we are forced to follow the empirical literature and to use the same proxy. With respect to the results of the empirical analysis, however, it is important to clarify that the meaning of the fiscal decentralization variable refers only to the extent or "magnitude" of the fiscal decentralization process, not to the effective devolution of autonomy or "intensity" of the process.

Our approach to the concept of poverty and the subsequent choice of the particular measure used in the empirical analysis also requires some clarification. The economic literature usually has focused on measures of poverty that are based on an assumption about the income or consumption's threshold. Individuals (or households) are considered poor if their levels of income or consumption fall below the selected threshold. Given this information, it is possible to compute the incidence, the depth, or the severity of poverty. The incidence of poverty (headcount index) is simply the share of the population that is defined as poor. The depth of poverty (poverty gap) is the sum of the distance between the selected threshold and the level of income or consumption of each individual, divided by the total population. Finally, the severity of poverty is computed by adding up the square of the distance between the selected threshold and the level of income or consumption of each individual, and then dividing by population; in this way the measure of severity of poverty places a higher weight on those individuals that are further away from the

[3] More refined measures of fiscal decentralization exist for a limited number of countries and for an also limited number of years. OECD (1999) offers a new classification of sub-national tax revenues and computes the values corresponding to each category for 19 countries in 1995. Stegarescu (2005) extends this database to include 23 OECD countries for the period 1965-2001 for alternative measures of revenue decentralization. See Ebel and Yilmaz (2003) for a comparison between traditional and improved measures of revenue decentralization in terms of their explanatory power in a number of decentralization issues. See also Martinez-Vazquez and Timofeev (forthcoming) on the power of different measures of decentralization and better and worse approaches to its measurement.

poverty line.[4] These measures of poverty are commonly associated with some problems. First, these measures are all based on an arbitrary choice of the poverty line; second, they measure poverty only among the poor; and third, poverty is not necessarily restricted to income and consumption, but in addition, it might encompass other dimensions like security and opportunities which might well be restricted for levels of income or consumption that are over the selected poverty line.

Another problem with these traditional measures of poverty is data availability. In our empirical analysis we use the headcount ratio and the poverty gap as dependent variables; however, these variables do not allow for a large sample size. In order to overcome this problem, in this paper we also use the Human Development Index (HDI) as our measure of poverty. The HDI has been developed by the United Nations Development Program (UNDP), and combines normalized measures of the population health and longevity, knowledge and education, and standard of living.[5] Of course, an increase in the HDI must be interpreted as a reduction of poverty, and the index offers several advantages with respect to other common proxies for poverty, some of which are particularly convenient for the analysis in this paper. The HDI does not require an arbitrary definition of the poverty line, it refers to the level of development (or poverty) of the whole population of a country (not only the poor), and it considers alternative dimensions of well being in addition to income and consumption. In this sense, given that fiscal decentralization reform is a nationwide process that can affect poverty in a variety of ways, the

[4] For a more detailed discussion on poverty concepts and measurement, see, for instance, Lok-Dessallien (2000) and Coudouel, Hentschel and Wodon (2002).

[5] In particular, the population health and longevity are measured by the life expectancy at birth; knowledge and education by the adult literacy rate and a combined primary, secondary, and tertiary gross enrollment ratio; and the standard of living is measured by the natural logarithm of gross domestic product per capita at purchasing power parity.

HDI might be better able to capture the full extent of the effects of fiscal decentralization on poverty.

The concept of inequality has also been surrounded with measurement problems and several alternatives have been used in the literature. The most common measure of inequality is the Gini coefficient, which can be defined in terms of income or consumption, and either for individuals or households.[6] The main problem with the Gini-coefficient is that any (non extreme) value can represent two or more different distributions of income or consumption, thus it provides an ambiguous description of any given distribution.[7] Another popular measure of inequality is the Decile Dispersion Ratio (DDR), equal to the ratio of the income or consumption of the richest 10% of the population divided by the income or consumption of the poorest 10% of the population. The obvious problem with this measure is that it says nothing about the 80% of the population that is between the richest and poorest deciles.[8]

In this paper, we follow the most common practice in the literature and use the Gini-coefficient as our proxy for inequality. More in particular, we focus on the observed inequality in the distribution of income among households, preferably based on surveys representing the whole population of a country and measuring "disposable" income (as opposed to consumption and gross income). These choices are justified by the need of a consistent sample of inequality measures which must be congruent with the nationwide coverage of a fiscal decentralization process.

---

[6] The Gini coefficient computes the relative size of the area between the Lorenz curve (plotting the share of population against the cumulative income share) and the egalitarian distribution (a 45° line representing identical shares for income and population). The Gini coefficient can be defined for a range of values between 0, which represents perfect equality, and 100, which represent perfect inequality (the whole income in the economy is concentrated in one single individual).

[7] Specifically, the ambiguity problem would not exist (only) in the extreme values of Gini coefficient, defined as perfect equality at 0, and perfect inequality at 100. At any intermediate value, however, there are countless possible distributional arrangements that can plausibly lead to any given value of the Gini coefficient.

[8] Other measures of income distribution exist, including the Hoover index, the Theil index, etc. See, for example, Coudouel, Hentschel and Wodon (2002).

Both poverty and income inequality are common government policy targets and often the same public policies implemented to reduce one of them will serve to reduce the other. In general, when poverty is defined in income terms, then any reduction of poverty will, ceteris paribus, also reduce income inequality. Similarly, assuming that national income remains constant (or is growing), any reduction in income inequality implies a reduction in poverty. Even though in this paper we do not limit the concept of poverty to income, we still can expect the relationship between poverty and income inequality to hold. The improvements of health and education outcomes captured by the HDI are presumably enjoyed by the poor, who can benefit by increasing their present and future productivity and thus also their present and future income.

In the next section we describe the channels through which fiscal decentralization can affect poverty and the distribution of income. We make use of the close relationship between poverty and inequality in the distribution of income and jointly examine the potential effects of fiscal decentralization on these two variables.

The Potential Effects of Fiscal Decentralization on Poverty and Income Inequality: A Framework of Analysis

The goal of this section is to outline the main channels by which fiscal decentralization may affect poverty and the distribution of income. Our objective is to provide a framework of analysis and to identify the causal relationships and specific factors that should be accounted for in an empirical model. As we show in this section, the potential channels relating fiscal decentralization to poverty and income distribution are multiple and lead to complex interactions, so it is virtually

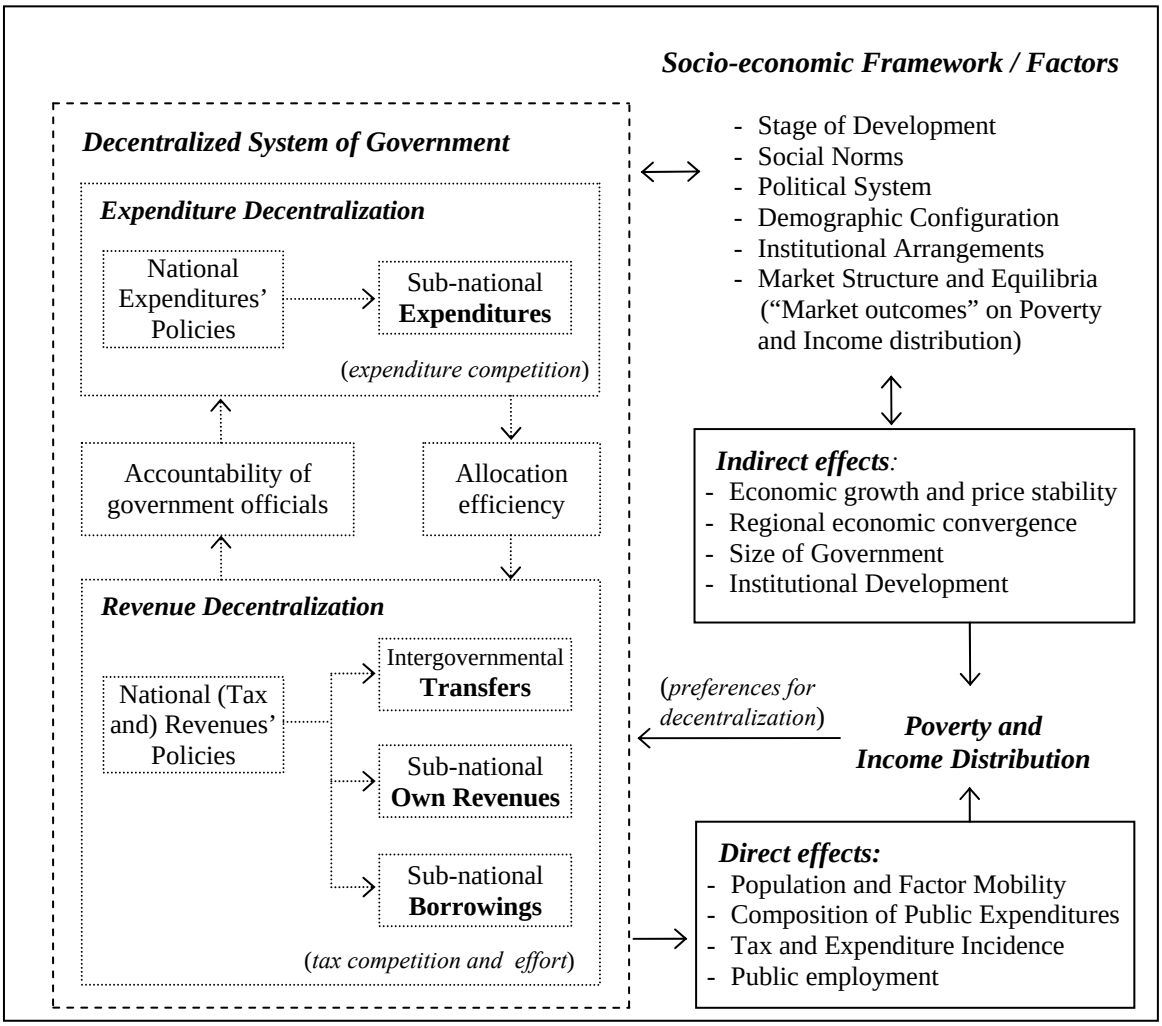
impossible to anticipate the sign of the net effect of fiscal decentralization on the two variables of interest.

In Figure 1 we present a schematic summary of the possible channels through which fiscal decentralization might affect poverty and the distribution of income. The socio-economic framework represents the context under which fiscal decentralization is implemented and where public policies and macroeconomic outcomes are determined. The socio-economic framework consists of, and is defined by, factors like the stage of development of the country and regions, social norms, the demographic configuration, the political system, markets, and other institutional arrangements. In turn, these factors jointly determine, and are determined by, the extent and characteristics of the fiscal decentralization process and other socio-economic outcomes such as poverty and income inequalities.

In order to identify the potential sources of influences on poverty and income inequality, we explicitly distinguish among the most characteristic components of a fiscally decentralized system of government. From a budgetary perspective, expenditures must be equal to the sum of own taxes and fees, net transfers received, and net borrowings. Any decentralized system operates under some combination of these four elements of government finances, and each element may have its own effect on poverty and income distribution.[9] Of course, the extent of "true" decentralization, or the degree of effective autonomy assigned to sub-national governments, will typically not be the same for each budgetary component. In this sense, the expenditure and revenue sides of the budget can be distinguished as two separate branches of government policy and, consequently, expenditure decentralization and revenue decentralization can be regarded as alternative, but complementary, sources of influences on poverty and income distribution.

[9] While borrowing clearly constitutes a type of revenue for any government units, intergovernmental transfers can be seen as expenditures at the central level or revenues for the local governments. Here, we implicitly follow a local perspective, and classify intergovernmental transfers as a revenue source.

Figure 1. Potential effects of fiscal decentralization on poverty and income inequality



The classic argument by which fiscal decentralization is said to improve social welfare is provided by Oates (1972) and focuses on public expenditures. Given that under a fiscally decentralized system the decisions regarding public expenditures are made "closer to the people," fiscal decentralization allows for a better fit of their (presumably heterogeneous) preferences and therefore for unambiguous efficiency gains for society. The decentralization literature also stresses the important role of own revenue collections in providing the right incentives to the correct functioning of a decentralized system of government. As long as a significant share of

local expenditures is financed via own revenue collections the local authorities can effectively become accountable to their constituents, who are able to correctly evaluate the performance of local governments and either punish it or award it in the voting process. In turn, this accountability mechanism serves as an incentive for the local authorities to make efficient spending decisions. [10]

Separately, the decentralization of expenditures and revenues give rise to a variety of sub-national government responses. On the expenditure side, sub-national governments might compete for better bundles of public goods and services in order to keep their tax bases or attract new taxpayers from other jurisdictions. On the revenue side, inter-jurisdictional competition might be observed in terms of the tax rates that are applied locally. More generally, local authorities are faced with a variety of decisions regarding the definition of tax burdens and the enforcement of their taxes, which ultimately describe the level of tax effort that they are willing to exert.

Altogether, a movement towards a fiscally decentralized system of government can most likely alter the functioning of the public sector and potentially reshape the design and implementation of public policies. Of course, since many expenditure policies have a pro-poor inception, and tax policies in general can plausibly change the distribution of disposable income among individuals within a country, then fiscal decentralization has the potential to influence both poverty and income inequalities.

Here we distinguish between direct and indirect effects of fiscal decentralization on poverty and income inequality. We define as direct those effects that can be associated either with a change in the implementation of public policies or with changes in the behavior of relevant

[10] In addition, high degrees of revenue autonomy can be effective in introducing more fiscally responsible behavior among sub-national units and in reducing the common pool problems associated with the predominance of revenue sharing and transfers as a mode of sub-national finance.

economic agents due to the decentralization process. As examples of direct effects we consider the mobility of households and production factors, the composition of public expenditures, tax and expenditure incidence, and public employment. Note that sub-national governments do not need to be explicitly involved in the design of redistributive policies in order to impose direct effects on poverty and inequalities. In contrast, we define as indirect those effects that are observed "after" the decentralization process has interacted with the socio-economic framework. The fiscal decentralization process can produce changes on certain macroeconomic outcomes and institutional arrangements that, in turn, can have their own effect on poverty and the distribution of income. In these cases, changes in macroeconomic and institutional variables act as transmission mechanisms between fiscal decentralization and the realization of poverty and inequality outcomes. Examples of these transmission mechanisms include economic growth, the size of government, and the development of civil and political institutions.

Finally, poverty and income inequalities can also help to determine, among many other political and socio-economic factors, the extent to which a country decides to push for the reform of expenditure and revenues decentralization. For example, in the presence of regional income disparities the richest regions might be inclined to demand greater expenditure and revenue autonomy, while poorer regions might prefer asymmetric decentralization arrangements of expenditures and revenues.

In the following discussion we review what is that we can learn from the literature for how fiscal decentralization through different channels might impact poverty and income inequality outcomes. We first discuss the direct effects, then the indirect effects, and finally the potential reverse causality between poverty and income distribution vis-à-vis fiscal decentralization.

Direct effects of fiscal decentralization on poverty and income distribution

The question about the potential direct effects of fiscal decentralization on poverty and income inequality involves the broadly unsolved issue of what should be the role of sub-national governments in the implementation of redistributive policies. On the one hand, the traditional public finance literature advises against the participation of sub-national governments in redistributive policies (Stigler 1957; Musgrave 1959; Oates 1968,1972; and Brown and Oates 1987). On the other hand, there is a growing and widely accepted recognition of the important role of sub-national governments in facilitating, catalyzing and coordinating the implementation of pro-poor policies. Indeed, the reduction of poverty and inequalities seems to be, in practice, an unavoidable concern of sub-national governments; and outright redistributive policies are a rather common practice of sub-national governments in decentralized countries.[11]

The reasons for the traditional theory to advice against the active participation of sub-national governments in redistributive policies are built on efficiency grounds. In order to improve the standard of living of the poor a sub-national government should, *ceteris paribus*, increase the tax burden of the rich, who in the absence of greater benefits might eventually try to migrate to other jurisdictions with lower taxes. At the same time, the poor in neighboring jurisdictions might try to move in. As a result, the costs of redistributive programs would tend to increase while the tax base of the jurisdiction would tend to erode, making the redistributive policy ineffective. Clearly, the case against an active redistributive role of sub-national governments critically depends on the inter-jurisdictional mobility of population and productive

[11] Regarding the participation of sub-national governments in redistributive policies see, for instance, Bahl, Martinez-Vazquez and Wallace (2002).

factors; and in actual fact fiscally induced migration is by itself considered in the traditional literature as a source of economic distortions and inefficiencies.

When mobility is imperfect or costly, however, sub-national governments may become efficient players in the implementation of redistributive policies. Assuming limited mobility, Pauly (1973) shows not only that under some conditions (majority voting and utility inter-dependence) the size of redistributive programs increases with decentralization, but also that the redistributive performance of sub-national governments is superior to centralized redistribution.[12] In this context, and based on the observation that mobility tends to be relatively low in developing countries, some authors have suggested that sub-national governments could be able to make a valuable contribution to fighting poverty.[13] Here of course, the concerns about the ability of sub-national governments to carry out redistributive policies would move towards the effective accountability of local government officials, the potential for local-elite capture, and their managerial and administrative capabilities.

But the importance of inter-jurisdictional mobility is not limited to the efficiency and effectiveness of sub-national redistributive policies. By itself, inter-jurisdictional mobility can have important effects on poverty and income inequality. On the one hand, mobility may be seen as a response of individuals and households who seek to increase their real income, and so by itself the sorting processes of individuals among jurisdictions offering alternative bundles of public services and tax burdens may alter poverty and the distribution of income. On the other

[12] A similar result is suggested by Pfingsten and Wagener (1997), who show that for certain interregional transfer mechanisms, decentralized intraregional redistribution can yield efficient outcomes.

[13] Inter-jurisdictional mobility might be constrained either because of cultural, ethnic, geographical or economic factors (e.g., people might not want to move or the costs of doing so might be too high), or because of legal restrictions imposed on mobility. With respect to the latter, some countries (e.g., the former Soviet Union and China) have used internal passports with the explicit purpose of restricting inter-jurisdictional mobility.

hand, mobility certainly affects the supply of productive factors and thus also their marginal productivity and return (Wildasin 1994).

Inter-jurisdictional mobility can also affect poverty and income distribution because it can plausibly alter the tax and expenditures policies at the sub-national level of government. The tax competition literature has traditionally focused on the "negative" consequences of inter-jurisdictional mobility.[14] In a closed economy, mobile factors tend to avoid tax burdens by migrating from higher taxed jurisdictions until the after-tax rate of return is equalized nationwide. In an open economy, mobility of factors might be even higher and so the negative effects of mobility are increased. Tax competition involving mobile factors can lead to a "race to the bottom" as local governments are forced to reduce their tax rates in order to avoid further erosion of the tax base, leading to lower revenues and to the under-provision of local public services.[15]

In contrast, attracting migration by efficient spending might also have some counterbalancing effects. In his seminal work, Tiebout (1956) established that, under certain conditions, taxpayer mobility allows for a better match of the heterogeneous preferences of constituencies and the autonomous revenue and expenditure decisions of sub-national governments. In this vein, based on the positive effect that migration would have on the value of properties, Wilson and Gordon (2003) suggest that depending on the production function of public goods and services, expenditure competition can potentially reduce tax burdens and thus improve welfare.[16] Still, migration will also be associated with an increase in labor supply which

[14] A different (positive) view of inter-jurisdictional competition is offered in the public choice literature as a way to control the growth of government (Leviathan) and streamline public expenditures (Brennan and Buchanan 1980).
[15] Surveys of the tax competition literature are provided by Wilson (1999) and Wildasin (2005),
[16] They use a principal agent framework to analyze the behavior of local government officials, who are assumed to benefit from the "waste" of expenditures in perks, and show that differences in the quality of local public goods (negatively related with the proportion of perks over total expenditures) across jurisdictions would induce migration toward those areas where government officials spend less on perks and more on public goods. Population mobility leads in this case to expenditure competition, providing a control mechanism by which local officials engage in welfare enhancing policies.

can plausibly reduce wages; therefore, the final effect on the income of original residents is uncertain.

In all, inter-jurisdictional mobility appears to be a distinctive determinant of the potential effects that fiscal decentralization might have on poverty and income inequalities. If mobility is constrained, redistributive policies carried out at the local level might be effective and inflict no efficiency costs. In addition, potentially large gains could be obtained by decentralizing some redistributive decisions and bringing them closer to the poor.

Fiscal decentralization can also alter poverty and income inequality through its effects on the composition of public expenditures. Public resources can be transferred to the poor as part of redistributive programs, and thus directly increase their disposable income. In general, however, there are many public expenditure programs that might have a pro-poor nature and thus help to alleviate poverty even without direct income transfers. Important examples are primary health and basic education, which might explicitly be targeted to the poor or to regions with low per capita levels of income or production, and which *per se* can also contribute to improve the distribution of income in the short and longer term. Arze, Martinez-Vazquez and McNab (2005) find that the share of education and health in total government expenditures increases with fiscal decentralization. Generally, these services have a positive impact on human capital development and, through this venue, fiscal decentralization might be expected to have a positive effect on the welfare of the poor.[17]

In the revenue side, fiscal decentralization can also affect the progressiveness of the tax system and therefore alter the distribution of disposable income. For example, sub-national

[17] See, for instance, Martinez-Vazquez (2001). The measurement of these effects is complicated because education and health expenditures do not have a direct impact on personal income. While the effect of transfers in cash on income distribution can be measured via Gini coefficients computed on a disposable income basis, in the case of public expenditures the pro-poor effect must be measured through benefit incidence analysis and these effects should only show up in future measurements of the Gini measures.

governments might be financed mainly by indirect taxation, which tends to be more regressive, or by property taxes, which generally are less progressive than the tax mix used by central governments.[18] In this context, a greater reliance on sub-national tax collection might reduce the progressivity of the tax system at the national level.

Naturally, the net incidence effect of tax and expenditure policies will also depend on the criteria by which public funds are distributed across jurisdictions. In practice, the decentralization of expenditure responsibilities is associated with expenditure needs whose costs significantly exceed the fiscal capacity gained with the devolution of tax revenue autonomy.[19] The asymmetric decentralization of expenditures and revenues creates vertical imbalances and, consequently, requires transfers from the center to the sub-national governments in order to balance the public budget of each level of government. Intergovernmental transfers are a distinctive element of all fiscally decentralized systems of government, and the type of transfers, their magnitude and economic justification can significantly differ from country to country. In a general sense, transfers can be considered as redistributive programs, but even though they can plausibly be used to address poverty and income inequalities among individuals, they are not necessarily meant to have this objective. In particular, equalization transfers, used to compensate those sub-national governments that are less able to provide public services, might have from a benefit incidence

[18] The conventional wisdom about the incidence of local taxes is that revenue decentralization usually has regressive effects on income distribution. See Boex et al. (2006). However, some studies, for example Sennoga, Sjoquist and Wallace (2008), suggest that the property tax can be progressive in developing countries.

[19] There are several reasons for this to happen. Tax administration requires technical capabilities that the sub-national governments might lack, and even if they have those capabilities, the tax collection process might still be subject to economies of scale that give the central government a comparative efficiency advantage in collecting taxes. Alternatively, the central government might simply prefer to keep for itself the most buoyant tax bases. This is arguably a good strategy for the central government to retain the ability of implementing stabilization policies, but in some cases a tight decentralization of tax revenue sources is an attempt to limit the political power of sub-national authorities.

point of view a positive redistributive effect.[20] Since poverty is usually related with lower fiscal capacity and greater expenditure needs, then we may expect larger equalization transfers to be given to those jurisdictions with poorer populations.[21]

There might be other ways by which fiscal decentralization could directly affect poverty and income inequalities, and that ultimately depend on the specific characteristics of each fiscal decentralization process.[22] One example is given by public employment. Alesina, Danninger and Rostagno (2001) show how public employment has been used as a redistributive device in Italy; the central government finances more jobs at higher real salaries in the south, where the average income of the population is comparatively lower than in the north.[23]

All in all, there are too many direct channels by which fiscal decentralization may improve or worsen poverty and the distribution of income; and it seems extremely difficult to anticipate the net direct effects of fiscal decentralization on these variables.

Indirect effects of fiscal decentralization on poverty and income distribution

As indicated above, by indirect effects of fiscal decentralization we refer to its effects on the *determinants* of poverty and distribution of income, which might be found in the socio-economic framework where the fiscal decentralization process takes place. In particular, we focus here on

[20] Intergovernmental equalization transfers can also be justified on efficiency grounds, as a way to reduce spillovers created by autonomous decisions at the local level.
[21] An alternative equalization approach is suggested by Buchanan (1950). Based on the principle of "equal treatment of equals," he proposes to equalize the "fiscal residuum" (defined as the difference between the contributions made by an individual and the value of public services received) across individuals with equal income. Under this scheme, equalization transfers would have, by definition, a null effect on income distribution cum public service benefits.
[22] Sub-national borrowing might have an impact on poverty income distribution by affecting, for instance, the affordability of pro-poor expenditure programs and the intergenerational distribution of tax burdens and benefits from public services. There are, however, few (mainly developed) countries where sub-national governments have general access to credit markets.
[23] See also related studies for the United States (Alesina, Baqir and Easterly 2000), for Spain (Marqués and Rosselló 2004), and for a cross-country analysis (Martinez-Vazquez and Yao 2009).

certain macroeconomic outcomes that can be affected by fiscal decentralization, and that have been identified in the literature as potential determinants of poverty and the distribution of income. Some examples of these outcomes are economic growth, macroeconomic stability, regional convergence, the size of government, and the degree of institutional development. To the extent that fiscal decentralization has measurable effects on these outcomes, then indirectly, it would be expected to have measurable effects on poverty and the distribution of income.

According to Oates (1993, 240), the argument by which local decision making can lead to (static) social benefits due to a better tailoring of public services and preferences (Oates 1972), "should also have some validity in a dynamic setting of economic growth." If policies regarding infrastructure and human capital are formulated with consideration of regional or local conditions, he argues, then they "are likely to be more effective in encouraging economic development than centrally determined policies that ignore these geographical differences." In line with this hypothesis, several empirical studies have analyzed the impact of fiscal decentralization on growth,[24] but the results are rather mixed and seem to depend on the stage of development of the countries.[25] Martinez-Vazquez and McNab (2003) suggest that the causal relationship between fiscal decentralization and growth might not be linear, and there could plausibly be an optimal level of decentralization after which more devolution of fiscal authority has a negative impact on economic development. Overall, the existence of a causal relationship between decentralization and economic growth, and therefore the indirect impact of fiscal decentralization on poverty and inequalities through this macroeconomic outcome, has not yet been clearly established.

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[24] Martinez-Vazquez and McNab (2003) and Breuss and Eller (2004) provide more detailed surveys about the literature on fiscal decentralization and growth.

[25] For example, Davoodi and Zou (1998) find a negative relationship in developing countries, while Akai and Sakata (2002) find a significant positive relationship across states in the US. More recently, Baskaran and Feld (2009) analyze the case of OECD countries and conclude that fiscal decentralization has no effect on economic growth.

The empirical evidence about the effects of fiscal decentralization on macroeconomic stability is even more limited. The classical approach to the problem is that macroeconomic policy should be an exclusive responsibility of the central government (Musgrave 1959). In line with this normative prescription, some authors argue that fiscal decentralization aggravates macroeconomic instability (Rodden 2002; Rodden, Eskeland and Litvack 2003). However, others authors argue that devolving some macroeconomic policy attributions to subnational governments can promote, not hinder, macroeconomic stability (Gramlich 1993; Shah 1999; Rodden and Wibbels 2002). These results are relevant because the poor are presumably more vulnerable to macroeconomic shocks reducing the economic activity and the demand for unskilled workers. In addition, the poor are less able to protect themselves against the loss of purchasing power due to high rates inflation. In a recent paper, Martinez-Vazquez and McNab (2006), using a panel data set that include both developed and developing countries find that fiscal decentralization does not present a threat to price stability. On the other hand, however, Treisman (2000) and Rodden and Wibbels (2002) find no clear relationship between decentralization and the level of inflation. Overall, the question about whether fiscal decentralization affects macroeconomic and price stability remains an open question, but the potential indirect effects on poverty and inequalities might plausibly be significant if fiscal decentralization does indeed promote macroeconomic stability.

Regional inequalities in per capita income can also be important in determining poverty and the distribution of income. Unfortunately, we know very little about the effects of decentralization on regional economic disparities. One possible presumption is that the state of regional development within the country might be less homogeneous under decentralized systems; however, we have no evidence to support this claim. On the other hand, there has been

considerable research on the issue of regional convergence. The relevance of this literature for this paper is that poverty and the distribution of personal income might be expected to improve at the national level if regions tend to converge in terms of per capita GRP. Barro and Sala-i-Martin (1991) have found strong statistical evidence of regional convergence in both the US and in a group of seven European countries, but also that the rate of convergence is very low, around 2% per year. Further, they found that migration explains only a marginal fraction of the rate of convergence.[26] Their results are fairly typical of the empirical literature on regional convergence; empirical studies commonly find that some sort of convergence tends to take place but the rate of convergence is very slow. The theoretical work in this area identifies several sources of convergence (de la Fuente, 2002). First, a necessary condition for convergence is the presence of diminishing returns to scale in the different forms of capital. Second, the rates of technological progress and the reallocation of factors from sectors with low productivity to others with higher productivity determine the existence of convergence and its velocity. In a recent study, Rodriguez-Pose and Ezcurra (2009) find that the relation between fiscal (and political) decentralization varies significantly with the level of development. They conclude that fiscal decentralization may contribute to reduce regional disparities in developed countries, but that the opposite happens in their sample of seven low income countries.

The size of the government is another macroeconomic outcome that can potentially affect poverty and income distribution. If the public sector is relatively big then it would have more capacity to implement sizable welfare programs with greater impacts on poverty and inequalities. The traditional public finance theory suggests that even though inter-jurisdictional tax competition tends to reduce the size of sub-national governments, the resulting amount of public

[26] The results are referred to as β-convergence, which accounts for the tendency of poor regions to grow faster (or slower if they diverge) than rich regions.

expenditures can be either over or under the optimal level. On the one hand, the Leviathan hypothesis (Brennan and Buchanan 1980), assumes that government officials are self-interested and seek to maximize their own power, represented by the size of the budget under their control. While their actions would therefore pursue a non-optimal increase of expenditures, inter-jurisdictional tax competition arising in the context of fiscal federalism would provide a binding constraint to the inefficient increase in government size. On the other hand, even when policy makers are assumed to be benevolent and maximize collective welfare, tax competition might impose downward pressure over revenue collections and the size of government, leading to under-provision of public services. Feld, Kirchgässner and Schaltegger (2003) provide a complete review of the empirical literature examining the impact of decentralization on the size of government and conclude that the evidence does not provide a definite answer to the problem.[27]

Finally, fiscal decentralization can also have an indirect effect on poverty and inequalities through its effects on institutional development. In reality, the presumption that fiscal decentralization would affect the institutions in a country is rather tautological, because by itself fiscal decentralization represents an institutional reform. However, the final effects on poverty and inequalities are unclear, and depend on the quality of the reforms as well as on the value assigned to poverty and inequalities as policy targets in the new fiscally decentralized scenario.

[27] In a recent paper, Fiva (2006), using new OECD data based on Stegarescu (2005) which allow distinguishing sub-national taxes according to their degree of local autonomy, finds that revenue decentralization reduces the size of the public sector. In addition, he also finds that the traditional measures of expenditure decentralization are positive related to government size.

Reverse causality: The potential effects of poverty and income distribution on fiscal decentralization

A review of the decentralization literature can identify some channels by which income distribution has been thought capable of shaping the process of fiscal decentralization. For example, the literature on secessions attempts to identify the sources of net benefits (and ensuing redistribution) that can be obtained from complete separation from the central authorities.[28] In fact, some theories of secession and the optimal size of countries rest on the simplifying assumption that the public sector has mainly (sometimes exclusively) a redistributive purpose.[29] Demands for decentralization may also be driven by some regions' higher preferences for redistributive policies vis-a-vis the national level.[30] On the other hand, fiscal decentralization may also be used by higher income groups and regions to protect themselves against unwanted redistribution policies. For example, in a Tiebout world with uniform communities in preferences and income, there is little room for net fiscal redistribution in taxes and services;[31] and highly decentralized systems will find it more difficult to reach regional consensus to implement significant equalization policies.

Even though the main economic argument in favor of fiscal decentralization stresses the efficiency gains associated with a better match of heterogeneous preferences across jurisdictions, the movement towards greater fiscal decentralization around the world appears to be often

[28] Secession can be considered an extreme case of devolution. Secession may be inefficient because of the possible reduction of inter-regional trade and the loss of economies of scale in public goods' provision (Bolton and Roland 1997). However, these costs may be acceptable to some groups, especially those that stand to benefit directly from the redistribution of power. Secessions have become rather common in recent years; the URSS, Czechoslovakia and Yugoslavia are examples. In some other countries, like Italy, Spain, Canada or Belgium, secession is an ongoing debate.
[29] See, for example, the work by Meltzer and Richard (1981).
[30] See Bolton and Roland (1997) and Beramendi (2003).
[31] See, for example, Martinez-Vazquez (1982).

dominated by political considerations.[32] The reorganization of the government through fiscal decentralization can be seen as an answer to central government failures or as a way of addressing different national problems, like ethnic conflicts, separatism, and development objectives. Fiscal decentralization can also be a way of strengthening democratic political institutions and basic civil rights (Shah 2004); and as a strategy to reduce corruption through improved governance.[33] Regardless of the merits of these arguments, the decentralization literature has for long accepted that fiscal decentralization can consist of very different processes in developed and developing countries, especially in regards to "quality" of government (La Porta et al. 1998). In this context, discontent regarding government's goals and performance in reducing poverty and inequalities, as well as the expectation that a fiscally decentralized system would better serve for these purposes, might plausibly ignite additional pressures for a fiscal decentralization reform.

The available decentralization literature has not identified poverty and income inequalities as relevant determinants of the fiscal decentralization reform.[34] Notable exceptions are found in Beramendi (2003, 2007), who argues that the political process might make decentralization endogenous to (the territorial structure of) income inequality. In the end, however, whether or not fiscal decentralization is endogenously determined by poverty level and the degree of inequalities will depend on the specific characteristics of each country. In this sense, the endogenous relationship between fiscal decentralization and poverty and income inequalities remains a hypothesis to be tested.

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[32] See Rondinelli and Nellis (1986) for an early presentation of this argument.
[33] The impact of decentralization on corruption (positive or negative) is an on-going debate. See Martinez-Vazquez, Arze and Boex (2007) for a review of the arguments and empirical findings.
[34] The main factors identified in the literature as determinants the observed degree of fiscal decentralization are per capita income, economic growth, population, land area, ethnic fragmentation, democratization, urbanization, intergovernmental grants and globalization are among the most common. Letelier (2005) and Arzaghi and Henderson (2005) survey the theoretical and empirical literature devoted to identifying these factors.

The Determinants of Poverty and Income Inequalities:

A Review of the Empirical Literature

In order to analyze the potential role that fiscal decentralization might play in explaining poverty and income inequalities, it is important to account for other relevant determinants of these two variables already identified in the empirical literature.

The conventional theory identifies the demand for unskilled workers as one of the most important determinants of poverty and income inequalities (Atkinson 2000). In addition, in recent years several authors have highlighted the importance of institutional and social factors, formerly ignored in empirical studies. For example, Atkinson (1997) emphasizes the role of institutional determinants of wages and employment and some macroeconomic variables like the interest rate and the income share of the factors of production to explain recent trends in income inequalities in a sample of developed countries.[35] Similarly, Tanzi (2000) argues that human capital, which usually stands for a high share of total income, tends to be much less concentrated in developed economies, which helps to explain their lower levels of income inequality; he also stresses the role of social norms and institutions in determining the endurance of poverty and income inequalities, including labor contract legislation, traditional rental contracts, norms about marriages, rules about inheritance, and the existence of positional rents or "social capital." These new perspectives advocate for policies focused on generating and redistributing human capital, which are said to have a very significant impact on poverty and income distribution. Some studies

[35] These determinants are presented as alternative explanations for the observed increase of income inequality in G7 countries between the late 70s and the early 90s. The fact that the real rate of return has increased explains in part why the share of capital income has also gone up during the period, and thus how the owners of capital, the non-poor, have benefited in relative terms.

support this hypothesis by showing a negative and significant relationship between education (measured as enrolment rates or years of schooling) and income inequalities. [36]

Some research has also focused on the structure and characteristics of the political system in order to explain poverty and income inequalities. For instance, Sirowy and Inkeles (1990) explore the possible effects of democracy on income distribution. More democracy with stronger political representation or a better organization of the poor (e.g. through unions) could allow for more active and systematic redistributive policies. A more democratic society, however, does not necessarily represent the interests of all constituencies equally, thus it might plausibly be less able to address poverty and income inequalities than an authoritative system.[37] In particular, the studies by Durham (1999) and Beramendi (2003, 2007) are some of the few examples that include decentralization as a determinant of income inequality. They also include other political variables such as regime-type (dictatorship versus democracy) or left government partisanship, and the unionization of labor markets. Finally, Gupta, Davoodi and Alonso-Terme (1998) find that a poorly functioning political system represented by high levels of corruption leads, in average, to higher income inequalities.

The empirical literature has given special attention to the interdependence of economic growth and income distribution. The most important proposition regarding this subject is described by the Kuznets' hypothesis. Kuznets (1955) suggests that economic growth initially leads to greater income inequality because the benefits of development are first collected by the high income segment of society. After the level of development reaches certain point, then the

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[36] For example, Barro (2000) finds that primary schooling significantly reduces inequalities, secondary schooling is not significant and higher education significantly increases inequalities. Chu, Davoodi and Gupta (2000) find negative effects of secondary enrollment rates on income inequality but with varying degrees of significance.

[37] Reuveni and Li (2003) find a negative and significant effect of democracy on income inequality. Other authors point out that given the clear correlation between development and democracy it is difficult, if not impossible, to separate the effects of both variables on income inequality (Sirowy and Inkeles 1990; Perotti 1996; and Durham 1999).

benefits become available for the poor and inequalities (and poverty) tend to diminish.[38] The available evidence provides some support for this hypothesis and the Kuznets' curve has even been referred to as an empirical regularity (Barro 2000), but still there is no general consensus about its validity.[39]

Besides economic growth or the level of development, other macroeconomic variables that have been given attention are openness to trade and inflation. One view on the effects of trade openness on income distribution is based on the Stolper-Samuelson theorem, according to which the abundant factor in the economy, or the one defining the comparative advantages of a country, is the main beneficiary of trade liberalization. Since unskilled labor is relatively abundant in developing countries, income inequalities would be expected to decrease when developing countries are more open to trade. An alternative view is that trade liberalization will benefit more those better able to take advantage of the new opportunities offered by globalization. Both conjectures have received empirical support in recent studies.[40]

Inflation typically leads to a transfer from those with higher propensity to consume to those who are able and willing to substitute future for present consumption. In such a context, devaluations of the exchange rate as well as high market premiums that are reflected in higher price levels would be associated with increasing income inequalities (Bahmani-Oskooee, Goswami and Mebratu 2006).

The demographic configuration of a country has also been shown to be an important determinant of both poverty and income inequalities. Three important variables considered in the

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[38] Kuznets explains this trend by describing the shift from the agricultural sector to the nonagricultural sector, and stresses the importance of industrialization and urbanization in economic development.

[39] For example, among others, Barro (2000), Vanhoudt (2000) and Thornton (2001) find support for the hypothesis and Deininger and Squire (1998) do not. See Moran (2005) for a review of the historical importance of the Kuznets' hypothesis.

[40] Barro (2000) finds a positive and significant effect of trade openness on income inequality, with the effect being more pronounced in poor countries. However, Reuveni and Li (2003) find a negative effect.

empirical literature are population growth, the age dependency ratio and urban population. Population growth reduces the relative average income of those demographic groups growing faster, usually the poor, which in turn worsens the distribution of income.[41] Furthermore, if population growth is concentrated in low-income groups, then a higher age dependency ratio can be associated with increased inequalities (Firebaugh 1999). High rates of population growth might be negatively related to the proportion of population over 65 years old, which have on average lower but less unequal income than the working population. Finally, the urban population generally enjoys a greater average income than the rural population, but at the same time income is usually more unequal in urban areas.[42] Martinez-Vazquez, Panudulkitti and Timofeev (2009) find a U-shaped relationship between the level of urbanization and poverty using a large panel data set; while poverty tends to decrease with the level of urbanization in the country, after urbanization reaches a threshold the poverty level tends to increase again.

Empirical analyses: The Effects of Fiscal Decentralization on Poverty and Income Inequality

In this section we analyze the effects fiscal decentralization on poverty and income inequality using a panel dataset for a large number of developed and developing countries. As we have seen, there are several channels through which fiscal decentralization can influence poverty and the distribution of income and, in the absence of an all-encompassing model, it is not possible to

[41] Perotti (1996) explains the link between these two variables in the context of income distribution.
[42] In reality, urban inequalities could plausibly be either lower or higher than the urban-rural inequality in income, and therefore the sign of the effect of urbanization on income distribution is uncertain. According to Kuznets (1955), economic development is associated with higher urbanization, and so inequalities would likely increase when rates of urbanization (and development) are low and rising, and they would be reduced in more advanced stages of urbanization due to the overall rise in average income. See also Perotti (1996).

predict the direction of these influences. Moreover, the final effect of fiscal decentralization on poverty and income inequalities depends on an array of socio-economic factors that can further condition the effect of fiscal decentralization on poverty and income inequalities. In this context, our empirical strategy consists, first, of controlling for other variables identified in the empirical literature as significant determinants of poverty and income inequalities; and second, of accounting for the potential endogeneity or reverse causation between fiscal decentralization and poverty and income inequality. Our aim is to capture in the estimated coefficients the overall (direct and indirect) effects of fiscal decentralization on poverty and income inequalities.

The data come from a variety of sources as described in Appendix I; the specific countries and periods considered vary due to data availability. In order to neutralize the effect of business cycles, we average most variables over five-year periods. The period averages should allow us to also improve the quality of two of the main variables of interest, the expenditure decentralization measure and the Gini coefficient, which are potentially subject to measurement error due to inconsistent definitions and measurement procedures.

We begin by analyzing the effect of fiscal decentralization on poverty and then, separately, we turn to analyze the effect of fiscal decentralization on inequalities in the distribution of income.

The effect of fiscal decentralization on poverty

The dependent variable, poverty, is measured by the headcount ratio and the poverty gap defined for a poverty line of US$1.25 (in purchasing power parity), and alternatively, by the Human Development Index (HDI). We use the three measures of poverty in order to find consistent

evidence about the effects of fiscal decentralization on poverty. However, as it turns out, only the HDI provides a data sample that is large enough to extract meaningful conclusions from the econometric analysis.

The sample consists of an unbalanced panel of 65 countries, 41 developing and 24 developed, and it comprises five (five-year) periods between 1976 and 2000. A list of the countries included in the sample and the summary statistics for the variables used in the estimation are presented in Tables II.1 and II.2, respectively in Appendix II.

We allow for the independent variable of interest, fiscal decentralization to have a non-linear effect on poverty. Our objective is to contrast the traditional view about the redistributive role of sub-national governments, according to which their intervention in redistributive policies is ineffective and should be avoided, with the role that in practice sub-national governments are playing in reducing poverty. As we have explained, there are several direct and indirect channels by which sub-national governments can influence poverty, and their involvement in redistributive policies seems to be, in practice, a widespread reality.

The econometric specification for the estimation including the non-linear effect of fiscal decentralization on poverty is:

$$Poverty_{it} = a_1 FD_{it} + a_2 FD_{it}^2 + B\,[Controls_{it}] + e_{it}$$

A quadratic effect of fiscal decentralization on poverty might allow to distinguish two possible scenarios; one in which sub-national governments are effectively helping in reducing poverty, from another scenario in which their involvement in redistributive policies is counterproductive. For instance, if the coefficients of fiscal decentralization (*FD*) and FD squared are both statistically insignificant (or, if significant, close to zero or negative) then a greater share of sub-national government expenditures over the general public budget would be associated with

no better poverty outcomes. In contrast, the participation of sub-national governments in redistributive policies would be considered as effective if at least a_1 is statistically significant, and the combined effect of a_1 and a_2 leads to greater human development.

Based on the available empirical literature, which is summarized in Section 4, we also include a number of control variables to account for the effects that other socioeconomic factors might have on poverty. The first control is government size, which represents the dimension of the public budget and therefore the ability or potential to carry out significant poverty alleviation policies.[43] In theory, we expect fiscal decentralization to have an indirect effect on poverty by altering the size of the government sector as well as through changing the composition of government expenditures; however, we include the size of the government as an independent variable in order to explicitly account for other possible effects that are not indirectly explained by fiscal decentralization. [44]

The demographic configuration is represented by population growth, the age dependency ratio, and the share of population living in urban areas. These are all variables that have been found in the previous literature to have significant effects on poverty. Both population growth and the age dependency ratio are related with a reduction of average per capita income and thus can be expected to increase poverty, and therefore to display a negative sign. In contrast, urban population usually enjoys higher income per capita and should be associated with a reduction of poverty, displaying a positive sign.

[43] Government size is computed as the general government share in real GDP, and consists of the final goods and services purchased by the government. Note that the funds allocated to social security and welfare programs are excluded from this measure; since social spending is likely influenced by poverty levels, the inclusion of those spending programs would have required treating the size of government as an endogenous variable.

[44] This means, of course, that the estimated coefficients for fiscal decentralization will be short of capturing the net total (direct and indirect) effects on poverty.

An index of democracy is used to represent structural characteristics of the political system and the responsiveness of government towards preferences related to poverty reduction and the universal satisfaction of basic needs in the country. In general, we expect the coefficient for this control variable to take a positive sign, although this is not consistently supported by the previous literature.

Finally, we also include openness to international trade as an additional control variable; this is a commonly used control variable in the empirical literatures on poverty and income inequalities; but there is neither theoretical nor empirical consensus about the sign of its influence.

The results of the regressions are presented in Table 1. Because we use an international panel data set, it is unlikely that any regression specification will be able to control for all the individual country effects that may affect poverty. For example, countries may differ in the distribution of general political ideology or for historical or other reasons in their acceptance of a significant level of poverty. For these reasons, we begin by allowing for unobserved specific country (and time) effects and use fixed effects estimation.

The first two regressions use the headcount ratio and the poverty gap as the dependent variables, and control for the log of per capita GDP (at purchasing power parity) in order to account for different levels of development. As expected, per capita GDP is associated with a reduction of the two poverty measures and is statistically significant. In addition, only urban population and openness to trade appear as having a significant effect in both regressions. Urban location is known to lead generally to higher income levels than rural living, which may explain the negative sign and statiscally significant coefficient for this variable. In contrast, the coefficient of openness to trade is positive and significant, suggesting that the gains from international trade do not reach the poor in our sample of countries.

Table 1. The determinants of poverty

Dependent variable:	Headcount		Poverty Gap		HDI		HDI		HDI	
Model:	Fixed Effects regression		Fixed Effects regression		Fixed Effects regression		Random Effects GLS regression		Random Effects GLS regression	
	(1)		(2)		(3)		(4)		(5)	
Fiscal Decentralization (%)	-0.464		-0.255		0.224	**	0.184	**	0.146	*
	(0.543)		(0.301)		(0.098)		(0.091)		(0.084)	
Fiscal Decentralization (%) squared	0.012		0.007		-0.003	**	-0.003	**	-0.003	**
	(0.012)		(0.006)		(0.002)		(0.002)		(0.001)	
Government size (% GDP)	0.161		0.151		-0.060	*	-0.052		-0.052	
	(0.305)		(0.181)		(0.035)		(0.037)		(0.038)	
Log of per capita GDP	-17.920	***	-7.552	***						
	(4.154)		(2.739)							
Population growth (%)	-3.112		-1.483		0.362		0.244		0.210	
	(2.308)		(1.322)		(0.420)		(0.393)		(0.385)	
Age dependency (%)	-0.220		-0.226	*	-0.026		-0.099	**	-0.087	**
	(0.207)		(0.123)		(0.036)		(0.039)		(0.037)	
Urban population (%)	-0.724	**	-0.466	**	0.261	***	0.328	***	0.228	***
	(0.359)		(0.194)		(0.054)		(0.038)		(0.035)	
Index of democracy	-0.010		0.005		-0.004		0.004		0.003	
	(0.036)		(0.020)		(0.008)		(0.008)		(0.008)	
Average schooling years total population					0.311		1.440	***	1.048	***
					(0.310)		(0.270)		(0.256)	
Openness to international trade	0.093	*	0.056	**	-0.023	*	-0.011		-0.006	
	(0.049)		(0.028)		(0.012)		(0.010)		(0.010)	
dummy Sub-Saharan Africa									-4.190	
									(3.770)	
dummy Latin America & Caribbean									3.978	*
									(2.229)	
dummy Developing Country									-12.781	***
									(1.938)	
Constant	219.121	***	105.185	***	63.209	***	54.231	***	69.827	***
	(51.020)		(32.309)		(4.294)		(4.234)		(3.985)	
Observations	132		132		297		297		297	
Number of countries	47		47		65		65		65	
R-square within	0.4122		0.3618		0.8286		0.7934		0.8107	
R-square between	0.5549		0.3141		0.6738		0.8272		0.8546	
R-square overall	0.5730		0.3401		0.6470		0.8131		0.8559	
Wald test							989.17		1513.34	
p-value							0.0000		0.0000	
Test of overidentifying restrictions							144.636		111.976	
p-value							0.0000		0.0000	
Turning point of the *FD* effect					32.4		26.6		24.7	

Notes:
Robust standard errors in parentheses.
All regressions include year's dummies (not shown)
* significant at 10%; ** significant at 5%; *** significant at 1%.

The variables of interest, fiscal decentralization and fiscal decentralization squared display no significant relationship with the headcount ratio and the poverty gap. However, their sign is the same in both regressions and suggest that fiscal decentralization might initially help to reduce

poverty (according to the negative sign of fiscal decentralization) and that this influence is reverted with the extent of fiscal decentralization (as implied by the positive sign of fiscal decentralization squared).

The first two regressions are run over a relatively small sample of 132 observations. In addition, the use of the fixed effects model notably reduces the degrees of freedom available for the estimations. In this context, there might not be sufficient information in the sample to find a significant relationship between fiscal decentralization and the poverty measures. One possible strategy is to use random effect estimators, but the test of overidentifying restrictions (Schaffer and Stillman 2006) suggests that the independent variables are correlated with the country-specific error and thus the random effects model is not adequate.[45] Alternatively, we use the Human Development Index (HDI) as a proxy for poverty, and take advantage of the fact that the measures of the HDI are more readily available. Although the HDI is a broader measure of welfare than the headcount ratio and the poverty gap, it is not a surprise that these variables are highly correlated.[46]

The HDI combines normalized measures of population health and longevity, knowledge and education, and standard of living; and varies in the same direction than the level of human development. As a consequence, an increase of the HDI should represent a reduction of poverty and vice versa. The HDI does not suffer from the same inconsistencies that affect the measures of fiscal decentralization and the Gini coefficient. Indeed, the HDI is based on well defined measures of per capita GDP and health and education outcomes widely available for most countries. [47] For

[45] The Sargan-Hansen statistics are 24.92 and 26.00 for the first and second regressions, respectively, while the associated p-values are 0.024 and 0.017, which are low enough to reject the null hypothesis of no correlation between the independent variables and the country-specific error implicit in the random effects model.
[46] The correlation between the HDI and the two previous measures of poverty, the headcount index and the poverty gap is, respectively, -0.85 and -0.79 in our data sample.
[47] Note that since the log of per capita GDP is used to construct the HDI we exclude this variable from the set of regressors.

estimation purposes we use the single year measures of the HDI at the end of each five-year period. This might allow us to capture some of the effects of fiscal decentralization on poverty that may not be observed within the same period that the fiscal decentralization reform is implemented. The HDI measures come from the most recently data set released by the United Nations Development Programme, which include measures for the HDI since 1980.

In column (3) we present the first regression for the HDI as the dependent variable using a fixed effects estimation model; note also that this regression incorporates a control variable for education, usually considered as an important determinant of poverty.[48] Since our dependent variable is partially defined in terms of education factors (specifically, using the adult literacy rate and an average of primary, secondary, and tertiary gross enrollment ratios) our education explanatory variable is defined as the average years of schooling for the total population; this variable is meant to capture the effect that accumulated education, or human capital, might have on the measure of poverty.

The quadratic effect of fiscal decentralization on the HDI (Table 1, column 3) is significant at the 5% level and displays an "inverted U" shape.[49] Starting from a hypothetical point where there is no fiscal decentralization ($FD = 0$), a movement towards fiscal decentralization increases the HDI (or decreases poverty), up to a point where more fiscal decentralization appears to have a negative effects on poverty. The turning point of the fiscal decentralization effects is shown at the bottom of Table 1, and for the fixed effects regression (column 1) it corresponds to 32.4%. This implies that, on average, when sub-national expenditures represent about one-third of total expenditures, sub-national budgets reach a

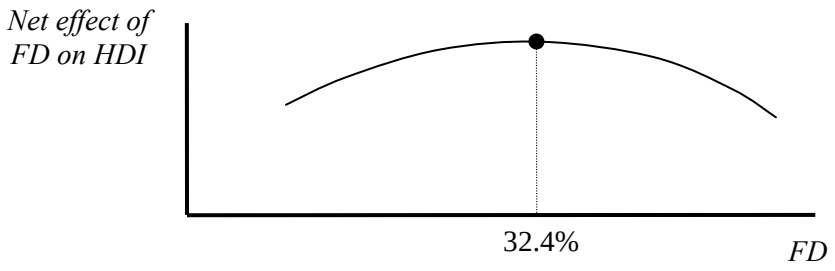
[48] The variable education was not included in the first and second regressions because of data availability. Given the limited number of education measures, the already small sample used in these two regressions is reduced up to the point where there are no enough degrees of freedom to obtain the fixed effects estimators.

[49] In general, we expect the signs of the coefficients of the regressions on the HDI to change with respect to those of the first and second regressions.

maximum level of efficacy in poverty reduction as measured by HDI; deepening fiscal decentralization beyond that point ends up in increased poverty levels. These effects are illustrated in Figure 2.

The control variables do not appear, in general, to have considerable predictive power. Population growth, age dependency, democracy and education are not statistically significant. The size of government and trade openness, both with negative sign, are significant at the 10% level, but their coefficient is relatively small. Only the percentage of urban population appears as a relevant predictor of poverty.

Figure 2. The effect of fiscal decentralization (FD) on poverty



In column (4) we present the random effects generalized least squares (GLS) estimation using the same set of variables. Fiscal decentralization maintains the same pattern of influence, although the turning point of its peak influence on poverty is reduced to 26.6%. Regarding the other controls, the main changes with respect to the fixed effects regression are observed in the coefficients of age dependency and education, which become statistically significant at the 5% and 1%, respectively, and are relevant in magnitude. Consistent with the previous literature, both variables show the expected sign. Age dependency has a negative coefficient, implying that it is

positively associated with poverty; while average schooling years of the total population works to reduce poverty.

The random effect GLS estimators are obtained by assuming that the independent variables are uncorrelated with the country-specific error. To verify the validity of this assumption we use a test of overidentifying restrictions (Schaffer and Stillman 2006).[50] In this case, the test of overidentifying restrictions produces a Sargan-Hansen statistic (shown in the Table) that soundly rejects the null hypothesis that independent variables are uncorrelated with the country-specific error. Therefore, we conclude that the fixed effects model is preferred to the random effects model.

A relevant econometric issue is whether fiscal decentralization is endogenously determined with our measure of poverty. Under the fixed effects model we require proper time-variant instruments in order to test and correct for this problem. Unfortunately, given the complexity of the relations between fiscal decentralization and poverty and their common dependency in certain socio-economic factors, it is difficult to find well defined instruments.[51]

One alternative strategy is to attempt to partially control for the country-specific effects in the context of the random effects GLS regression, and test if in the new specification the independent variables are indeed uncorrelated with the country-specific error. Column (5) presents an additional random effects GLS regression including control dummies for two regions, Sub-Saharan Africa and Latin America & Caribbean, which have been found to be relevant determinants of income inequalities. In addition, we add a third dummy that takes the value of 1 for developing countries and 0 for developed countries. In general, the results remain similar to

[50] In general, the Hausman's specification test fails to provide useful results due to the unbalanced nature of our data samples.

[51] The instruments must be correlated with the endogenous variable but uncorrelated with the error term. Using weak instruments may actually aggravate the asymptotic bias instead of correcting it (Staiger and Stock 1997).

those found in the second regression. However, the test of overidentifying restrictions again rejects the null hypothesis that the regressors are uncorrelated with the country-specific error, indicating that the fixed effect model of column (3) is still preferable.

Although the inability to control for possible endogeneity casts doubts about the validity of the results, the consistent pattern of influence found in the regressions suggests that the non-linear (inverted-U shaped) function might be a good approximation to the true causal relationship between fiscal decentralization and poverty. This result is particularly important because it implies that sub-national governments can positively contribute to poverty reduction under fairly common conditions. Indeed, the average fiscal decentralization measure in our sample of countries is 19.6% (see Table II.2 in Appendix II). The result indicates that the net effect of fiscal decentralization is to work to lower the poverty level. This may be because sub-national governments do get more directly involved in the provision of services that most immediately help the poor but that at higher levels of decentralization the fiscal resources left at the central level may be too scarce for implementing effective national anti-poverty programs.

The effect of fiscal decentralization on income inequality

We have seen that the channels through which fiscal decentralization may affect the distribution of income are, for the most part, the same as those through which fiscal decentralization may affect the poverty level. However, differences in the definition of the dependent variables and the computational problems and availability of the Gini coefficient (our selected measure of inequality) justify several changes in the econometric specification.

Data on the Gini coefficient are obtained from the World Income Inequality Database (WIID). [52] The measures available in the original dataset are computed from several definitions of gross or disposable income and consumption, and are based on individual or household surveys applied in rural or urban areas and nationwide. For our estimation we use only data classified as reliable in the original database, and for consistency we choose to work with income Gini measures based on nationwide surveys of households.[53] In particular, we prefer Gini measures based on disposable income, as opposed to gross income, because they better capture the results of government interventions in the form of tax and expenditure policies.[54] We use gross income measures of the Gini coefficient only in those cases where a disposable income measure is not available, and we control for the change of income base incorporating a dummy variable, equal to 1 if the Gini coefficient is based on gross income, and equal to 0 if it is based on disposable income. [55]

The resulting unbalanced data panel consists of 56 countries, from which 34 are developing countries and 22 are developed countries. Tables III.1 and III.2 in Appendix III,

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[52] This data base builds on the work of Deininger and Squire (1996), who assembled a large number of Gini coefficients available in the literature. In order to ensure the quality of the sample, they imposed several requirements or selection criteria. The resultant data set included 682 observations for 108 countries and a varied number of years for each country. The data set was further corrected and upgraded by UNU/WIDER, and the most recent version of the World Income Inequality Database (WIID 2.0c), published in May 2008, includes 5,313 observations for 159 countries.

[53] Gini coefficients based on expenditures are more common among developing countries and expected to be lower than those based on income (Deininger and Squire 1996). Since the final data set includes few expenditure-based observations, we prefer to avoid any possible noise by simply eliminating them. A similar criterion is applied to Gini measures based on individuals, which are eliminated in order to ensure the consistency of the sample. According to Deininger and Squire (1996), there is no reason to expect that the individual and household-based Gini measurements would present systematic differences; however, here we follow a conservative approach in order to avoid undesirable bias in the coefficients.

[54] For further discussion see, for example, Chu, Davoodi and Gupta (2000) and Deininger and Squire (1996). UNU/WIDER (2005) defines disposable income in accordance with the concept recommended by the Camberra Group, as total income minus employees' social contributions and taxes on income. Note that cash benefits from the government including social insurance benefits, universal social assistance and mean-tested social assistance are included as a part of total income.

[55] Here we follow, among others, Durham (1999) and Barro (2000), who also use dummy variables in order to control for differences in the measurement of the Gini coefficient.

provide the list of countries and a summary statistic of the variables. The observations are available from 1971 to 2000, and all variables are expressed in five-year averages.

Conceptual differences between poverty and inequality in the distribution of income call for a differentiated approach to analyze the effects of fiscal decentralization. Under quite common circumstances the reduction of poverty is a necessary, but not sufficient, condition for the reduction of income inequalities. The reduction of inequalities requires, in addition, that a lower share of national income is received by the wealthier households. In order to reach this goal a government requires the capacity to implement sizeable redistributive programs at the national level. A progressive income tax schedule, for instance, might serve to directly alter the distribution of income. A larger public sector share in GDP also facilitates pro-poor expenditure programs at the central and sub-national levels and other expenditure programs that may also benefit middle income groups directly (for example, college education or public health) or indirectly (for example, higher levels of private income through productivity enhancing public infrastructure). But, note that in order to become an effective redistributive tool, the government sector (central and sub-national levels) must be a relevant player in the economy and rely on a fairly well developed institutional framework. Finally, a more decentralized system of government may overall leave the central government with less available resources to implement distributional programs, if indeed central governments are more likely to focus on redistribution objectives than sub-national governments; this scarcity of funds argument should be more valid in situations where the government sector is relatively smaller. In this case, we could observe that higher levels of fiscal decentralization can lead to higher inequality in the distribution of income.

In this context, we argue, the potential of fiscal decentralization to reduce income inequalities may depend on the importance of the public sector in the overall economy. Sub-

national governments generally do not have discretion over major tax bases, and generally they are not expected to be able to reduce income inequalities through their tax policies. However, sub-national governments might have an effective influence on income inequalities by using some of their comparative advantages in the expenditure side of the public budget; or, at the least, the negative impact of decentralization on income distribution because of the deviation of funds from redistributive government policies may be neutralized when the presence of the public sector in the economy is higher. In order to capture these nuances in our estimation we introduce in the econometric specification an interaction term between the government size in GDP and fiscal decentralization:

$$Gini_{it} = b_1 FD_{it} + b_2 FD_{it} \times Gov.Size_{it} + B\,[Controls_{it}] + e_{it}$$

Among the controls we include a quadratic function of the log of per capita GDP to represent the Kuznets' hypothesis.[56] Income levels are typically correlated with other factors like the strength and quality of institutions, the rule of law, the development of the financial sector and the labor markets, etc.; therefore, using the log of per capita GDP as a control variable allows us to control for several other aspects of the socio-economic framework where the influence of fiscal decentralization on income inequalities takes place.

As in the regressions for poverty, we include here population growth and the share of urban population to account for changes in the demographic composition; we also include an index of democracy to control for the possible impact of different political frameworks on income

[56] The inclusion of the quadratic function of the log of per capita GDP has become a common practice in the empirical literature on income inequalities. Some examples are Barro (2000), Thornton (2001) and Bahmani-Oskooee, Goswami and Mebratu (2006).

distribution, and trade openness, a commonly used control variable in previous empirical analyses of income inequalities.[57]

Table 2 presents the estimation results for income inequality. The first regression (column 1) is obtained with the fixed effects model, which controls for all unobservable specific-country effects. The positive and statistically significant coefficient of fiscal decentralization indicates that, by itself, fiscal decentralization worsens inequality in the distribution of income. However, the negative and also significant coefficient for the interaction term between decentralization and the size of the government sector indicates that the worsening effect of decentralization decreases with government size and that, after the government reaches a sufficiently large size, fiscal decentralization actually works to reduce inequalities. The government size at which fiscal decentralization turns to be effective in reducing income inequalities is, as displayed at the bottom of the table, equal to 18.2% of the GDP. Given the level of aggregation of our estimates and the complexity of the direct and indirect effects through which decentralization may affect the distribution of income we cannot be sure of how the net effect comes about. But, it is as if for situations where the share of the government sector is relatively low, under 20 percent, decentralization works to increase income inequality perhaps because scarce funds are deviated from redistributive central government programs. For shares of the government sector in the economy over 20 percent, fiscal decentralization works to decrease income inequality perhaps due to the type of expenditure programs that can be implemented at the sub-national level in combination with the fact that central government budgets are large enough to implement redistribution programs.

[57] We also tested the effect of left-leaning partisanship and several education variables; however, they did not display significant effects on income inequalities. Given also that their inclusion reduces significantly our sample size, we do not present here the results of those regressions.

Table 2. The determinants of income distribution

Dependent variable: Gini coefficient based on disposable income (plus gross income Gini measures)

	Fixed Effects regression	Random Effects GLS regression	Random Effects GLS regression	Random Effects GLS regression	G2SLS Random Effects IV regression [a]
	(1)	(2)	(3)	(4)	(5)
Fiscal Decentralization (%)	0.237 **	0.284 ***	0.308 ***	0.324 ***	1.143 **
	(0.109)	(0.106)	(0.088)	(0.087)	(0.559)
Interaction term	-0.013 **	-0.016 ***	-0.015 ***	-0.015 ***	-0.057 **
(F.Decent.× Government size)	(0.006)	(0.005)	(0.004)	(0.004)	(0.028)
Government size (% GDP)	0.194	0.243 **	0.260 **	0.258 **	1.017 **
	(0.129)	(0.121)	(0.117)	(0.118)	(0.509)
Log of per capita GDP	51.519 ***	64.432 ***	51.298 ***	51.585 ***	63.872 ***
	(13.947)	(11.716)	(10.741)	(10.769)	(14.790)
Log of per capita GDP squared	-3.014 ***	-3.865 ***	-2.985 ***	-3.013 ***	-3.798 ***
	(0.785)	(0.656)	(0.597)	(0.598)	(0.885)
Population growth (%)	0.771	2.765 ***	1.632 ***	1.688 ***	1.429 *
	(0.700)	(0.784)	(0.544)	(0.532)	(0.804)
Urban population (%)	-0.057	0.045	-0.049	-0.046	-0.030
	(0.098)	(0.047)	(0.043)	(0.043)	(0.049)
Index of democracy	0.019	0.023 *	0.024 **	0.024 *	0.015
	(0.013)	(0.013)	(0.012)	(0.012)	(0.018)
Openness to international trade	-0.021	-0.021 *	-0.017		
	(0.016)	(0.012)	(0.011)		
dummy Gross-income Gini measure	4.867 **	6.564 ***	6.598 ***	6.475 ***	7.297 ***
	(2.291)	(1.535)	(1.399)	(1.398)	(1.413)
dummy Sub-Saharan Africa			10.575 ***	10.495 ***	9.068 ***
			(3.026)	(3.066)	(2.557)
dummy Latin America & Caribbean			13.351 ***	13.525 ***	12.663 ***
			(1.906)	(1.865)	(1.880)
Constant	-179.302 ***	-234.603 ***	-187.440 ***	-189.414 ***	-250.637 ***
	(61.518)	(52.091)	(47.851)	(47.991)	(67.288)
Observations	213	213	213	213	213
Number of countries	56	56	56	56	56
Wald test		143.87	332.31	333.37	364.26
p-value		0.0000	0.0000	0.0000	0.0000
R-square within	0.3767	0.3428	0.3651	0.3555	0.2485
R-square between	0.5976	0.7238	0.8461	0.8465	0.7665
R-square overall	0.5886	0.7048	0.8212	0.8206	0.7429
Test of overidentifying restrictions		38.638	18.024	17.939	0.126
p-value		0.0007	0.2614	0.2096	0.7224
Max. Kuznets' curve (year 2000 US$)	5,149	4,169	5,392	5,221	4,486
Maximum *FD* effect (in terms of government size)	18.2	17.8	20.5	21.6	20.1

[a] The instruments for expenditure decentralization and its interaction term are the log of area (square kilometers), log of population times the developing country tummy and, openness to international trade.

Notes: Robust standard errors in parentheses.
All regressions include year's dummies (not shown)
* significant at 10%; ** significant at 5%; *** significant at 1%.

For the other control variables, the Kuznets hypothesis is strongly supported by the estimates in Table 2. On average, the Gini coefficient increases in the first stages of development and after a certain level of per capita GDP is reached, income inequality starts to decrease. The

maximum point of the Kuznets' curve, under the fixed effects model, is US$5,149 dollars per capita (in prices of year 2000). Countries with a lower (greater) level of per capita income tend to experience greater (lower) income inequalities as they grow. Regarding the other control variables, none of them display a statistically significant effect on income inequalities in the fixed effects regression.[58]

For completeness we present in the second column of Table 2 the random effects GLS estimations obtained by using the same variables considered in the fixed effects regression. But, even though most of the control variables gain in terms of statistical significance, the test of overidentifying restrictions suggests that the random effects model wrongly assumes that the explanatory variables are uncorrelated with the country-specific error.

In column (3) of Table 2 we present an additional random effects GLS estimation, which incorporates dummy controls for two regions, Sub-Saharan Africa and Latin America and the Caribbean. These dummy variables allow us to partially control for country-specific effects, such that the random effects' assumption is correctly applied to the new specification. Indeed, the two regional dummies are significant at the 1%, suggesting that a great deal of the country-specific error has a regional component. This assertion is supported by the test of overidentifying restrictions, which with a p-value of 0.2614 fails to reject the null hypothesis of no correlation between the independent variables and the country-specific error. The random effects regression with dummy regional control variables, therefore, seems to provide consistent and efficient estimators.

[58] But note that interestingly the dummy controlling of gross income measures of the Gini coefficient is significant at the 5% level, and it is relevant magnitude with a positive sign. In average, gross income measures of the Gini coefficient are systematically greater than disposable income measures. Since the differences between gross and disposable income measures are mostly explained by tax payments, this result suggests that the tax policy has an effective redistributive character.

The random effects regression of equation (3) confirms that the effect of fiscal decentralization on income inequalities depend on the size of government. The point at which fiscal decentralization starts reducing income inequalities is defined for a government size of 20.5% of the GDP. The Kuznets' hypothesis is confirmed again, and the maximum point of the Kuznets' curve is reduced to US$5,392. Other control variables turn out to have a significant effect on income inequalities under this specification. The size of government, by itself, increases income inequalities. This finding helps clarify the active role of sub-national governments in contributing to the reduction of income inequalities, as opposed of playing a passive indirect role of reducing more or less the ability of the central government to implement national redistributive programs.

As discussed earlier, there are good reasons to suspect that fiscal decentralization may be an endogenous variable. Differences in income distribution may help shape preferences for fiscal decentralization and the actual extent of its implementation. If fiscal decentralization is endogenous then the estimates obtained from fixed effects and random effects (GLS) models in Table 2 might be biased.

Given that the random effects regression in column (3) is presumably making correct assumptions about the correlation of regressors and the specific-country error, we can use the (random effects) generalized two-stage (instrumental variables) least squares (G2SLS) model as a framework to analyze the possible endogeneity of fiscal decentralization. Note that time-invariant variables are not dropped in random effects models, thus we can use time-invariant instrumental variables. Two out of the three instruments used represent the size of the country.[59] The size of

[59] Among many others, Beramendi (2003) uses ethnic fractionalization to instrument fiscal decentralization also in the context of its effects on income inequalities. Ethnic fractionalization, however, is highly correlated with the Gini coefficient in our sample, thus it does not meet the basic requirements of a good instrument for fiscal decentralization.

the country does not seem to be related with income distribution, but it has been identified as an important determinant of fiscal decentralization. The size of the country is represented by the log of geographical area (measured as square kilometers) and the interaction term between the log of population and the developing country dummy.[60] The costs of centralized service provision can be expected to increase with the geographical size of the country, and thus also the justification for decentralized expenditure responsibilities.[61] The interaction term between the log of population and the developing country dummy allows us to control for the effects that population on fiscal decentralization only in the context of developing countries. Within de sub-sample of developing countries, we argue, the movement towards fiscal decentralization might be partially explained by the need for improving efficiency in public service delivery for vast populations; but note that the size of the population itself has not played any important role in determining the distribution of income.[62] In addition, provided that openness to international trade has been shown no to be a significant determinant of income inequalities in our sample, and that it may be at the same time a good predictor of fiscal decentralization, we also use it as an instrument for fiscal decentralization.[63] The possible effects of openness on fiscal decentralization and income inequalities are several, but the net result is uncertain. Here we argue that the positive and negative effects that openness might have on income inequalities, as revealed by the random effect regression of column (3), tend to cancel out. In contrast, openness might be associated with

[60] Arzaghi and Henderson (2005) show that the area of the country and population are both important determinants of fiscal decentralization.
[61] Panizza (1999) offers strong support for the positive effect of area on fiscal decentralization. An example of the use of geographical area as an instrument for fiscal decentralization is given by Enikolopov and Zhuravskaya (2006).
[62] Among developing countries, the correlation between the log of population and fiscal decentralization is 0.46, while the correlation between the log of population and the Gini coefficient is 0.09. The same argument might not be applicable to developed countries, where the efficiency gains from fiscal decentralization can be expected to be lower.
[63] The correlation between openness to trade with respect to fiscal decentralization and the Gini coefficient is -0.24 and -0.11, respectively. In addition, the coefficient of openness to trade is negative and significant at the 1% level in the regressions of fiscal decentralization and its interaction term on the full set of exogenous variables.

a lower ability to carry out stabilization policies, and therefore with a central government more reluctant to transfer tax and expenditure powers to the sub-national level.[64] The exclusion of openness to trade does not significantly affect the results of the random effects estimations, which are presented in column (4). Again, the test of overidentifying restrictions (with a p-value of 0.2096) fails to reject the null that the random effects' assumption is valid.

The generalized two-stage least squares (G2SLS) regression results are presented in column (5) of Table 2. In the context of the G2SLS the test for overidentifying restrictions is a test on the null hypothesis that the excluded exogenous variables are valid instruments. The p-value of the test is 0.7224, which means that this hypothesis cannot be rejected and that the set of instruments is adequate.

The G2SLS results in column (5) shows that our previous results about the significance of fiscal decentralization and the functional form of its influence on income distribution are robust to the correction for possible endogeneity bias. The coefficients of fiscal decentralization and its interaction term with the size of government remain highly significant, while the size of government that maximizes the redistributive effect of fiscal decentralization is set at 20.1% of the GDP, which is very close to the previous results.

Summary and Conclusions

Currently, many countries around the world are simultaneously embarked in active policies involving poverty reduction and improvements in the distribution of income, on the one hand, and fiscal decentralization reform, on the other hand. It is important to clarify the extent to which these policy thrusts are complementary or may be working against each other.

[64] For more detailed discussions see, for example, Prud'homme (1994) and de Mello (2005).

To research this question this paper explores the wide array of possible effects that fiscal decentralization policy may have on poverty and income distribution outcomes. First, we draw up a conceptual framework to distinguish between direct and indirect effects of fiscal decentralization on poverty and income distribution outcomes. Direct effects are those that can be associated with changes in fiscal policies or behavioral responses with a direct redistributive impact. In contrast, indirect effects include mostly macroeconomic outcomes, such as economic growth, macroeconomic stability and so on, that can be important in determining poverty levels and the distribution of income and that can plausible be affected by fiscal decentralization.

Although interesting and suggestive, the relationships between decentralization, poverty and income distribution are many and complex and often they are quite likely to work in opposite directions. Therefore, it is not possible *a priori* to anticipate what may be the net impact of fiscal decentralization on poverty and inequality, largely making it an empirical question.

We use a large international panel dataset covering the past three decades to test to what extent fiscal decentralization affects poverty and income distribution outcomes. Besides fiscal decentralization measures, the econometric specifications include other control variables that have been found in the previous literature to be relevant determinants of poverty and inequality of income distribution.

The analysis uses three different definitions of poverty: the headcount ratio, the poverty gap, and the Human Development Index (HDI). When using the headcount ratio and the poverty gap as the dependent variable we do not find a statistically significant effect for fiscal decentralization; this is possibly due to the limited number of observations available when using those definitions of poverty. For the the case of HDI as the dependent variable, fiscal decentralization is found to have a non linear effect on poverty. When sub-national governments

represent one-third or less of total public expenditures fiscal decentralization appears to be instrumental in reducing poverty levels; however, higher levels of decentralization lead to increases in poverty. Many of the public services assigned as responsibilities to sub-national governments have the potential of improving the standard of living of poor households by, for example, creating access to basic services such as primary education and basic health or better targeting aid. However, it is as if at higher levels of decentralization the fiscal resources left at the central level may be too scarce for implementing effective national anti-poverty programs.

With respect to the distribution of income, we find that the impact of fiscal decentralization on income inequalities depends on the size of government. When the overall government is relatively small in the economy, higher levels of decentralization may deviate resources that otherwise may be used at the national level in redistributive programs and sub-national budgets may too small anyway to include expenditure programs with redistributive impact. But with overall government budgets around 20 percent of GDP of higher we find a robust effect of fiscal decentralization contributing to decreased inequality in the distribution of income. Given that the sub-national governments are usually constrained in their capacity to implement progressive tax policies, their comparative advantage with respect to the central government is centered in the expenditure side of the budget, and particularly, in their ability to target the poor.

The findings of the analysis about the influence of fiscal decentralization on income inequalities are fairly compatible with our findings about the effects of fiscal decentralization on poverty. These results provide consistent evidence about the significant role played in practice by sub-national governments in the reduction of poverty and inequalities.

The findings of this paper suggest that in the international experience sub-national governments can play directly or indirectly a significant role in poverty alleviation outcomes and improving the overall distribution of income. However, these findings do not fit easily with the traditional normative recommendation in the theory of fiscal federalism that redistribution policy should be exclusively the reserve of central governments. One way to make the findings fit within the conventional theory is to note that the key assumption of household mobility behind the normative recommendation is not met in reality in many countries. Another possibility is that the direct distributional policies of sub-national governments in many countries do not differ in fact that much from jurisdiction to jurisdiction, in which case no significant migration movements are induced (poorer households into and richer households out of jurisdictions with more redistribution) and positive redistribution outcomes are feasible and sustainable at the sub-national level. One final possibility, also explaining the results found in this paper is that poverty alleviation and income distribution outcomes are more the result of indirect effects of fiscal decentralization as opposed to open direct policies of sub-national governments. In this case, our findings in the paper would be perfectly compatible with the normative recommendation in the conventional theory of public finance. Which of these possible explanations is more accurate should be the subject of further future research.

ESSAY II: ON THE SECOND BEST SOLUTION TO THE PUBLIC EXPENDITURES' PROBLEM

Introduction

The normative theory of public expenditures attempts to determine the (optimal) combination of public and private goods that a benevolent and omniscient government would choose in order to maximize social welfare. The traditional approach to this problem distinguishes between the first-best scenario, in which non-distortionary lump-sum taxation is available to the policymaker, and the second-best scenario, in which the government must rely on others inefficient or distortionary tax instruments. The traditional first-best solution to the welfare maximization problem is described by the Samuelson's (1954) condition.[65] In the presence of economic distortions, however, the first-best solution is not feasible and the Samuelson's condition must be adjusted in order to describe the optimal second-best solution to the government problem. The appropriate adjustment has been the main focus of the marginal cost of public funds (MCF) literature.[66] The MCF is defined as the welfare costs associated with raising a marginal amount of tax revenue collections, and the normative prescription for public expenditure decisions is usually referred to in this literature as the MCF rule.[67]

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[65] The Samuelson's condition states that the optimal amount of public expenditures corresponds to a point where the sum of the marginal rates of substitution between public and private goods for all taxpayers is equal to the marginal rate of transformation between public and private goods.

[66] Some relevant papers focused on developing and clarifying the concept of the MCF are Browning (1976), Wildasin (1984) and Ballard and Fullerton (1992).

[67] According to the MCF rule, at the optimal amount of public expenditures the sum of the marginal rates of substitution between public and private goods is no longer equal to the marginal rate of transformation between public and private goods. In order to account for the distortions imposed in the economy, the marginal rate of

In this paper we show that the traditional MCF rule does not necessarily maximizes welfare in a second-best scenario. We begin by introducing a new analytical tool, the "effective budget constraint" for the government, which shows the set of affordable combinations of public and private goods at any possible tax rate for any tax instrument. The effective budget constraint captures the positive restrictions imposed by taxpayers' behavioral responses on the amount of revenues that the government is able to collect through its tax policy. By itself, this analytical tool does not represent a conceptual innovation because it can be readily derived in the traditional framework of the government problem. However, we show in this paper that the effective budget constraint plays a key role in determining the optimal solution to the government problem.

The basic argument we use to show that the traditional MCF rule does not maximize social welfare is a simple one. In the traditional time allocation model, taxpayers do not take into account the marginal benefits of taxation on their behavioral responses to taxation. In contrast, in the traditional welfare maximization problem the benevolent and omniscient government fully considers the marginal benefits received by taxpayers from the public goods. Thus, it is assumed that the government is able to use information about the welfare benefits of taxation that taxpayers ignore in their individual labor supply responses to taxation. In the traditional framework an omniscient government would know that labor effort does not only provide the taxpayers with income to purchase private goods, but that the labor effort also serves to finance public goods that are valuable for the taxpayers. This implies that whenever taxpayers do not fully account for the marginal benefits of taxation on their behavioral responses to taxes, the omniscient government would know that the taxpayers' first order conditions would underestimate the marginal benefits from labor effort or the "true" opportunity cost of leisure.

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transformation must be multiplied by the MCF, defined as the marginal welfare cost of taxation divided by marginal revenue collections.

The traditional MCF literature does not consider the fact that taxpayers fail to recognize the true opportunity cost of leisure and computes the MCF rule by simply substituting the taxpayers' first order conditions into the first order conditions of the government problem. As a consequence, the traditional measure of the MCF underestimates the marginal welfare costs of tax revenue collections.

In this paper we propose an alternative to the second best solution to the government problem. The alternative solution is described by a point where the sum of the marginal rates of substitution between public and private goods is equal to the *slope* of the effective budget constraint. Accordingly, we also propose to redefine the concept of MCF as the slope of the effective budget constraint.

In addition, in this paper we also show that the analytical framework used to describe the second-best solution to the government problem can also be used to explain actual government behavior. In particular, we show that the flypaper effect, an empirical regularity that has for long challenged the traditional theory, can easily be obtained as a prediction within our framework. The flypaper effect is characterized by a situation where lump-sum transfers to a local government increase the amount of local public expenditures by more than an equivalent amount of income increases received by the residents in the same jurisdiction. Considering that the lump-sum transfers received by the local government do not have tax collection costs, the recipient government is able to increase public expenditures while enjoying lower marginal costs of tax collections. The same response is not necessarily possible under transfers to individuals, because in that case the government must fully face the increasing marginal costs of tax collections. The importance of this application is that it suggests that the normative and positive approaches to the

government problem, thus far separated in the traditional theory, can be integrated in one simple general framework.

The rest of the paper is structured as follows. In the next section we present a general definition of the effective budget constraint and show its dependence on taxpayers' behavioral responses to taxation. The third section focuses on the second-best solution to the government problem. Here we briefly explain the traditional approach to the problem and show the corrections that are necessary to the traditional concept of the marginal cost of funds. In the forth section we use our framework of analysis to explain the flypaper effect. The last section concludes.

The Effective Budget Constraint of the Government

In this section we briefly explain the relationship between the taxpayers' labor supply responses to a proportional labor income tax and the affordable combinations of public and private goods. Our goal is to provide a general definition of the *effective* budget constraint of the government. By itself, the effective budget constraint does not represent a conceptual innovation because it can be directly derived from the conventional framework of the government problem. However, it has not yet been explicitly described in the literature.[68]

We assume that public expenditure on a pure public good (G) is entirely financed via a proportional tax on labor income. We assume that a change in the proportional labor income tax rate (t) affects the supply of labor (L), which in turn determines the size of the tax base (B). We

[68] The budget constraint of the government is traditionally characterized as a straight (minus one slope) line representing a costless transfer of private income to the public sector. That representation does not account for the fact that the taxpayers do respond to taxes, altering the tax base and imposing an implicit cost on the transfer of private income to the public sector.

define the *effective tax base* as the amount of private income that is available for tax collections after the taxpayers' behavioral responses have taken place:

$$B^*(t) = wL^*(t), \tag{1}$$

where w is the wage rate and an asterisk represent the taxpayers' optimal choices. The effective tax base and the amount of tax revenue collections (R) are fully determined by the taxpayers' responses to taxation, and they can therefore be expressed as functions of t. If we assume that the government spends all tax revenues on the public good G during the period they are collected, then the maximum feasible level of public expenditures is given by: [69]

$$\max\ G = R^*(t) = tB^*(t). \tag{2}$$

In addition, the effective tax base also determines the amount of income available to finance private consumption, denoted here by X and assumed to be equal to the sum of disposable (after tax) income, $(1-t)wL^*(t)$, plus the total amount of non-labor income, M.

Given that both tax revenues and private consumption are functions of t, for each value of the tax rate $t \in [0,1]$ the taxpayers' utility maximizing behavior leads to a unique combination of tax collections $R^*(t)$ and optimal private consumption $X^*(t)$. Now we can formally define the *effective budget constraint* of the government as the set of points described generically by $[R^*(t), X^*(t)]$ for any given value of $t \in [0,1]$. This set can be represented in the public-private goods plane by a function whose shape ultimately depends on the tax elasticity of labor supply as well as on the exogenous parameters of the model.

[69] The costs of tax administration and enforcement are omitted to simplify the analysis. These costs would directly reduce the amount of public goods that can be provided for any given level of tax revenues, and thus tightening the budget constraint of the government. Even though their inclusion is important in order to fully describe the costs of tax collections, in this paper we focus on different aspects of the solution to the government problem that have not been consider till now, and leave tax administration costs as an extension of the discussion developed in the paper.

The taxpayer problem and the effective budget constraint of the government

Individual utility ω is represented by a quasi-concave utility function, which increases in the individual's consumption of the private good x and the pure public good G, and decreases with the individual supply of labor l.[70] Each taxpayer chooses his optimal labor supply l, while t and G remain exogenous to his decision. Assuming no savings, the utility maximizing taxpayer must exhaust his income by consuming private goods and contributing to the provision of public goods. The representative taxpayer's maximization problem can be written as:

$$\max_{l} \ \omega = u\{(1-t)wl + m, l, G\} \ , \tag{3}$$

where m represents the amount of non-labor income, assumed to be exogenous and untaxed, and $(1-t)wl + m = x$ is the individual budget constraint. The first order condition for individual welfare maximization, as described in the traditional labor supply literature, is given by:

$$\omega_l = (1-t)wu_x + u_l = 0 \quad , \tag{4}$$

where the subscripts represent derivatives with respect to the designated variable. This first order condition implicitly defines the individual labor supply $l^*(t)$, which in turn determines both the taxpayer's optimal level of private consumption, $x^*(t)$, and the amount of taxes he pays to the government, $tb^*(t)$. Assuming that there are N identical taxpayers, the aggregate amounts of private consumption and tax revenue collections can readily be obtained as $Nx^*(t) = X^*(t)$ and $Ntb^*(t) = tB^*(t) = R^*(t)$.

Moreover, based on the representative taxpayer's budget constraint, the effect of an increase of the tax rate on aggregate private consumption is described by:

$$X_t^* = -B^*(t) + (1-t)wL_t^* \ , \tag{5}$$

[70] Throughout the paper the individual parameters are represented by lowercases, while the aggregate values are represented with uppercases.

which is assumed to be negative. Similarly, from equation 2 we can express the marginal effect of t on tax revenue collections as:

$$R_t^* = B^*(t) + tB_t^*, \tag{6}$$

which depends on the relative sizes of the effective tax base and the behavioral responses to taxation.[71]

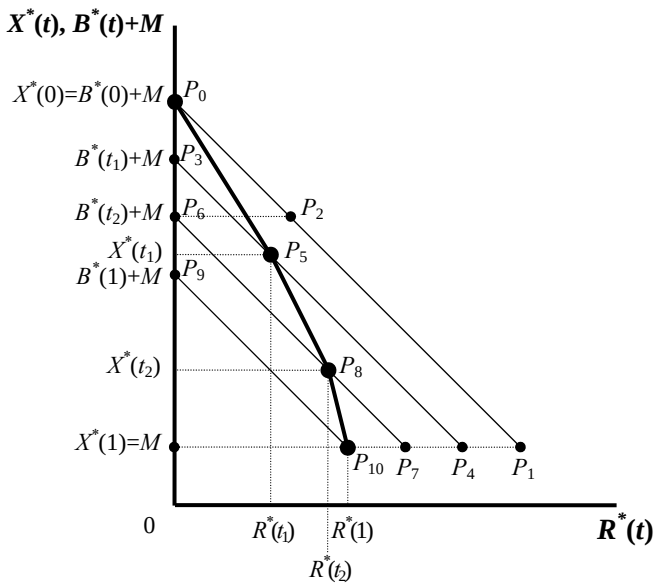
The effective budget constraint of a benevolent and omniscient government choosing the optimal combination of public and private goods is illustrated in Figure 3. The vertical axis represents aggregate private consumption X and the horizontal axis represents the government tax revenues R. While a higher t usually reduces private consumption vertically, government revenues increase horizontally towards the right as a result of larger tax collections; however, tax collections might eventually decrease towards the left when tax collections become negatively related to the tax rate. The figure shows the changes in consumption and tax collections given four possible levels of the tax rate under the assumption that the labor supply response to taxation is negative. We start with a statutory tax rate t equal to zero, and then we increase it gradually to t_1, t_2, and finally to $t_3 = 1$.

Point P_0, located at $[0, X^*(0)]$ in Figure 3, corresponds to the optimum level of aggregate private consumption when $t = 0$. Aggregate private consumption must be equal to the sum of the effective tax base and the aggregate level of non-labor income M, defined as $M = Nm$. The line P_0P_1, which can be referred to as the (effective) "tax base line" given $t = 0$, corresponds to the traditional representation of the government budget constraint, which is a minus-one (constant) sloped function representing a costless transfer of private income to the government for any given level of the tax rate. In the absence of behavioral responses to taxation a positive tax rate t_1 would

[71] Negative labor responses imply a reduction of $B^*(t)$, thus subsequent increases of the tax rate might plausibly lead to a point where $B^*(t) < |tB_t^*|$, from which the total amount of revenues decreases with t.

lead to the point P_2 in Figure 3, where the amounts of tax revenues and private consumption are equal to $t_1 B^*(0)$ and $(1 - t_1)B^*(0) + M$, respectively. However, once the effective tax base is allowed to change with t the transfer of private income to the government is no longer costless. The resulting decrease in labor supply reduces the effective tax base from $B^*(0)$ to $B^*(t_1)$, as represented by a shift of the tax base line from the P_0P_1 to P_3P_4 .

Figure 3. Diagrammatic derivation of the effective budget constraint



Under $B^*(t_1)$ the affordable combination of public and private goods is given by the point P_5, where $R^*(t_1) = t_1 B^*(t_1)$ and $X^*(t_1) = (1 - t_1)B^*(t_1) + M$. Note that, as a result of the reduction of the effective tax base, point P_2 is no longer feasible.[72] Therefore, point P_5 (not P_2) is the relevant constraint describing the affordable combination of public and private goods, and

[72] The vertical distance between P_2 and P_5 corresponds precisely to the marginal change in after-tax income that results from the labor supply response to the tax rate. Indeed, using equation 5 in its discrete form, the vertical distance between P_0 and P_5 is equal to $dX^* = -Bdt + (1 - t)wdL^*$. The first term in the right hand side corresponds to the vertical distance between P_0 and P_2, while the second to the vertical distance between P_2 and P_5. Similarly, the discrete form of equation 6 serves to decompose the horizontal distance between P_0 and P_5 as the sum of Bdt –the horizontal distance between P_0 and P_2, and tdB^* –the horizontal distance between P_2 and P_5.

thus the line P_0P_5 can be considered as a segment of the effective budget constraint derived for a discrete change in the tax rate equal to t_1.

Following an identical procedure, a higher tax rate t_2 reduces the effective tax base even further, from $B^*(t_1)$ to $B^*(t_2)$, which leads to a new shift of the tax base line to P_6P_7, where the point P_8 is also shown to belong to the effective budget constraint. Finally, when $t = 1$ the tax base line shifts to P_9P_{10}. Since at $t = 1$ the effective tax base is fully devoted to financing government revenues, then P_{10} represents the ending point of the effective budget constraint, where private consumption is equal to the aggregate amount of (untaxed) non-labor income. The effective budget constraint is defined discretely by P_0, P_5, P_8 and P_{10}, and the set of points connecting them.

Given that the aggregate amount of private consumption $X^*(t)$ and the maximum level of revenue collections $R^*(t)$ are both defined as functions of t, the slope of the effective budget constraint, denoted here as S, can be computed for any value of $t \in [0,1]$ as:

$$S(t) = \frac{change\ in\ private\ consumption}{change\ in\ government\ tax\ collections} = \frac{X_t^*}{R_t^*} = \frac{-B^*(t)+(1-t)wL_t^*}{B^*(t)+tB_t^*}. \qquad (7)$$

Provided that private consumption decreases with t, the slope of the effective budget constraint is negative as long as t has a positive effect on tax revenues. In particular, if and only if the behavioral responses to taxation are nil for all $t \in [0,1]$, then $S = -1$ along the entire effective budget constraint, which would be identical to the tax base line P_0P_1, drawn for $t = 0$.

Moreover, the curvature of the budget constraint can further be analyzed by taking the first derivative of S with respect to t:[73]

$$\frac{d}{dt}\left(\frac{X_t^*}{R_t^*}\right) = \frac{BB_{tt}^* - 2B_t^{*2}}{R_t^{*2}}. \qquad (8)$$

[73] See derivation in Appendix IV.

Assuming for simplicity that $B_{tt}^{*} = 0$, for any value of $L_t^{*} \neq 0$ the right hand side of equation 8 is negative, implying that the effective budget constraint is concave in t with respect to the origin. Only in the special case where $L_t^{*} = 0$, the right hand side of equation 8 is zero, and the effective budget constraint displays no curvature.[74]

The Second-best Solution to the Government Problem

The optimal combination of public expenditures and private consumption should be determined by maximizing social welfare subject to the set of affordable combinations of public and private goods. In this section we briefly review the traditional normative approach to the government problem. Our goal is to show that the second-best solution provided by the literature on the marginal costs of funds (MCF) can be considered suboptimal. The reason for this is that the traditional MCF literature does not exploit the information advantage that the government has regarding the marginal benefits derived from the provision of the public good. While the conventional treatment of the time allocation problem assumes that taxpayers do not account for the marginal benefits of public goods' provision in their labor supply decisions, the government is assumed to fully consider those benefits in the social maximization problem. The problem arises in that the traditional MCF rule solves the government's problem by assuming that the government bases its decision on the taxpayers' first order condition, thus ignoring the marginal benefits of taxation and providing incomplete information about the taxpayers' preferences.

[74] Note that by rotating the diagram of figure 1 in 90 degrees to the left we can represent an increase on the tax rate as a rightwards movement on the horizontal axis (equivalent to a reduction of private consumption), while the vertical axis still represents the amount of taxes that the government is able to collect. In such a framework a negatively sloped effective budget constraint would correspond precisely to the increasing portion of the (inverted U-shaped) Laffer curve. Furthermore, if preferences are convex in the relevant range, then a welfare maximizing government will always choose a combination of public and private goods in the increasing portion of the Laffer curve.

We will show that the optimal solution to the government problem corresponds to the point of tangency between the effective budget constraint and the highest attainable level of social welfare. Based on this result we propose a refinement of the normative prescription for public expenditures and a consequent modification of the MCF concept.

The traditional approach to the government problem

The fundamental standpoint from which allocation efficiency is defined and analyzed in public finance theory is a first-best scenario where there are no distortions. Samuelson (1954) shows that if the government acts as a benevolent and omniscient policymaker (and if lump-sum taxation is available), then social welfare is maximized by the level of pure public goods for which the sum of marginal rate of substitution between public and private goods, $\sum MRS$, is equal to the marginal rate of transformation, MRT. Following Samuelson's seminal contribution, the literature has emphasized several aspects of the government problem that are relevant in a second-best context, and which call for the adjustment of the Samuelson condition by a factor called the marginal cost of funds (MCF):[75]

$$\sum MRS = MCF \cdot MRT. \tag{9}$$

The MCF is broadly defined as the welfare cost of rising one dollar of additional revenue and is typically measured in terms of private consumption. The precise measure of the MCF and its meaning, however, depends on the framework of analysis. Musgrave (1959) distinguished between differential incidence, meant to compare the costs (or distributive effects) associated with two revenue sources of equal yield, and balanced-budget incidence, in which the additional

[75] See, for instance, Ballard and Fullerton (1992). A recent comprehensive review of the MCF theory and its empirical applications is provided by Dahlby (2008).

revenues exactly finance a new expenditure program.[76] Musgrave's distinction is used by Ballard and Fullerton (1992) to clarify the differences between two different branches in the MCF literature. First, the Pigou-Harberger-Browning tradition is associated with the concept of differential incidence analysis. This branch uses non-distortionary lump-sum taxes as a benchmark to compute the deadweight loss associated with the substitution effects imposed by any other tax instrument. Since the income effect is in this case irrelevant, the measures of welfare costs are based exclusively on compensated supply and demand functions, making the MCF by definition equal or greater than one. Second, the Stiglitz-Dasgupta-Atkinson-Stern tradition is associated with the balanced-budget approach to the measurement of welfare costs of taxation, which is the natural framework of cost-benefit analysis (Fullerton 1991). Here both the substitution and the income effects must be considered because they are equally important in determining whether a project should be undertaken or not. This measure of the MCF is based on uncompensated demand and supply functions. In the case of a labor income tax, the MCF may plausibly be less than one if the income effect in the labor supply is big enough to counterbalance the substitution effect. In this context, the measure of welfare costs based on uncompensated labor supply boils down to a measure of the sensitivity of the tax base and revenue collections with respect to changes in the tax rate. In this paper we focus on the costs faced by the government in collecting revenues via a proportional labor income tax, so we implicitly follow the second tradition.

The government problem consists of determining the tax rate t on labor income that maximizes social welfare, subject to the taxpayers' behavioral responses to taxation. In turn, the optimal labor income tax rate simultaneously solves for the optimal amounts of public goods G

[76] Discussions about the differential and balanced-budget approaches in the context of the MCF can be found, among others, in Ballard (1990) and Ballard and Fullerton (1992). The distinction between the two approaches was previously discussed by Stuart (1983) and Wildasin (1984).

and private consumption X. Assuming that the welfare function is utilitarian and that there are N identical taxpayers, the traditional formulation of the government problem is:

$$\max_{t} \ \Omega = Nu\{(1-t)wl(t) + m, l(t), Ntwl(t)\} \ , \tag{10}$$

where Ω represents social welfare and $Ntwl(t) = G(t)$. The first order condition for this problem is given by:

$$\{-wL + (1-t)wL_t^*\}u_x + L_t^* u_l + N\{wL + twL_t^*\}u_G = 0 \ , \tag{11}$$

where L_t^* denotes the aggregate labor response to taxation. Using the first order condition for the taxpayers' labor supply decision in equation 4, the first order condition for the government problem can be reduced to:

$$-wLu_x + Nu_G\{wL + twL_t^*\} = 0 \ . \tag{12}$$

Rearranging terms we derive the traditional normative prescription for the optimal amount of public goods:

$$N\,\frac{u_G}{u_x} = \frac{wL}{R_t^*} \ , \tag{13}$$

where Nu_G/u_G represents the sum of the marginal rates of substitution between public and private goods for all taxpayers. Equation 13 corresponds to the adjusted Samuelson condition presented in equation 9, which has been simplified by assuming a marginal rate of transformation equal to one. The right hand side of this equation is equal to the MCF, whose formal definition is usually presented as:[77]

$$MCF(t) = \frac{wL}{R_t^*} = \frac{change\ in\ consumer\ welfare}{change\ in\ government\ tax\ collections} = \frac{1}{1-\frac{t}{1-t}\varepsilon_{L,w}} = \frac{1}{1+\varepsilon_{L,t}} \ , \tag{14}$$

[77] References to this definition can be found, among others, in Mayshar (1991), Håkonsen (1998), and Auerbach and Hines (2002).

where $\varepsilon_{L,w}$ and $\varepsilon_{L,t}$ are the uncompensated wage elasticity of labor supply and the uncompensated tax elasticity of labor supply, respectively. [78] In particular, the term wL is referred to as the change in consumer welfare or the marginal welfare costs of taxation, and it corresponds to the loss of equivalent non-labor income imposed by the tax. In order to compute this cost, we can first assume that non-labor income is endogenous in the labor supply decision (equation 3) and then obtain the corresponding taxpayer's first order condition for any given change in tax policy:

$$m_t - wl + (1-t)wl_t^* + \frac{u_l}{u_x} l_t^* = 0 \ . \tag{15}$$

where m_t represents the marginal loss of equivalent non-labor income due to a change in t. Provided that the first order condition of the labor supply decision in equation 4 is satisfied, equation 15 can be reduced to $m_t = wl$, or the individual change in consumer welfare measured in accordance with the individual perception of welfare.[79]

Sub-optimality of the traditional solution to the government problem

Thus far we have, separately, characterized the effective budget constraint and reviewed the traditional approach to the government problem, which leads to a solution that is formally described by the MCF concept. Both the slope of the effective budget constraint (equation 7) and the MCF (equation 14) measure the marginal cost of tax collections. However, the former measures this cost in terms of the amount of private consumption forgone and the latter in terms of the welfare costs of taxation. In the following discussion we will show that the solution implied

[78] Given that the tax rate is simply a correction of the disposable wage rate, then $L_w^* = [(1-t)/w]L_t^*$, which implies that $-[t/(1-t)]\varepsilon_{L,w} = -[t/(1-t)](w/L)L_w^* = [t/(1-t)](w/L)[(1-t)/w]L_t^* = (t/L)(dL/dt) = \varepsilon_{L,t}$.

[79] Even though the expression wl can be interpreted as the total labor income of the taxpayer, it is important to recognize that it refers to the *marginal* change in consumer's welfare. Indeed, m_t can also be written as dm/dt, and from $m_t = wl$, we can also write $dm = wl \cdot dt$, such that the (discrete) equivalent change of welfare due to a change in the tax rate, dm, is equal to $wl \cdot dt$, or the total labor income of the taxpayer multiplied by the *change* of the tax rate.

by the MCF is sub-optimal, and that the welfare maximizing solution to the government problem requires the sum of the marginal rates of substitution between public and private goods to be equal to the negative value of the slope of the effective budget constraint.

With labor income taxation, both the slope of the effective budget constraint and the MCF can be analyzed diagrammatically in the context of the labor market. In Figure 4(a) we represent a linear and positively sloped (uncompensated) aggregate labor supply function L^S, and assume, as is usually done, that the wage rate w is exogenous and that the labor demand function L^D is perfectly elastic.[80]

When $t = 0$ the optimum amount of labor supplied in the market is found at point p_0, at the intersection of the labor supply and the labor demand functions; and the size of the effective tax base $B^*(0)$ is given by the rectangle $0\,w\,p_0\,L^*(0)$. Once a tax rate $t_1 > 0$ is imposed, taxpayers adjust their labor supply to $L^*(t_1)$ and, as a result, marginal tax collections are equal to the sum of the areas A_1, A_2, and A_3. Note that since marginal tax collections serve as the denominator of the slope of the effective budget constraint as well as the MCF rule, the difference between the two concepts is observed only in the numerator.

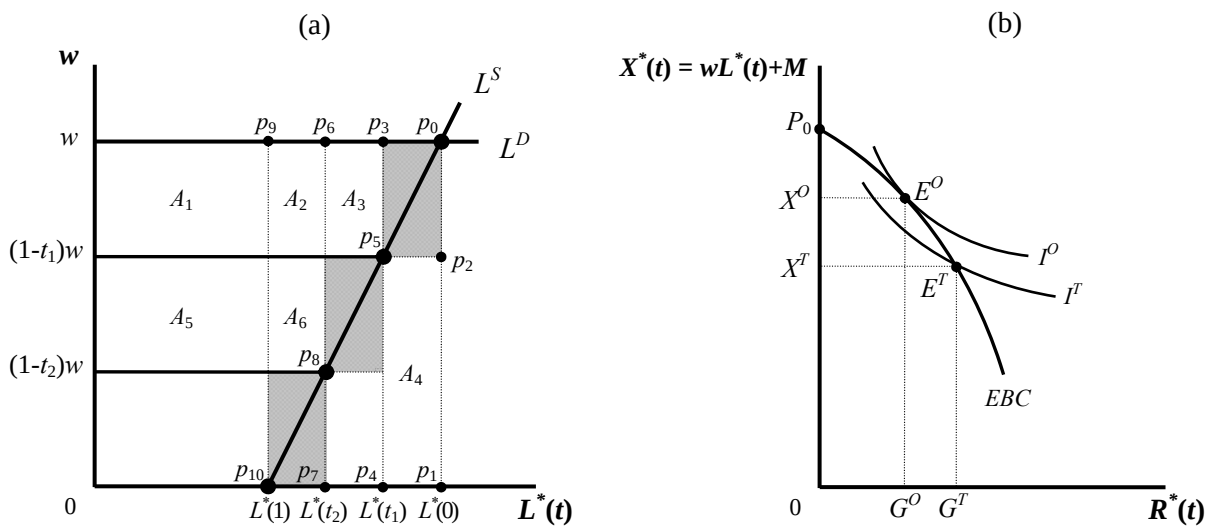
The numerator of the slope of the effective budget constraint measures the full reduction in private consumption resulting from a marginal change in the tax rate, represented in Figure 4(a) as the sum of the areas A_1, A_2 and A_3, plus the area A_4.[81] In contrast, the MCF only accounts for

[80] A similar representation of the MCF is provided, for example, in Boadway and Wildasin (1984, 393-395). For convenience, all measurements in Figure 2(a) correspond to those of Figure 1, and the points are numbered consistently to show the equivalence between the two frameworks. Due to the change in dimensions, however, the correspondence in terms of private (public) goods is observed by comparing the vertical (horizontal) value of each uppercase point *P* in Figure 1 with the cumulative area at the left and below (left and above) each lowercase point *p* in figure 2(a).

[81] The grey rectangles in the graph correspond to marginal variations that cannot be assigned in a discrete analysis like the one presented here. In any case, in the limit, when the change of the tax rate approaches to zero, these areas are negligible.

the reduction in consumer welfare, given by the sum of the areas A_1, A_2 and A_3.[82] The MCF does not consider the labor-induced change in disposable income (area A_4) as a welfare cost of taxation because, according to the taxpayers' first order condition (equation 4), any welfare loss due to a decrease in disposable income is always perfectly offset by the welfare gains associated with longer leisure time.[83]

Figure 4. The marginal welfare costs of taxation and the solution to the government problem



In general, for any value of t, the vertical distance below the labor supply function represents the amount of disposable income forgone with a marginal increase in the tax rate, and its welfare equivalence is correctly defined as the negative value of the welfare gain associated with the reduction of labor effort. The first order condition of the taxpayers' problem does not,

[82] According to equation 5 the discrete change in private consumption following the first increase in the tax rate can be represented by $dX^* = -B^*(0)t_1 + (1-t_1)wdL^*$, where $(1-t_1)wdL^*$ is the labor-induced change on disposable income.

[83] Subsequent increases in the labor income tax rate allow us to observe, in addition, the erosion of tax collections that result from marginal reductions of the labor supply. When the tax rate increases to t_2 the labor supplied is reduced to $L^*(t_2)$ and tax collections grow in an amount equal to the sum of the areas A_5 and A_6, minus the area A_3. Area A_3 is usually referred to as "revenue leakage," because it corresponds to tax revenues previously collected, but lost due to the reduction of the labor supplied. In any case, the revenue effect of a marginal change in the tax rate is accounted for identically by the slope of the effective budget constraint and the MCF, thus the revenue leakage has no role in explaining the differences between the two measures of the marginal cost of tax collections.

however, provide sufficient information to maximize welfare as the traditional MCF literature presumes. Any additional units of leisure time reduce not only the amount of income available to purchase private goods (as suggested by the taxpayers' first order condition of equation 4) but also the amount of tax revenues collected by the government.

In Table 3 we compare the taxpayers' labor decision with the government's expenditure decision, and show that they lead to a different computation of the opportunity cost of leisure. Given that in the taxpayers' problem (equation 3) the amount of public goods is determined exogenously, their first order conditions (equation 4) do not consider the welfare effects of a change in public goods' provision. As a consequence, the labor decisions are based exclusively on their ability to purchase private goods, and the opportunity cost of leisure is defined accordingly as the marginal after-tax income, $(1-t)w$. In contrast, in the government problem (equation 10) the amount of public expenditures is assumed to be determined by both the tax rate and the labor response to taxation. In this case the first order condition of the government problem (equation 11) captures not only the effect of the taxpayers' labor supply responses to taxation on private consumption, but also on the public good. This means that the traditional theory implicitly assumes that the government is able to capture more information about the consequences of labor decisions on taxpayers' welfare than taxpayers do in their own labor decisions.

The opportunity cost of leisure as computed by the government is presented in the table as equation (*), which is directly derived from its first order condition in equation 11. Note in equation (*) that under plausible values for the sum of marginal rate of substitutions between public and private goods (Nu_G/u_x) and the tax elasticity of labor supply $\varepsilon_{L,t}$ the opportunity cost of leisure is greater than $(1-t)w$.[84]

[84] For instance, if $1 < N\frac{u_G}{u_x} < 2$ and $-1 < \varepsilon_{L,t} < -0.5$, then $(1-t)w < -\frac{u_l}{u_x} < w$.

Table 3. Taxpayers' and government's computations of the opportunity cost of leisure

	Taxpayers' labor decision:		Government expenditures' decision :	
Problem:	$\max_{l} \ \omega = u\{(1-t)wl + m, l, G\}$	(3)	$\max_{t} \ \Omega = Nu\{(1-t)wl(t) + m, l(t), Ntwl(t)\}$	(10)
First order condition:	$(1-t)wu_x + u_l = 0$	(4)	$X_t^* u_x + L_t^* u_l + R_t^* N u_G = 0$; where $X_t^* = -wL^* + (1-t)wL_t^*$; $R_t^* = wL^* + twL_t^*$	(11) (5,6)
Opportunity cost of leisure:	$-\frac{u_l}{u_x} = (1-t)w$		$-\frac{u_l}{u_x} = \left[1 - t\left(1 - N\frac{u_G}{u_x}\right)\left(1 + \frac{1}{\varepsilon_{L,t}}\right)\right]w$	(*)

Note: Numbers in parentheses identify the equations as in the text. Equation (*) is derived from equation 11, which is solved for $-u_l$ and divided by $L_t^* u_x$, and where $\varepsilon_{L,t}$ represents the tax elasticity of aggregate labor supply.

Given that the taxpayers do not fully account for the marginal benefits of public goods' provision associated with their labor supply decisions, in the aggregate, the first order condition of their labor supply decisions will lead to "excessive" leisure in the economy, meaning that the labor actually supplied would be insufficient to reach the combination of public and private goods that truly maximizes social welfare.

The argument is illustrated in Figure 4(b). Assuming that labor supply decreases with t, the traditional measure of MCF is necessarily lower than the negative value of the slope of the effective budget constraint. Such a situation is found at a point like E^T, which represents the solution for the government problem suggested by the MCF literature. At E^T the MCF is equal to the sum of the marginal rates of substitution between public and private goods for all taxpayers, which is represented by the slope of the social indifference curve I^T. Although feasible, this solution is not optimal because social welfare can be increased even further.[85] The maximum level of welfare that can be attained is at point E^O, where the social indifference curve I^O is

[85] Note that the amounts of public and private goods suggested by the MCF rule and described by E^T are not explicitly described in the traditional literature. Indeed, the MCF rule is usually acknowledged as a normative prescription that applies *at the margin*, and regardless the absolute amounts of public and private goods. Paradoxically, even though the traditional normative theory of public expenditures can be used to describe the optimal size of the public and private sectors, it has remained separated from the normative question of how big the government should be, and of course also from the (positive) problem of explaining the actual size of the government.

tangent to the effective budget constraint. If preferences are convex in the relevant range, the social indifference curve I^O represents a greater level of welfare than the one achieved by applying the MCF rule. Since no further improvement can be made at point E^O, it also represents the optimal solution to the government problem.

In reality, any movement along the effective budget constraint takes place within the G-*leisure*-X space, and a marginal tax-induced reduction of labor supply leads to a movement backwards of the G-X plane. The traditional solution at E^T corresponds to the point of tangency between the taxpayers' preferences and the effective budget constraint in the G-*leisure*-X space. However, a benevolent and omniscient government would know better because it is, by definition, fully aware of the benefits associated with the provision of the public good, and it can also observe how tax revenues change with t. In fact, a benevolent and omniscient government knows that, even though E^O is *not* tangent to the effective budget constraint in the G-*leisure*-X space, given the taxpayers' behavioral responses to taxation the combination of public goods, leisure, and private goods at E^O is feasible and allows the economy to reach a greater level of social welfare than at E^T.

The welfare maximizing first order condition for the government problem, therefore, describes the point of tangency between the maximum attainable social indifference curve and the negative value of the slope of the budget constraint:

$$N\frac{u_G}{u_x} = -S(t) = \frac{wL-(1-t)wL_t^*}{wL+twL_t^*}. \tag{16}$$

In general, $L_t^* < 0$ ($L_t^* > 0$) implies that the negative value of the slope of the budget constraint is greater (lower) than one.

First order conditions for welfare maximization

We have shown that the traditional MCF rule does not exploit the fact that the government generally considers *more* information about taxpayers' preferences for public goods than the taxpayers themselves do in their labor supply decisions. In the following discussion we revisit the optimal solution to the government problem in terms of the marginal welfare changes induced by the proportional labor income tax. We show that the effective budget constraint produces an additional first order condition for welfare maximization that is required to describe the optimal solution in a second-best framework, and that this is not accounted for by the conventional theory.

We first define the marginal net compensating variation of income, m_t^n, as the amount of non-labor income required by the representative taxpayer in order to keep his welfare level unchanged after a marginal increase in t. The value of m_t^n is equal to the marginal welfare costs of taxation minus the marginal welfare benefits of taxation, and therefore it corresponds to the negative value of the change in welfare that results from a marginal tax increase.

In order to compute the value of m_t^n for any optimal tax rate we need only to treat non-labor income m as an endogenous variable and solve the conventional government problem of equation 10.[86] Allowing for m to vary with t, the modified first order condition for the government problem can be written as:

$$Nm_t^n - wL + (1-t)wL_t^* + \frac{u_l}{u_x}L_t^* + N\frac{u_G}{u_x}(wL + twL_t^*) = 0\ . \qquad (17)$$

[86] The assumption about the endogeneity of m is made only for mathematical convenience, in order to compute the compensating marginal effect of t on income. In actual fact, non-labor income m remains untaxed and its value is still exogenously determined in the model.

Using the first order condition for the taxpayer's decision (equation 4), we can solve for the marginal net compensating variation of income associated with a movement along the effective budget constraint:

$$Nm_t^n = wL - N\frac{u_G}{u_x}(wL + twL_t^*) = wL\left[1 - N\frac{u_G}{u_x}\left(1 + \varepsilon_{L,t}^*\right)\right], \tag{18}$$

where $\varepsilon_{L,t}^*$ is the elasticity of aggregate labor supply with respect to the tax rate on labor income. Equation 18 suggests that the marginal welfare benefits of taxation decrease with t along the effective budget constraint. At point P_0 in Figure 4(b) the labor income tax is equal to zero, thus there are no public goods in the economy and taxpayers fully spend their income on private consumption. Since in the vicinity of P_0 public goods are scarce the marginal rate of substitution between public and private goods can safely be expected to be large, such that for a given value of $\varepsilon_{L,t}^* > -1$ the marginal net compensating variation of income is small and plausibly negative.

When t increases along the effective budget constraint, however, public goods become relatively less desirable, reducing the marginal rate of substitution between public and private goods and with it, the marginal welfare gains of taxation.[87] In the vicinity of P_0, therefore, we can expect the proportional labor income taxation to be associated with net welfare benefits, which will eventually turn into net costs as t increases over certain level.

Equation 18 can also be arranged in order to show the value of the sum of marginal rates of substitution between public and private goods along the effective budget constraint:

$$N\frac{u_G}{u_x} = \frac{wL - Nm_t^n}{R_t^*}. \tag{19}$$

The traditional MCF rule for public goods' provision of equation 13 corresponds to a particular case of equation 19, defined as the one in which the marginal net compensating

[87] In Section 4 we show that under certain plausible conditions $\varepsilon_{L,t}^*$ is a decreasing function of t, which is also consistent with a marginal net compensating variation of income that is increasing in t.

variation of income is equal to zero. This result would imply that the marginal welfare costs of taxation are identical to the marginal welfare benefits, thus social welfare would be at its maximum. In a first-best scenario, where no restrictions are imposed on the welfare maximizing decision, we might expect this result to be correct. However, when taxpayers do not fully account for the marginal benefits of taxation on their labor responses to taxation they impose a distortion in the economy that prevents the first-best solution from being attainable. In this context a benevolent and omniscient government can take advantage of the full information that it enjoys regarding taxpayers' preferences in order to maximize social welfare.

As explained, the solution to the government problem is found at the point of tangency between social preferences and the effective budget constraint, and described by equation 16. Substituting this expression into equation 17 we find that:

$$Nm_t^{n*} = -\frac{u_l}{u_x} L_t^* \,, \tag{20}$$

which is a necessary condition for social welfare maximization. Equation 20 represents our point of departure from the traditional MCF literature, which implicitly assumes that the welfare costs and benefits of taxation are identical at the second-best solution to the government problem.[88]

Equation 20 suggests that social welfare is globally maximized as a first-best solution to the government problem if only if $m_t^n = 0$, a condition that in turn requires the aggregate labor supply to be perfectly inelastic with respect to the tax rate. In contrast, $m_t^n \neq 0$ would imply that distortions are present in the economy and that the solution corresponds to a second-best optimum where the tax elasticity of labor supply is necessarily different from zero. This interpretation of equation 20 can be considered as a straightforward expression of the Theorem of the Second Best, which states that "if there is introduced into a general equilibrium system a constraint which

[88] For a complete coverage of the first-best normative public finance theory, see for instance, Tresch (2002).

prevents the attainment of one of the Paretian conditions, the other conditions, although still attainable, are, in general, no longer desirable" (Lipsey and Lancaster 1956, 11). The constraint imposed in this case is given by the fact that the taxpayers are not accounting for the marginal benefits of taxation on their labor supply responses to taxation. In this sense, the traditional MCF literature is unable to provide an optimal second-best solution to the problem because it does not recognize that when taxpayers do not account for the marginal benefits of taxation on their labor supply decisions, they prevent the attainment of the first-best solution to the problem. As a result, the MCF literature offers a second-best solution that incorrectly satisfies the necessary condition for a first-best solution.

In Figure 4(b) the solution to the government problem is represented by E^O. Using the taxpayers' first order condition in equation 4, the (aggregate) optimal marginal net compensating variation of income, Nm_t^{n*}, is equal to the labor-induced change in disposable income, $(1 - t)wL_t^*$. In particular, note first that a welfare maximizing government will never choose a proportional labor income tax rate for which $L_t^* > 0$. A positive labor response to taxation would imply that private goods are assigned, at the margin, a greater welfare value than leisure, such that a reduction of disposable income triggers an increase in labor supply. This necessarily implies that the marginal welfare loss due to less leisure time available is not valuable enough to offset the marginal welfare gains from private goods *plus* the marginal welfare gains from the public goods financed with the tax increase. As a result, whenever the labor response to taxation is positive, the optimal government behavior is to increase the labor income tax rate.

In contrast, when $L_t^* < 0$, equation 20 shows that Nm_t^{n*} is also negative and at the optimal solution to the government problem must be equal to the labor-induced reduction of disposable income. This is represented in Figure 4(a) by the area A_4. Indeed, at the optimal second-best

solution to the government problem the welfare gains of more leisure correspond, precisely, to the marginal net welfare gains of taxation.

Equations 19 and 20 are summarized by equation 16, which is regarded here as the general first order condition of the government problem and describes the optimal combination of public goods, leisure, and private goods in the economy. In addition, since the government is restricted to take the taxpayers' labor responses to taxation as given, the taxpayers' first order conditions are satisfied at any point of the effective budget constraint.

An important implication of equation 20 is that the general equilibrium solution for the economy dichotomizes into the taxpayers' time allocation problem and the government's social welfare maximization problem. Just as in the traditional allocation problem, taxpayers decide on their own about the combination of private goods and leisure time that maximizes their individual welfare. In contrast to the traditional government problem, however, the government can disregard leisure and exclusively focus on determining the *best affordable* combination of public and private goods. In fact, the effective budget constraint as restrictedly defined in the G-X plane, summarizes *all* the relevant constraints faced by a welfare maximizing government.[89]

Given that equation 20 holds independently of whether distortions exist in the economy, we can use it in order to simplify the first order condition for the government problem in equation 17. Replacing the value for the optimal change of the net compensating variation of income we obtain:

$$-wL + (1-t)wL_t^* + N\frac{u_G}{u_x}R_t^* = 0\ , \qquad (21)$$

[89] In this paper we do not consider tax administration costs, but as long as they are a function of the tax rate or the amount of tax collections we can expect them to affect the shape the shape of the effective budget constraint and the optimal solution to the government problem. For example, greater tax administration costs would imply that, for any amount of private consumption X, a lower proportion of tax revenues will be available to finance the public good. As a consequence, the effective budget constraint would shift horizontally towards the left.

from which the optimal solution to the government problem as described by equation 16 can readily be obtained. In practical terms, equation 20 implies that the disutility of labor (or the utility of leisure) is of no consequence to the government decision and, for the purpose of determining the optimal combination of public and private goods, it can simply be excluded from the social welfare function. The resulting social welfare maximization problem can therefore be written as:

$$\max_{t} \ \Omega' = Nu'\{(1-t)wl(t) + m, Ntwl(t)\} \ . \tag{22}$$

The first order condition and the normative prescription for government expenditures are given by equations 21 and 16, respectively. Note that under this specification $m_t^{n^*}$ is necessarily equal to zero, but such a modification in the model does not affect the validity of the solution. The fact that no welfare change is observed in the solution to the modified government problem of equation 22 only means that once the optimal solution has been reached, and given the affordable combinations of public and private goods described by the effective budget constraint, social welfare is maximized.

In conclusion, the effective budget constraint does not only allow us to ensure that the optimal solution to the government problem is feasible, but also it allows us to simplify the formulation of the government problem. The effective budget constraint provides a clear distinction between the positive and normative dimensions of the government problem. On the one hand, the positive dimension of the government problem is fully summarized by the effective budget constraint. On the other hand, the normative dimension continues to be the welfare maximizing criterion pursued by a benevolent and omniscient government. In turn, any solution to the government problem can be characterized in terms of a first-best or a second-best solution.

At the first-best solution the net welfare cost of a proportional labor income tax is equal to zero, while at the second-best solution this tax instrument must provide a net welfare gain for society.

In this context, it might seem appropriate to redefine the concept of MCF as the slope of the effective budget constraint; after all, the MCF can be understood to be referring to all the effective welfare costs associated with the tax collection problem, and the slope of the effective budget constraint is capable of fully summarizing these costs for any possible solution to the government problem.

An Application to the Flypaper Effect

Even though the optimal amount of public expenditures is a matter of central concern in the public finance literature, the available theory is still subject to criticism regarding its practical applicability and predictive power. In this section we show that the analytical framework developed in this paper, and under which the traditional second-best solution to the government problem has been corrected, can also be used to explain actual government behavior. In particular, we focus on explaining the expenditure decisions of *local* governments, and show that the second-best solution to the government problem proposed in this paper can be used to predict the so called "flypaper effect." The flypaper effect an observed empirical regularity whereby intergovernmental (lump-sum) transfers are found to be more stimulative of local government expenditures than equivalent increases in private income within the jurisdiction.[90]

Even though the flypaper effect has become a widely accepted phenomenon, it is directly in conflict with the prediction of the conventional theory about the effect that intergovernmental

[90] A recent attempt to explain the flypaper effect with the marginal cost of funds (MCF) is presented in Dahlby (2009). However, his analysis is based on the traditional definition of the MCF, which in this paper we have shown to be incomplete.

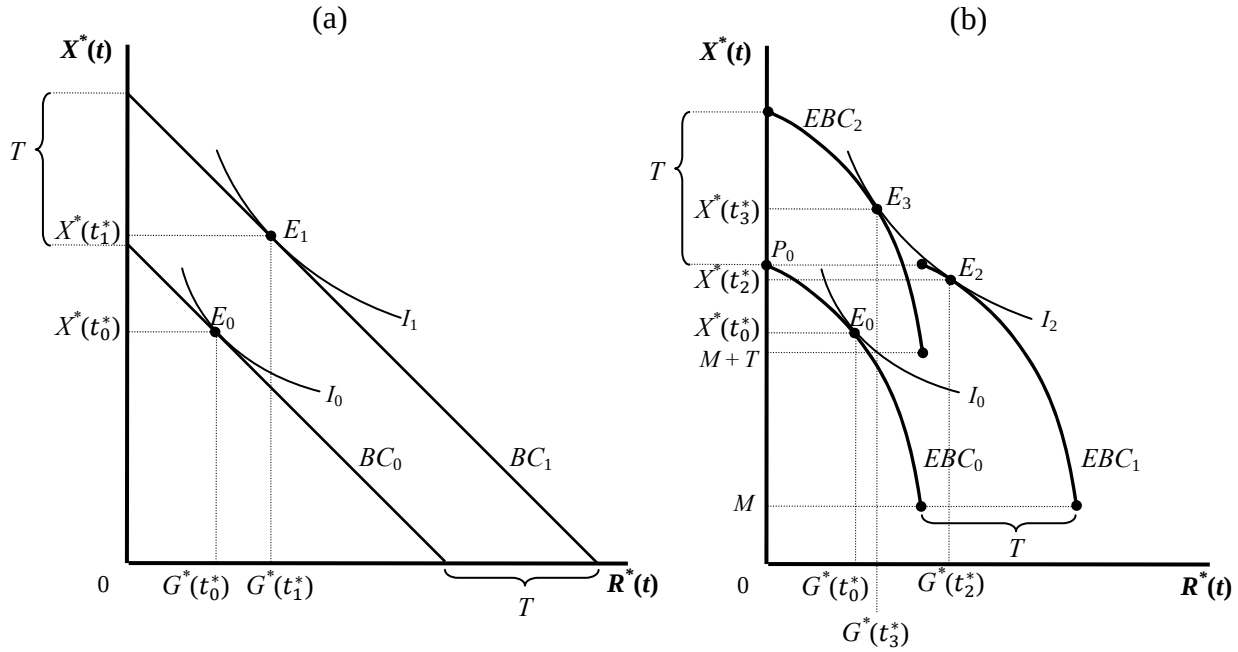
transfers “should” have on local public expenditures. The alternative traditional approaches to this problem usually built their framework upon the median voter model. There is agreement about the convenience of representing social (or community) preferences by the preferences of a single decision making body (Bailey and Connolly 1998), and for this purpose, median voter’s preferences are said to determine the preferences of the government.

Figure 5(a) represents the effects of lump-sum transfers on local expenditures as predicted by the traditional theory. The initial equilibrium is located at E_0, where the optimal amounts of private consumption X^* and public expenditures G^* are defined for a given labor income tax rate t_0^*. According to the Equivalence Theorem of Bradford and Oates (1971), lump-sum intergovernmental transfers have the same allocative effects than equivalent lump-sum payments to taxpayers. As a consequence, regardless of who is receiving the lump-sum transfers (the government or the taxpayers) a given amount of lump-sum transfers (T) can be represented as a parallel shift from the original budget constraint BC_0 to the new budget constraint BC_1. The new equilibrium is found at E_1, where the consumption of public and private goods increases as long as both are normal goods. The tax rate might decrease, increase or remain at the same level, depending on whether the median voter values private consumption more, less or the same as public goods.

In practice, however, as already pointed out, the empirical literature has found that such equivalence does not hold. In the words of Courant, Gramlich and Rubinfeld (1979), “money sticks where it hits,” because the lump-sum transfers received by local governments have a greater effect on public expenditures than an identical increase in private income, which tends to be spent more in private consumption. The flypaper effect phenomenon has for long called the attention of public finance researchers and several theories have been put forward to explain it.

One group of theories explain the flypaper effect as specification or measurement errors related with the econometric analyses; and a second group places the "errors" in the behavior of local government or on the taxpayers' themselves. [91] The most accepted explanation is given by the "fiscal illusion" hypothesis, according to which lump-sum transfers make the median voter, or taxpayers in general, to misperceive the true marginal costs of public expenditures. [92] In particular, Courant, Gramlich and Rubinfeld (1979) and Oates (1979) propose that under lump-sum transfers to the local government, taxpayers wrongly base their new preferences for public goods on the lower average cost of local public goods.

Figure 5. The effect of transfers in local government expenditures



[91] Surveys on the competing explanations about the flypaper effect are found in Hines and Thaler (1995), and Bailey and Connolly (1998).
[92] For a theoretical discussion about the fiscal illusion hypothesis, see Logan (1986), Chu (2003) and Logan and Shieh (2005).

This fiscal illusion explanation is, in principle, compatible with the explanation for the flypaper effect that we offer in this paper. However, our explanation is simpler, in the sense that it does not require any assumption in addition to the (second-best) optimal solution to the government problem described in the previous section. In Figure 5(b) we show the effect of lump-sum transfers on local public expenditures. The original equilibrium is, again, represented by E_0, where the optimal amounts of private consumption X^* and public expenditures G^* are same as those in Figure 5(a); however, the original equilibrium in Figure 5(b) corresponds to the point of tangency between the community preferences (plausibly those of the median voter) and the effective budget constraint (EBC_0).

Lump-sum transfers to the local government shift the effective budget constraint rightwards to EBC_1, and lump-sum transfers to the taxpayers shift the effective budget constraint upwards to EBC_2.[93] Moreover, assuming that there is one community indifference curve that is simultaneously tangent to EBC_1 and EBC_2, then the new optimal solutions are found at E_2 and E_3, respectively. It is easy to verify that lump-sum transfers have different effects on public expenditures depending on whether they have been received by the government or by the taxpayers. When transfers are given directly to the local government there are no tax collection costs for the recipient government, and therefore it is able to reduce the marginal costs of public expenditures. Such a case would imply that in Figure 5(b) the slope of the effective budget constraint at E_2 is lower than the slope at E_0. In contrast, when the same amount of transfers is given to the taxpayers, the local government must fully face the increasing costs of collecting taxes, and greater public expenditures would likely be associated with an increase of the marginal

[93] The shape of the effective budget constraints, EBC_1 and EBC_2, will likely change do to the effect of government expenditures and private income on labor supply, but for simplicity we assume that the shape of the effective budget remain identical to the original. This assumption does not change the validity or the generality of the conclusions.

cost of funds (or a greater slope of the effective budget constraint) at E_2. [94] In general, contrary to the Bradford and Oates' (1971) Equivalence Theorem, the concavity of the effective budget constraint suggests that the marginal cost of public goods' provision increases with the tax rate. In this context, a welfare maximizing government will necessarily account for these variations, and will tend to increase (decrease) public expenditures when the marginal cost of tax collections decreases (increases). Indeed, the case portrayed in Figure 5(b) shows that direct transfers to the local government lead to lower marginal costs than the transfers to the taxpayers, and that the optimal amount of public expenditures under the first case, $G^*(t_2^*)$, is greater than the optimal amount of public expenditures under the second case, $G^*(t_3^*)$.[95]

Figure 5(b) shows that the flypaper effect is a straightforward consequence of the fact that behavioral responses to taxation might likely impose an increasing marginal cost of tax collections. Similar to the fiscal illusion hypothesis, our explanation for the flypaper effect suggests that when lump-sum transfers are directly allocated to the local government, economic agents inside the jurisdiction might underestimate the true marginal costs of public expenditures. Different from the fiscal illusion hypothesis, however, this result is not due to their "confusion," neither to the fact that they consider average instead of marginal costs. Instead, our explanation in Figure 5(b) suggests that lump-sum transfers to the local government *do in fact reduce* the marginal costs inside the jurisdiction.[96] In other words, the flypaper effect is the consequence of

[94] Of course, there are costs associated with the funds used in the transfer, but those costs are assumed elsewhere, presumably by the central government that implements the transfer.

[95] In addition, Figure 5(b) shows that the optimal amount of private consumption under direct transfers to the local government, $X^*(t_2^*)$, is lower than the optimal amount of private consumption under transfers to the taxpayers, $X^*(t_3^*)$. This result is quite intuitive in the sense that, given a certain level of (local) income, greater government expenditures offset private consumption. However, note that the amount of (local) income at E_2 and E_3 are independent, and ultimately depend on the effect of local government expenditures and lump-sum income increases on the labor supply, respectively.

[96] For instance, Oates (1979) has also suggested that intergovernmental transfers have price effects on government expenditures, but his arguments are related with production technologies, not with the marginal cost of funds or tax revenue collections.

rational and efficient economic behavior inside the jurisdiction. The problem, if there is any, is not the perception of taxpayers, but instead the effect of intergovernmental transfers on the price paid inside each jurisdiction for the public goods. In the end, an efficient allocation of intergovernmental transfers among sub-national governments should take into account the marginal costs of raising revenues in each jurisdiction and elsewhere in the economy.[97]

Concluding, the analytical framework developed in this paper allows us to model the public expenditures' problem not only from a normative perspective, but also can help explain actual public expenditures' decisions. Of course, the fact that we are able to explain the flypaper effect under our framework does not necessarily "prove" the validity of our framework, but certainly provides empirical evidence about its applicability. Even more important, the analysis in this paper suggests that the normative and positive aspects of the government problem do not need to be analyzed separately, as it has become the traditional practice in the public finance literature. In principle, the normative and positive approaches to the government problem should be separated only of the actual government behavior is known not to meet the assumptions of the normative model, but there are no *a priori* reasons to claim that this is the case.

Summary and conclusions

In this paper we analyze the problem of determining the optimal amount of public expenditures in a second-best framework where the only tax instrument available for the government is a proportional labor income tax. We first introduce the effective budget constraint in order to summarize the positive restrictions that behavioral responses to taxation impose on the solution to

[97] For example, Dahlby and Wilson (1994) argue that "[i]n a federal state, welfare maximization requires the equalization of the marginal cost of rising revenue across jurisdictions."

the government problem. We have shown that the effective budget constraint is likely to be concave, which would imply that the marginal costs of collecting taxes is increasing along the range of possible tax rates. By itself, this finding is important because the traditional literature does not describe the marginal costs of public funds as an increasing function of the tax rate.

Using the effective budget constraint, we also show that the traditional solution to the government problem in a second-best scenario, represented by the marginal costs of funds (MCF) rule, does not necessarily maximize welfare. The reason is that this solution is obtained by simply substituting the taxpayers' first order conditions into the first order condition of the government problem, and this procedure does not account for the fact that an omniscient and benevolent government has additional information about the marginal benefits of public goods' provision to taxpayers. The proposed optimal solution to the government problem is found, instead, at the point of tangency between the highest attainable social indifference curve and the effective budget constraint.

The second-best solution to the government problem must be represented by a condition under which the sum of marginal rates of substitution between public and private goods is equal to the slope of the effective budget constraint of the government. Based on this condition, we propose to redefine the concept of the MCF as the slope of the budget constraint.

We have also shown that the same framework used to describe the second-best solution to the government problem can be used to explain actual government behavior. In particular, we show that the flypaper effect may be obtained as a straightforward prediction of the model, showing its predictive power. This suggests that, contrary to the position taken in the conventional literature, the normative and positive aspects of the government problem do not need to be treated separately.

Appendix I: Variable description and data sources

Variable	Description and sources
Human Development Index (HDI)	Combines normalized measures of population health and longevity (measured by life expectancy at birth), knowledge and education (adult literacy rate and a combined primary, secondary, and tertiary gross enrollment ratio), and standard of living (natural logarithm of gross domestic product per capita at purchasing power parity). *Source*: United Nations Development Program (UNDP),
Reported Gini	(As defined in User Guide:) Gini as reported by the source (if no Gini were reported by the source, this will include the Gini as calculated by WIDER or Deininger & Squire for the old databases using POVCAL, a program estimating the Gini coefficient using parametric extrapolation). *Source*: UNU/WIDER World Income Inequality Database V 2.0a June 2005 (WIID2a)
Fiscal Decentralization	Share of expenditures of all sub-national governments (net of transfers to other levels of government) in total expenditures of consolidated central budget measured in percents. Scale from 0 to 100. *Source*: Database on Fiscal Indicators, by the World Bank, based on IMF's Government Finance Statistics.
Log of per capita GDP	Based on per capita real GDP (PPP). *Source*: Penn World Table, PWT6.2**,** Heston, Summers and Aten (2006).
Government share of per capita GDP	Government share of real GDP per capita. Scale from 0 to 100. *Source*: Penn World Table, PWT6.2**,** Heston, Summers and Aten (2006).
Population growth	Based on yearly population. Scale in percentage form. *Source*: Penn World Table, PWT6.2**,** Heston, Summers and Aten (2006).
Age dependency ratio	Number of dependents over the working-age population. *Source*: World Bank's World Development Indicators (2005)
Urban population	Urban population over total population. Scale from 0 to 100. *Source*: World Development Indicators (2005), by the World Bank.
Average schooling years	Average schooling years in the total population. *Source*: Barro, J. Robert and Jong-Wha Lee, 2000.
Index of democracy	POLITY2 is a modified version of the POLITY, which is obtained by subtracting the value of the scaled value representing AUTOCRATIC (range 0-10) from the value of DEMOCRATIC (range 0-10) in order to provide a unified polity scale ranging from +10 (strongly democratic) to -10 (strongly autocratic). The index has been rescaled to range between 0 to 100. *Source*: Polity IV Project. 2005. Political Regime Characteristics and Transitions. College Park: University of Maryland. Available online at http://www.bsos.umd.edu/cidcm/inscr/polity/index.htm
Openness to trade	Openness in constant prices: Exports plus Imports divided by real GDP per capita (Laspeyres). Scale in percentage form. *Source*: Penn World Table, PWT6.2**,** Heston, Summers and Aten (2006).
Log of Population	Based on population (thousands). *Source*: Penn World Table, PWT6.2**,** Heston, Summers and Aten (2006).
Ethnic Fractionalization	Probability that two randomly selected people from a given country will not belong to the same ethnic group. Scale in percentage form. *Source*: Alesina et al. (2003).

Appendix II: Descriptive statistics of *Poverty* determinants' data

Table II.1: Sample of countries (and number of observations)

	Developing countries	**182**
	Sub-Saharan Africa	
1	Botswana	2
2	Mauritius	3
3	Malawi	4
4	Senegal	3
5	Swaziland	5
6	Uganda	3
7	South Africa	4
8	Zimbabwe	3
	sub-total observations:	27
	South Asia	
9	Bangladesh	2
10	India	5
11	Sri Lanka	5
12	Pakistan	4
	sub-total observations:	16
	Europe & Central Asia	
13	Hungary	5
14	Poland	3
		8
	Middle East & North Africa	
15	Iran, Islamic Rep.	5
16	Tunisia	4
	sub-total observations:	9
	East Asia & Pacific	
17	China	5
18	Indonesia	5
19	Malaysia	5
20	Philippines	5
21	Papua New Guinea	4
22	Thailand	5
	sub-total observations:	29
	Latin America & Caribbean	
23	Argentina	4
24	Bolivia	5
25	Brazil	5
26	Chile	5
27	Colombia	5
28	Costa Rica	5
29	Dominican Republic	5
30	Ecuador	4
31	Guatemala	5
32	Honduras	5
33	Mexico	5
34	Nicaragua	5
35	Panama	5
36	Peru	5
37	Paraguay	5
38	El Salvador	5
39	Trinidad and Tobago	5
40	Uruguay	5
41	Venezuela, RB	5
	sub-total observations:	93

	Developed countries	**115**
	High income: OECD	
42	Australia	5
43	Austria	5
44	Belgium	5
45	Canada	5
46	Switzerland	5
47	Germany	2
48	Denmark	5
49	Spain	5
50	Finland	5
51	France	5
52	United Kingdom	5
53	Greece	5
54	Ireland	5
55	Italy	5
56	Korea, Rep.	5
57	Netherlands	5
58	Norway	5
59	New Zealand	5
60	Portugal	5
61	Sweden	5
62	United States	5
	sub-total observations:	102
	High income: nonOECD	
63	Bahrain	5
64	Cyprus	3
65	Israel	5
	sub-total observations:	13

Table II.2: Summary statistics

Variable		Mean	Std. Dev.	Min	Max	Observations	
Human Development Index	overall	75.2	15.0	32.8	96.1	N =	297
	between		15.8	34.0	92.9	n =	65
	within		3.3	65.2	85.7	T-bar =	4.6
Fiscal decentralization (%)	overall	19.6	15.9	1.0	58.8	N =	297
	between		15.7	1.3	57.5	n =	65
	within		3.3	-0.7	39.4	T-bar =	4.6
Government share of per capita GDP	overall	19.8	6.8	7.5	48.9	N =	297
	between		6.4	7.9	37.9	n =	65
	within		2.8	0.9	32.5	T-bar =	4.6
Population growth (%)	overall	1.6	1.1	-0.6	6.1	N =	297
	between		1.0	-0.1	3.7	n =	65
	within		0.4	-0.4	4.0	T-bar =	4.6
Age dependency ratio (%)	overall	66.5	16.4	40.0	104.2	N =	297
	between		16.2	45.2	103.4	n =	65
	within		5.4	51.5	84.7	T-bar =	4.6
Index of democracy	overall	73.3	33.1	0.0	100.0	N =	297
	between		29.2	1.6	100.0	n =	65
	within		16.7	17.9	121.8	T-bar =	4.6
Urban population (%)	overall	58.3	21.8	9.8	97.0	N =	297
	between		22.3	11.3	96.1	n =	65
	within		3.5	43.5	69.2	T-bar =	4.6
Openness to trade	overall	61.2	37.6	9.5	213.6	N =	297
	between		35.3	11.6	171.3	n =	65
	within		13.5	8.0	130.3	T-bar =	4.6
Average schooling years	overall	6.4	2.7	0.9	12.2	N =	297
	between		2.6	1.5	12.0	n =	65
	within		0.7	4.2	8.5	T-bar =	4.6
Ethnic fractionalization	overall	35.8	23.9	0.2	93.0	N =	297
	between		24.4	0.2	93.0	n =	65
	within		0.0	35.8	35.8	T-bar =	4.6
Log of population	overall	9.5	1.6	5.8	14.0	N =	297
	between		1.6	6.1	13.9	n =	65
	within		0.1	9.2	9.8	T-bar =	4.6
Log of area (squared kilometers)	overall	11.5	2.6	5.8	16.6	N =	297
	between		2.5	5.8	16.6	n =	65
	within		0.0	11.5	11.5	T-bar =	4.6

Appendix III: Descriptive statistics of *Inequality* determinants' data

Table III.1: Sample of countries (and number of observations)

	Developing countries	**106**
	Sub-Saharan Africa	
1	Botswana	2
2	Mauritius	3
3	Uganda	2
4	South Africa	2
	sub-total observations:	9
	South Asia	
5	Bangladesh	3
6	Sri Lanka	6
	sub-total observations:	9
	Europe & Central Asia	
7	Bulgaria	2
8	Belarus	2
9	Czech Republic	2
10	Estonia	2
11	Hungary	5
12	Lithuania	2
13	Latvia	2
14	Poland	4
15	Romania	3
16	Slovenia	2
	sub-total observations:	26
	East Asia & Pacific	
17	China	3
18	Indonesia	4
19	Malaysia	5
20	Philippines	4
21	Thailand	5
	sub-total observations:	21
	Latin America & Caribbean	
22	Argentina	4
23	Bolivia	2
24	Brazil	5
25	Chile	3
26	Colombia	2
27	Costa Rica	3
28	Ecuador	2
29	Mexico	6
30	Panama	3
31	Peru	2
32	Trinidad and Tobago	2
33	Uruguay	4
34	Venezuela, RB	3
	sub-total observations:	41

	Developed countries	**107**
	High income: OECD	
35	Australia	4
36	Austria	4
37	Belgium	5
38	Canada	7
39	Switzerland	3
40	Germany	3
41	Denmark	5
42	Spain	5
43	Finland	6
44	France	7
45	United Kingdom	6
46	Greece	2
47	Ireland	5
48	Italy	6
49	Korea, Rep.	2
50	Netherlands	6
51	Norway	6
52	New Zealand	4
53	Portugal	5
54	Sweden	6
55	United States	6
	sub-total observations:	103
	High income: nonOECD	
56	Israel	4

Table III.2: Summary statistics

Variable		Mean	Std. Dev.	Min	Max	Observations	
Gini (disposable income)	overall	34.2	9.0	20.0	58.9	N =	169
	between		9.6	23.4	57.1	n =	45
	within		2.3	28.5	40.0	T-bar =	3.8
Gini (gross income)	overall	47.6	7.3	30.8	63.0	N =	44
	between		7.4	34.4	61.0	n =	14
	within		2.5	38.5	54.9	T-bar =	3.1
Expenditure decentralization (%)	overall	23.4	14.9	1.3	58.8	N =	213
	between		14.3	2.6	57.6	n =	56
	within		2.8	9.4	33.6	T-bar =	3.8
Government share of per capita GDP	overall	19.8	6.3	4.8	41.1	N =	213
	between		6.8	8.1	36.8	n =	56
	within		2.0	13.0	29.7	T-bar =	3.8
Log of per capita GDP (PPP)	overall	9.2	0.8	6.9	10.4	N =	213
	between		0.8	6.9	10.2	n =	56
	within		0.2	8.5	9.8	T-bar =	3.8
Population growth (%)	overall	1.0	0.9	-1.5	3.5	N =	213
	between		1.0	-1.3	3.1	n =	56
	within		0.3	-0.1	2.1	T-bar =	3.8
Index of democracy	overall	83.4	26.6	5.0	100.0	N =	213
	between		22.3	15.0	100.0	n =	56
	within		15.7	22.0	127.8	T-bar =	3.8
Urban population (%)	overall	64.5	19.7	9.0	97.0	N =	213
	between		19.6	11.7	96.1	n =	56
	within		3.0	51.5	76.6	T-bar =	3.8
Openness to trade	overall	60.7	36.6	9.5	213.6	N =	213
	between		34.7	14.6	165.6	n =	56
	within		15.0	7.5	129.8	T-bar =	3.8
Ethnic fractionalization	overall	32.7	23.0	0.2	93.0	N =	213
	between		23.5	0.2	93.0	n =	56
	within		0.0	32.7	32.7	T-bar =	3.8
Log of population	overall	9.7	1.4	6.8	14.0	N =	213
	between		1.5	7.0	14.0	n =	56
	within		0.1	9.4	10.0	T-bar =	3.8
Log of area (squared kilometers)	overall	11.2	2.6	4.1	16.0	N =	213
	between		2.6	4.1	16.0	n =	56
	within		0.0	11.2	11.2	T-bar =	3.8

Appendix IV: Proof of equation 8

The slope of the effective budget constraint $S(t)$ as defined in equation 7 is:

$$S(t) = \frac{X_t^*}{R_t^*} = \frac{-B^*(t)+(1-t)wL_t^*}{B^*(t)+tB_t^*}.$$

where $B^*(t) = wL^*(t)$ and thus $B_t^* = wL_t^*$. The derivative of $S(t)$ with respect to t is equal to:

$$\frac{dS(t)}{dt} = \frac{X_{tt}^* R_t^* - X_t^* R_{tt}^*}{{R_t^*}^2}$$

$$= \{[-B_t^* - wL_t^* + (1-t)wL_{tt}^*]R_t^* - X_t^*[B_t^* + B_t^* + tB_{tt}^*]\}/{R_t^*}^2$$

$$= \{[-2B_t^* + (1-t)wL_{tt}^*]R_t^* - X_t^*(2B_t^* + tB_{tt}^*)\}/{R_t^*}^2$$

$$= \{[-2B_t^* + (1-t)wL_{tt}^*](B^* + tB_t^*) - [-B^* + (1-t)wL_t^*](2B_t^* + tB_{tt}^*)\}/{R_t^*}^2$$

$$= \{[-2B_t^* + (1-t)B_{tt}^*](B^* + tB_t^*) - [-B^* + (1-t)B_t^*](2B_t^* + tB_{tt}^*)\}/{R_t^*}^2$$

$$= \{[\cancel{-2B_t^*} + (1-t)B_{tt}^*](B^* + tB_t^*) + (B^* + tB_t^*)[\cancel{2B_t^*} + tB_{tt}^*] - (2B_t^* + tB_{tt}^*)B_t^*\}/{R_t^*}^2$$

$$= \{(1 - \cancel{t})B_{tt}^*(B^* + tB_t^*) + \cancel{(B^* + tB_t^*)tB_{tt}^*} - (2B_t^* + tB_{tt}^*)B_t^*\}/{R_t^*}^2$$

$$= \{B_{tt}^*(B^* + \cancel{tB_t^*}) - (2B_t^* + \cancel{tB_{tt}^*})B_t^*\}/{R_t^*}^2$$

$$= \{B^* B_{tt}^* - 2{B_t^*}^2\}/{R_t^*}^2$$

result that is displayed in equation 8.

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