DECENTRALIZATION AND THE COMPOSITION OF PUBLIC EXPENDITURES

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Abstract

We examine the relationship between fiscal decentralization and the functional composition of public expenditures. Using a distance-sensitive representative agent model, we hypothesize that higher levels of fiscal decentralization induce agents to demand increased production of publicly provided private goods. We test this hypothesis using an unbalanced panel data set of 59 developed and developing countries covering a 30-year period. We find that expenditure decentralization positively and significantly influences the share of health and education expenditures; this finding is robust across multiple estimators. Expenditure decentralization thus appears to alter the composition of public expenditures towards publicly provided private goods.

Keywords: Fiscal Decentralization, Functional Composition, Pure Public Goods, Publicly Provided Private Goods, Education, Health

JEL classification: H30, H50

1. Introduction

The application of fiscal decentralization reforms and demand for fiscal decentralization policy design has grown significantly in developed and developing countries in the past three decades (Bird, Ebel, & Wallich, 1995; Campbell, 2003; Dillinger, 1994; Martinez-Vazquez & McNab, 2003; Martinez-Vazquez & Vaillancourt, 2010; Oates, 2005). Diverse economic and political factors, from the pursuit of increased economic efficiency to the expansion of democratic governance, have driven this wave of decentralization reforms (Arzaghi & Henderson, 2005; Shah & Chaudhry, 2004). Researchers and policymakers alike have promoted decentralization reform agendas on the premise that decentralization results in a more efficient allocation of public goods by enabling local governments, which have better information, to tailor more closely their public spending decisions to the needs and preferences of their constituencies (Oates, 1993, 1999). Theoretically, a significant body of work suggests that fiscal decentralization, under certain conditions, promotes allocative efficiency (Diamantaras & Gilles, 1996; Mas-Colell, 1980; Oates, 1993; Rubinfeld, 1987).

While efficiency increases in public service delivery have been attributed to fiscal decentralization programs (Alderman, 1998; de Sousa Santos, 1998; Galasso & Ravallion, 2005; King & Ozler, 1998), the complexity of generating standardized measurements of allocative efficiency across countries has handicapped empirical research on the hypothesized impact of decentralization on allocative efficiency. Implicit in the argument that decentralization can increase allocative efficiency, however, is the implication that decentralization is likely to alter the composition of public expenditures. In comparison to using direct measures of allocative efficiency, examining the relationship between fiscal decentralization and composition of public expenditures is relatively straightforward.

Recent papers have considered the determinants of the composition of public expenditures (Barro, 1990; Devarajan, Swaroop, & Zou, 1996; Fan & Rao, 2003; Sanz & Velázquez, 2004; Shelton, 2007; Shonchoy, 2010). While this literature offers insight on the determinants of the composition of public expenditures, none of these studies explicitly examines the potential influence of fiscal decentralization on expenditure composition and its link to allocative efficiency. An emerging literature, however, studies the influence of decentralization on expenditure composition (Alegre, 2010; Ashworth, Galli, & Padovano, 2009; Busemeyer, 2008; Faguet, 2004; Fiva, 2006; Kwon, 2003). This paper surveys and extends this literature.

The main goal of this paper is to offer an indirect test of decentralization's allocative efficiency effects by examining its role in the composition of public expenditures. First, we explore the theoretical linkages between decentralized governance and expenditure composition by means of a distance-sensitive representative agent model. Then we estimate the impact of fiscal decentralization on the level and functional composition of public expenditures using an unbalanced panel data set spanning 59 developed and developing economies over a period of 30 years.

The remainder of the paper is organized as follows. In the following section, we briefly review the two strands of literature on the determinants of the composition of public expenditure and, more specifically, the impact of fiscal decentralization on expenditure composition. In the third section, we develop a distance-sensitive representative agent model to explore the potential influence of decentralization on expenditure composition. The fourth section discusses the data and presents the estimation results. In the last section of the paper, we conclude and offer suggestions for future research.

2. Review of the Literature

In this section, we briefly review the rapidly expanding literature on the relationship between the composition of public expenditures and a variety of macroeconomic variables, including welfare and human capital, income inequality, macroeconomic stability, fiscal competition, globalization and economic growth has grown rapidly over the last two decades (Aschauer, 1989; Brueckner, 2006; Devarajan et al., 1996; Dreher, Sturm, & Ursprung, 2006; Gupta, Clements, Baldacci, & Mulas-Granados, 2002; Matovu, 2000; Sanz & Velázquez, 2004; Turnovsky & Fisher, 1995). Several authors have examined whether there is empirical evidence to support Wagner's Law (Akitoby, Clements, Gupta, & Inchauste, 2006; Durevall & Henrekson, 2011; Shelton, 2007; Shonchoy, 2010; Zaghini & Lamartina, 2008) while others have examined the influence of corruption on government expenditure (Alesina, Campante, & Tabellini, 2008; De La Croix & Delavallade, 2011). As such, this brief literature review does not attempt to examine the entire literature and instead focuses on those contributions related to question of whether fiscal decentralization influences the composition of public expenditures.

The literature anticipated whether fiscal decentralization would result in the concentration of public expenditures on the provision of services related to poverty alleviation (Bird & Vaillancourt, 1998; Fox, 1995; Fox & Aranda, 1996). Decentralization in Bolivia from 1991 to 1996, for example, increased investment in socially oriented sectors, such as education, urban development, water and sanitation, and health care (Faguet, 2001). Decentralization appears to serve as a constraint on the behavior of the central government in South Korea, but also promotes the development of local governments (Kwon, 2003). Fiscal decentralization in Spain

seems to be a critical determinant in the share of the public budget devoted to capital expenditures (Alegre, 2010).

When examining the evidence across countries and time for the impact of fiscal decentralization on expenditure composition, there is a distinct lack of consensus with regards to the impact of decentralization. Decentralization may improve health outcomes (Robalino, Picazo, & Voetberg, 2001). Decentralization, regardless of whether measured by revenue or expenditure shares, appears to influence the share of consumption in government expenditures (Devarajan et al., 1996; Fiva, 2006; Shelton, 2007). While evidence suggests that decentralization unambiguously increases education expenditures in OECD countries, whether it influences healthcare or social security expenditures remains an unsettled question (Ashworth et al., 2009; Busemeyer, 2008). Given that the majority of decentralization efforts now exist in developing countries, the paucity of empirical evidence on the influence of decentralization on expenditure composition (and its outcomes) is striking.

The evidence to date is suggestive of a relationship between fiscal decentralization and the functional composition of public expenditures. While the literature suggests that decentralization results in improved allocative efficiency given improved matching of subnational preferences and, implicitly, shifts in the composition of public expenditures, the theoretical basis for this argument is lacking. The empirical literature to date on the impact of decentralization on expenditure composition is also suspect. We endeavor to address these gaps in the literature in the following sections of the paper.

3. Modeling the Relationship between Decentralization and Expenditure Composition

The model appearing in this section stresses the potential heterogeneous nature of tastes among individuals residing in different jurisdictions as a fundamental factor of the relationship between fiscal decentralization and the composition of public expenditures.

We rely on a theoretical framework that focuses only on a "representative" median-voter. Representative-agent models have largely ignored the heterogeneity of individual preferences and the literature has criticized the application of this type of model to decentralization issues.[1] Here we employ a distance-sensitive utility function that allows us to assume that all individuals have the same general utility, but "each one of them" has a different preferred type of public good with independent quantity preferences. Intuitively, we interpret the distance between individuals as a measure of their variation in preferences. The further an individual is from the median voter, the greater their dissatisfaction with the median voter's decision, and the less utility they derive from the provision of the public good in question.

Previous work has employed distance-sensitive utility functions with one public and one private good (Alesina, Baqir, & Easterly, 1999; Alesina, Baqir, & Hoxby, 2004; Alesina & Spolaore, 1997; Panizza, 1999). While previous research has broken the correspondence between preference heterogeneity and geographical distance, the examination is limited to provision of one public good, schooling (Alesina et al., 2004). In our model, we extend the distance-sensitive representative agent model to an economy with two levels of government and two types of publicly provided goods. In short, the model, for the first time in the literature of which we are aware, explicitly provides a link between the representative agent's utility and the composition of national and subnational public expenditures.

[1] Fundamentally, decentralization would not make much sense if we assume that all individuals have identical preferences as representative-agent models often assume (Kirman, 1992; Martinez-Vazquez & McNab, 2003).

We extend from a uni-dimensional to a multi-dimensional voting framework Alesina, Baquir, and Easterly's (1999) result that the optimal amount of publicly provided goods is a function of the "median distance from the median." We further base our model of heterogeneous preferences on two additional assumptions: a) individuals are uniformly distributed along a country area, and b) individual utility accrued from any given public good is decreasing on distance to the middle of the country or jurisdiction that provides it.

We assume that individuals are uniformly distributed along a country with area A, population N, and J municipalities (where $J > 1$). Each agent consumes three types of goods: one private good (C) and two publicly provided goods: S, a Samuelsonian pure public good (*PPG*) provided solely by the central government and G, a publicly-provided private good (*PPPG*) whose provision is divided between the central government and local governments. The letters c, s, and g, respectively, represent the per capita consumption of these goods . We assume an exogenous level of centralization (θ) that is equal to the fraction of the PPPG provided by the central government.[2] Education and national defense are examples of a PPPG and a PPG, respectively.[3]

We assume that each individual has a set of characteristics that determine their preferred type and quantity of the PPG and PPPG.[4] The type and quantity of each public good are decided democratically by the median voter (med^s, med^g). For this reason, it is possible that there may be a separate "type median voter" and "quantity median voter" for each public good. In order to

[2] We do not derive an optimal level of centralization. This would require the specification of a government objective function and the determinants of fiscal decentralization (Panizza, 1999).

[3] There may be disagreement with the choice of these two examples, but in essence we assume there are PPPG subject to "crowding," as opposed to PPG, which are not.

[4] We must differentiate between the two kinds of publicly provided goods and the many types of each good that can be provided. Education is a publicly provided good, which can be clearly categorized into different types based on the characteristics of the educational curriculum of schools. Some educational programs may impart certain religious beliefs and practices while others may be mainly focused on the development of the musical abilities of the students. Alesina, Baqir and Easterly (1999) present a model on which each jurisdiction decides on the type and quantity of a unique public good, the only difference here is that we assume the existence of more than one public good.

ensure the median voter result in the presence of multidimensional issues, we must assume that: a) individuals vote on one issue at a time and b) individuals have separable preferences.[5]

We further assume that individuals are uniformly distributed, Tiebout-sorted, and pay a lump sum tax t on the same income y.[6] Each type of PPG is located on an ideological Euclidean space that captures individual preferences and represents the area of the country.[7] We assume that voter's optima are evenly distributed over the space, that the number of voters is large enough so that the space can serve as a proxy for the voters, and that the country size area is normalized at one with no loss of generality.[8] The distribution of individuals is such that each alternative can be uniquely mapped in the Euclidean space.

Based upon these assumptions, individual i's utility function is given by:

$$U_i = s_i^{1-\alpha y_{ic}} g_i^{(1-\alpha(\theta x_{ic}+(1-\theta)x_{ij}))} c_i^{\beta} \quad (1)$$

where s, g, c, and θ are as defined previously; y_{ic} is individual i's distance to the middle of the country measured on the PPG axis; x_{ic} is individual i's distance to the middle of the country measured on the PPPG axis; and x_{ij} is individual i's distance to the middle of the jurisdiction where he resides measured over the PPPG axis. The parameter α, where $0 \leq \alpha \leq 1$, measures preference heterogeneity, that is as α approaches 0, preferences become relatively more homogenous.

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[5] Assumptions *a* and *b* are introduced to avoid issues, such as cycling, related to simultaneous multidimensional voting. Under these assumptions, the outcome of majority voting is the optimum alternative of the median voter on each issue (Enelow & Hinich, 1984). Note also that we do not consider any distortions to the democratic process in this model. Others have explored the capture of the democratic process at the local and national level (Bardhan & Mookherjee, 2000) and the extent that a democratic system is offset by Leviathan local and central governments (Panizza, 1999).

[6] Income distribution issues are assumed away, not because they are considered unimportant, but in order to isolate the locational efficiency effects of decentralized decision-making (Wildasin, 1991, 1994).

[7] This is an extension of the multidimensional problem (Alesina & Spolaore, 1997).

[8] These assumptions have been used on several other studies that use a Euclidean space as an analytical tool for spatial analysis (Davis, DeGroot, & Hinich, 1972; Plott, 1967; Tullock, 1967).

The public budget constraint is $T = G + S$, where T represents general (central plus subnational) tax revenue and p_g and p_s are normalized to one.[9] If the representative agent's budget constraint before taxes is $y = s + g + c$ or $y = c + t$. Let $\delta_i = 1 - \alpha(\theta x_{ic} + (1-\theta) x_{ij})$ and $\gamma_i = 1 - \alpha y_{ic}$, then the maximization of the individual's utility function with respect to the budget constraint generates the following demand functions:

$$g_i = \frac{\delta_i y}{\delta_i + \gamma_i + \beta};\ s_i = \frac{\gamma_i\ y}{\delta_i + \gamma_i + \beta};\ c_i = \frac{\beta\ y}{\delta_i + \gamma_i + \beta} \tag{2}$$

We can employ the Euclidean distance between two points to measure each individual's distance between their preferred types of PPPGs and those actually provided. Let $\| z - z^m \| = c$ be part of a circle on which each point $z = (y_1, x_1)$ has a constant Euclidean distance to the point of the type-median's location $z^m = (y_m, x_m)$. As illustrated in Figure 1, for each individual located on the circle, there exists another individual with exactly the same horizontal and vertical distance to the center of the circle. Individuals with same horizontal and vertical distances to the type-median will demand the same quantity of each good.[10]

Given symmetric preferences, the location of median voter's preferred quantity is at a distance equal to the 'median distance to the median' along the horizontal axis. For a country with area A, the median distance to the median is Ax/4. Let $\delta_k = 1 - \alpha(\theta x^m_{kc} + (1-\theta) x^m_{kj}) > 0$ and $\gamma_k = 1 - \alpha y_{kc} > 0$, y^m_{kc} be the median distance to PPG type-median, x^m_{kc} be the median

[9] It is important to note that the maximization of individual utility serves as the basis for this model by finding the optimal demand for public goods. For this maximization problem the relevant constraint is individual after tax income. Individual after tax income is independent of the level of government providing the good and of the location of the individual. The facts that an income lump sum finances all public goods in this model and the model's assumption that all individuals have equal income, guarantees independence. Also note that we do not include any assumptions related to the production of public goods, such as costs differentials, or shared tax sources between levels of government (Caplan, 2001; Faguet, 2004; Nechyba, 1997; Wrede, 2000).

[10] This is as opposed to individuals with same Euclidean distance to type median, who will not all demand the same quantity of public goods. In Figure 1 all points in the circle have the same Euclidean distance to the middle. However, just the pairs of points situated exactly in opposite sides of the circle have same horizontal and vertical distances to the middle.

distance to the PPPG country type-median, and x^m_{kj} be the median distance to the PPPG jurisdiction type-median. Using (2) we can express the quantities of *g* and *s* provided at equilibrium as:

$$g^*_k = \frac{\delta_k y}{\delta_k + \gamma_k + \beta}; \quad s^*_k = \frac{\gamma_k \ y}{\delta_k + \gamma_k + \beta} \tag{3}$$

From (2) and (3), we develop four propositions which we test empirically in the following section. We summarize the decision-making mechanism for both type and quantity of both types of public goods in Table A.1 in Appendix 1 and present, where applicable, the proofs of the propositions in Appendix 2.

Propositions on Centralization and the Composition of Public Expenditure

Given heterogeneous preferences, as the centralization level increases, the number of dissatisfied individuals with respect to the PPPG's type increases accordingly. All else being equal, demand for PPPG expenditure is inversely related to the level of centralization. Conversely, demand for PPG expenditure is positively related to the level of centralization as individuals substitute away from PPPGs towards the centrally provided PPG. The following propositions summarize these results.

Proposition 1: PPPG equilibrium quantity is decreasing in the centralization level, that is, $\delta g^*_k / \delta\theta < 0$.

Proposition 2: PPG equilibrium quantity is increasing in the centralization level, that is, $\delta s^*_k / \delta\theta > 0$.

The intuition of Proposition 1 is simple. In a more centralized country there will be more unhappy individuals with the chosen PPPG's type. As a result, overall demand and support for this kind of expenditure will be smaller, other things equal, than in a more decentralized country. Given that PPGs are provided centrally, the country's median voter will decide the quantity of

each PPG. The median voter's decision on the provision of the PPG is inversely related to the median distance to the country median. Likewise, local governments provide a share of PPPG expenditure and the median vote of each jurisdiction decides the quantity of each PPPG. This decision is inversely related to the median distance to the jurisdiction median. If more than one jurisdiction exists, the median distance to the country median is greater than the median distance to the jurisdiction median. Thus, the more decentralized the provision of public goods, the higher the demand for PPPGs relative to PPGs. As the level of decentralization increases, the provision of PPGs declines at a faster rate than the PPPGs increase, thus, the total level of public expenditure also declines. Intuitively, decentralized provision of public goods allows local governments to provide combinations of goods to each jurisdiction, as opposed to providing a whole package to all jurisdictions in the country like the central government may be forced to do (due to lack of knowledge on local preferences or other constraints).[11] The following propositions summarize these results.

Proposition 3: PPPG share of total expenditure is decreasing in the centralization level, that is, $\delta(g/(g+s))/\delta\theta < 0$.

Proposition 4: Total public expenditure is increasing in the centralization level, that is, $\delta(g+s)/\delta\theta > 0$.

The interpretation of these results is again quite straightforward. First, the central government chooses the level of centralization for public good provision (exogenous in this model). Second, if the government centralizes the public good's provision, the preferences of the overall median voter will decide the "type." If, in contrast, each jurisdiction provides the public good, the type-median voter of each locality will decide the "type" of public good. Once

[11] Note that it may be possible to get the central government to provide different packages of PPPGs to different jurisdictions. The central government may be able to discriminate among jurisdictions with different packages of services (Besley & Coate, 2003; Lockwood, 2002). In this paper we keep the conventional assumption that central provision is homogenous for all jurisdictions.

jurisdiction decides the type of each kind of public good, individuals decide the quantity to be provided. Individuals demand more publicly provided goods the closer the type is to their individual preferences.

Given the fact that the government centrally provides the pure public goods in our model, the overall median voted will decide the quantity of such goods. This decision is inversely related to the 'median distance to the country median.' Conversely, in our model, the local government provides a share of PPPG expenditures. The jurisdiction median voter decides the quantity of the PPPG. This decision is inversely related to the median distance to the jurisdiction median. In countries with more than just one jurisdiction, the median distance to the country median is higher than 'the median distance to the jurisdiction median.' This determines that the more decentralized the provision of public goods, the higher the demand for publicly provided private goods (as opposed to pure public goods). In other words, given the distribution of preferences, the more centralized the provision of goods, the lower the ratio of publicly provided private goods to total amount of public goods provided.[12]

Intuitively, Proposition 4 suggests that decentralized provision of public goods allows local government to provide specific goods or combinations of goods to each jurisdiction, rather than needing to provide a whole package to all jurisdictions in the country, which the central government may be forced to do given an absence of knowledge on local preferences or otherwise (political) inability to discriminate among jurisdictions.[13] This specialization of public good provision implies a potentially lower level of total expenditures. Proposition 4 is also in line with several hypotheses in the decentralization literature. Alternative explanations include: a) decentralization can lead to lower expenditures arising from a reduction in redistribution

[12] Given our assumption of the spatial distribution of individuals on the country and the correspondence of location and preferences.
[13] But see footnote 21 above.

expenditures as a result of Tiebout sorting, which would imply income-homogeneous jurisdictions; this is an argument originally made by Musgrave (Oates, 1985)[14]; or b) decentralization constitutes a disciplining force that provides a closer link between revenues and spending (Brennan & Buchanan, 1980). What is novel in our result in Proposition 4 is that the shrinking effect of decentralization on overall public expenditures does not depend on fiscal competition, as in Brennan and Buchanan, or on the reduction of redistributional expenditures as noted by Musgrave. However, our results presuppose some sort of Tiebout sorting and the inability of the central government to offer different packages, or discriminate, across local jurisdictions (in contrast to the assumptions in Lockwood, 2002 and Besley and Coate, 2003).

4. Empirical Analysis

We now turn to examining whether empirical support exists for the implications of our theoretical model. In this section we focus on testing the empirical validity of Proposition 3 on the relationship between decentralization and expenditure composition.[15] We employ a panel data set of developed and developing countries to explore the relationship between fiscal decentralization and expenditure composition.

The Data

One common difficulty faced in the cross-country study of fiscal decentralization is how to properly measure the extent of decentralization. Ideally, we would construct a panel data set from measures of fiscal decentralization that effectively quantify the activities of subnational

[14] Income-homogenous jurisdictions may not be necessary for equilibrium to exist. Given heterogeneity of preferences and income, an allocation of households across communities may exist where stratification by income no longer holds (Epple & Platt, 1998).

[15] Testing the effects of decentralization on the equilibrium quantities of PPPG and PPG in Propositions 1 and 2 will involve very different data sets and we will perform this in future research. On the other hand, the public finance literature has tested the equivalent of Proposition 4 on many different occasions, especially in the case of the Leviathan model, with mixed results (Oates, 1985, 1989; Rodden, 2003).

governments resulting from their autonomous or independent decisions. This would require classifying those expenditures that are under the effective control of the central government as central government activities, regardless of the level of government at which these expenditures occurred, and so on. Constructing such a panel data set from measures of the decentralization of expenditures would require information on the overall level of political, administrative and fiscal autonomy of subnational governments (Martinez-Vazquez & McNab, 2003). Unfortunately, we cannot readily address these issues with the available data. We are left with the standard, albeit imperfect, measure of fiscal decentralization based on expenditure (or revenue) ratio data. We define fiscal decentralization as the share of subnational government expenditures to general government expenditures.[16] We employ the International Monetary Fund's Government Finance Statistics Annual Yearbook (GFS) as the primary data source for expenditures of national and subnational governments.[17]

We would be remiss not to note that, due to a shift in recording methods, GFS data are not comparable across two distinct periods of time. From 1972 to approximately 2003 (depending upon when the country switched to accrual reporting), the GFS contained information on a cash basis. After 2003, the GFS records data on an accrual basis and there is no existent method for reconciling the two subsets of data. For the purposes of this study, we employ the GFS data prior to the shift to accrual reporting.

[16] Several authors have noted the pitfalls associated with the conventional measurement of fiscal decentralization (Dreher, Sturm, & Ursprung, 2006; Ebel & Yilmaz, 2002; Fisman & Gatti, 2002; Fiva, 2006; Prud'homme, 1995; Stegarescu, 2005). While some studies of fiscal decentralization have attempted to construct measures of decentralization net of grants and transfers and net of certain types of expenditures, we do not construct such measures, as we are not able to ascertain, with any degree of certainty, whether these techniques reduce or enhance the bias already present in our measures of fiscal decentralization.

[17] We use GFS data at the consolidated central government, regional and state government, and local government levels. For those countries that do not report consolidated central government data, we substitute data on the budgetary central government. Of the 180-plus potential countries in the GFS data set, we select countries that reported expenditures for at least the central government and at least one level of subnational government. We did not include those countries that stopped reporting expenditure information prior to 1990 and those countries whose reported data were mathematically inconsistent. We did include countries that reported zero or minimal expenditures for at least one subnational level of government.

Combining the GFS data with the data extracted from the other data sources reduced the size of the data set from approximately 1,500 to approximately 1,149 observations due to missing observations for some control variables in the World Development Indicators 2010 dataset. The final panel dataset covers 59 countries from 1972-2003, albeit with gaps. Table 1 defines the variables used in the empirical model and their sources. Tables 2 and 3 present descriptive statistics of these variables and the sample countries and time periods, respectively. A discussion of the control variables used in the econometric model appears below.

To test the proposition regarding expenditure composition developed in the preceeding section, we need to classify observed public expenditures as either coming from pure public goods or from publicly provided private goods. We simplify this task by focusing on the identification of two public services as publicly provided private goods: education and health. Together these two services tend to represent a large share of decentralized expenditures in most countries. A standard technique to identify the degree of publicness of government services, used in studies related to the determinants of public expenditures and the demand for public goods, is the calculation of a crowding parameter (Blecha, 1987; Borcherding & Deacon, 1972; Gonzalez & Means, 1991; Gramlich & Rubinfeld, 1982; Martinez-Vazquez, 1982). Health and education expenditures should be classified as publicly provided private goods, subject to specific caveats on the measurement of the crowding parameter (Borcherding & Deacon, 1972; Oxley & Martin, 1991; Saunders, 1993).

While we cannot provide empirical evidence at this juncture on the degree of crowding for education and health services in the sample countries, we believe that is relatively safe to assume that these two types of services generally do not exhibit the characteristics of non-excludability and non-rivalry of pure public goods. With respect to the private nature of health

services, over 60 percent of total health spending is out of pocket in low-income countries, relative to 20 percent in high-income countries. In Africa, out-of-pocket spending accounts for almost 50 percent of total health spending, on average, and in 31 African countries, it accounts for 30 percent or more of total health spending (Schieber, Fleisher, & Gottret, 2006). Immunization, sanitation, other public health services also appear to be non-exclusive but rival; while services of acute health care are clearly rival and exclusive (Burki, Perry, & Dillinger, 1999). Similarly, classroom size limitations and number of teachers per student in most of the developing countries clearly add some degree of rivalry to education services.

Model Specification and Econometric Issues

We now turn to the empirical examination of the theoretical propositions developed in the previous section. We define the dependent variable, *Comp*, as the ratio of education and health expenditures to total public expenditures. Thus, the empirical statement of Proposition 3 in the previous section, is that, all other things equal, more decentralized countries spend a higher share of their expenditures on education and health. In terms of the explanatory variables in the model, our main interest is on decentralization, *Dec*, which we measure as the share of subnational expenditures in total public expenditures. A matrix $\boldsymbol{X}$ of control variables, includes population, population density, GDP per capita, and budget balance. We allow for potential differences in the impact of decentralization on expenditure composition in developing and developed countries by introducing an interaction term, *dev*, between our decentalization measure and a dummy variable to capture OECD membership status. We can specify the general estimation form as:

$$Comp_{i,t} = G(\alpha_0 + \alpha_1 Dec_{i,t} + \alpha_2 OECD_{i,t} + \beta X_{i,t} + a_i + b_t + u_{i,t}) \quad (4)$$

where $G(\cdot)$ is a transformation function we apply due to the fractional nature of the dependent variable (discussed below), and where a_i and b_t denote the unobserved country and time effects. The subscripts i and t denote country and time period, respectively. We note the presence of heteroscedasticity and serial correlation and proceed accordingly.[18]

The general estimable form in (4) may preclude the use of several time-invariant variables that the literature has previously used, depending on the type of estmator. If we employ a fixed effects estimator, variables such as ethnic fractionalization, country size, colonial tradition, legal tradition, and religious dominance are all 'swept' by the Within transformation of the fixed effects estimator.[19] On the other hand, it is unlikely that the rather stringent assumptions for the use of the random effects GLS estimator can be met using the data at hand. To this end, we revisit previous estimators employed in the litearture before discussing two relatively new approaches for the fiscal decentralization literature: the dynamic estimation methodology first developed by Arellano and Bond; and second, use of a Quasi-Maximum Likelihood Estimator (QMLE).

The first estimator employs the two-way error components estimator (fixed effects) and differs only in two ways: whether the model is estimated using levels or first differences and whether we employ the Cochrane-Orcutt transformation for unbalanced panel data (Baltagi, 2008). The second and third estimators are those developed by Arellano and Bond (1991) and employ a dynamic approach to the question of the impact of fiscal decentralization on

[18] Following Wooldridge (2001), we strongly reject the null of no serial correlation (F(1,58)=107). Using a Breusch-Pagan test for heteroscedasticity, we also strongly reject the null of homogeneity (Chi Squared(1) =33.4).

[19] Unlike previous analyses which rely primarily on OECD data (Sanz & Velázquez, 2004), our sample includes non-OECD members and we were unable to collect panel data for many of these countries with regards to population age structure. We are not certain of what effects that may have in our estimates, but previous studies have found find no or little effect of population age structure on education spending (Fernandez & Rogerson, 1997; Poterba, 1997).

expenditure composition.[20] The last estimator is the QMLE suggested by Papke and Wooldridge, with fixed country and time specific effects. We correct the standard errors in all the estimated models through the use of the White variance-covarariance matrix estimator. Table 4 summarizes the econometric approches used on each of the models estimated.

For the error components estimator, we use Likelihood Ratio and F tests to examine if the country and time-specific effects are jointly equal to zero and in all cases we are unable to reject the null hypothesis that the effects are jointly equal to zero. We thus include country and time specific effects for these models. We also test whether the explanatory variables and individual effects are correlated using a modified Hausman test to ascertain whether we should employ the Within or random effects GLS estimator (Hausman, 1978). We reject the null hypothesis of no correlation in all cases, thus confirming our *a priori* suspicison about the inconsitency of the random effects GLS estimator.

With respect to the QMLE model, we control for serial correlation by correcting the estimated variance-covariance matrix as opposed to transforming the data through first differencing or a Cochrane-Orcutt transformation. Using the variance-covariance matrix is desirable as we are interested in examining a proposition in levels while the first differencing transformation would have changed the question under consideration to one of change-on-change. With respect to the fixed effects, the literature supports the argument that fully robust estimators work reasonably well even when the cross-sectional sample size is not especially large relative to the time series dimension (Wooldridge, 2001, 2003). Given the relatively small number of groups in our sample (N=59), the inconvenience of using a set of country dummies in

[20] Arellano and Bond (1991) develop a Generalized Method of Moments estimator that instruments the differenced variables that are not strictly exogenous with all their available lags in levels.

order to control for unobserved country effects is not as great compared to the existing alternatives.[21]

Estimation Results

Tables 5 and 6 present the estimation results. From the perspective of this paper, the most important result is the positive, statistically significant, and robust influence of fiscal decentralization on the composition of public expenditures, as measured by the ratio of total health and education expenditures to total expenditures. The estimated coefficient for fiscal decentralization is positive and statistically significant across all models. This result is strikingly robust to modifications in the estimator, whether we estimate the model in levels or first differences. This suggests that expenditure decentralization is not only associated with a higher proportion of public expenditures on health and education public goods, but also that a change in change expenditure appears to induce a change in expenditure composition. We believe that these findings, for the first time in the literature, illustrate the potential impact of expenditure decentralization in developed and developing countries.[22]

Briefly, the estimated coefficient for expenditure decentralization in levels is statistically significant across the fixed effects estimations. Depending on whether the model is estimated in levels of first differences or with the Cochrane-Orcutt transformation, a one standard deviation increase in the level of expenditure decentralization would induce an approximate 2 percent increase in the share of education and health expenditures. This suggests, as posited by the theoretical model, that the share of PPPGs increases as the level of decentralization increases.

[21] In contrast to the within and random estimation methods for linear models, the literature on fixed and random effects for nonlinear models is limited. One theoretical approach to control for unobserved effects in nonlinear models is to maximize a conditional likelihood, for which the unobserved effects are integrated out. This is done through a conditional joint distribution (W. Greene, 2004; W. H. Greene, 2001; Hausman, Hall, & Griliches, 1984; Wooldridge, 2001). Despite these computational advances, in most models it is not always possible to remove the unobserved effects from the density, especially in estimations with continuous dependent variables.

[22] To check the robustness of the estimated coefficient, we examine a variety of estimation approaches, including pooled OLS, fixed and random effects, and first differencing the data. These estimates are available upon request.

The question is then which estimator to employ: the system GMM or difference GMM? We present the results of both estimators in Table 6. Unlike the difference GMM, which transforms the regressors to expunge the fixed effects, system GMM differences the instruments (lagged values of the regressors) to make them exogenous to the fixed effects (Roodman, 2006). The estimated coefficient for fiscal decentralization is statistically significant at the 1% level (System GMM) and 5% level (Difference GMM). In both cases, decentralization appears to positively and significantly influence expenditure composition, although the size of the estimated coefficient for decentralization differs between the two estimation approaches.

As noted previously, due to the fractional nature of expenditure decentralization, we argue that the QMLE provides estimated coefficients and the marginal effects, the latter being more appropriate for interpreting the results. The QMLE marginal effects are non-linear functions of the estimated coefficients and the specific values of the explanatory variables. Given the logistic density function $g(z) = \delta G(z) / \delta z = exp(z)/(1+exp(z)]^2$, the QMLE marginal effects are equal to $\delta E(y|x)/\delta x_j = m_j = g(x\beta)\beta_j$. In order to find the marginal effects, we must choose values for the explanatory variables to estimate a scalar value for $g(x\beta)$, which then is multiplied to each variables coefficient. For this, we choose the mean values of the explanatory variables, as reported in the descriptive statistics (Table 2).

We can, for example, calculate the marginal effects using the mean values of the explanatory variables where the QMLE linear prediction is = 1.03, and the density for the logistic distribution is 0.25. We thus determine that the estimated marginal effect of expenditure decentralization on expenditure composition is 0.26, that is, for a one standard deviation increase in the level of expenditure decentralization, the share of health and education expenditures increases by approximately 2.6 percent (Table 7). While the marginal effect of decentralization is

lower with the QMLE relative to the other estimators, we note that the finding that decentralization positively influences the share of health and education expenditures appears to be robust to a variety of estimation approaches.

Let us now turn to the other explanatory variables. The parameter for the interaction term for fiscal decentralization and industrial country status is negative and of various levels of significance in the two-way error component and difference GMM models. This result suggests that decentralization's influence on expenditure composition may be attenuated in industrialized countries. We must caution, however, that the estimated coefficient for the OECD interaction variable was neither significant in the System GMM model nor the QMLE estimator and that this result bears further investigation.

The coefficient for GDP per capita is positive and statistically significant in the errors components in levels and the QMLE estimator. The estimated coefficient for GDP, however, is not statistically significant in the GMM models. This result suggests that the estimated coefficient may be sensitive to the type of instruments included in the model and that we must use caution must in drawing inferences with regards to the influence of GDP on expenditure composition.

The positive and statistically significant coefficient for the budget balance in the two way error components and difference GMM models suggests that education and health expenditures may be vulnerable to cuts in times of economic crisis (International Monetary Fund, 2003; Lora & Olivera, 2007; Snyder & Yackovlev, 2000). Health and education expenditures would appear to fall at a greater rate than other components of total expenditures in times of economic turmoil. We caution, however, that the estimated coefficient for budget balance is not statistically

significant in the QMLE model, suggesting that this finding may not be robust to different estimation methodologies.

Regarding our composite measure of freedom, we note that the estimated coefficients appear to be fragile to estimator specification. Freedom is, however, statistically significant in the GMM and QMLE models, suggesting that increased political rights and civil liberties increase the expenditure share of health and education. We also examine whether the results are sensitive to alternative measures of corruption. A significant issue is that alternative measures of corruption are available for a limited period of time, thus reducing the sample size. Using data from Transparency International and the International Country Risk Group, however, we find that the results are indeed robust.[23]

In summary, we find robust statistical evidence from cross country panel data that decentralization affects the composition of public expenditures increasing the share of publicly provided private goods, as captured by public education and health. These results suggest that expenditure decentralization significantly influences the composition of public expenditures and that this finding is robust to alternative specification measures. Even at the lower bound of the results, expenditure decentralization shifts the composition of public expenditures towards PPPGs. Therefore these results offer strong support to Proposition 3 in our theoretical model.

5. Conclusion

This paper set out to suggest an indirect test of the allocative efficiency effects of decentralization by examining the role of decentralization on the composition of public expenditures. We investigate this issue from a theoretical viewpoint by means of a distance-sensitive representative agent model. By employing a two-dimensional space country framework

[23] These estimations are available upon request.

we are able to integrate two features of fiscal decentralization: the distribution of expenditure assignments between two levels of government and the composition of public expenditures into two types of public goods. This approach allows us to represent the heterogeneous nature of tastes within a representative agent model. Among other implications of the model, we find that decentralization leads to a higher share of publicly provided private goods in total government expenditures. Our empirical analysis strongly supports this prediction of the model based an unbalanced panel data set spanning 59 developed and developing economies over a period of 30 years.

The policy implications of our findings are intriguing. Decentralization trends all over the world are likely to result in a reallocation of resources in the public sectors from centrally provided PPGs to subnationally provided PPPGs. This higher emphasis of expenditures on education and health may not only yield increases in allocative efficiency and overall welfare, but also may support, given the key importance of expenditures on those services, national efforts for poverty alleviation and improving economic growth.

Table 1
Variables

Variable	Definition	Units	Source
Expenditure Composition	The ratio of education expenditures plus heath expenditures to total expenditures	Fraction (0-1)	Calculated from GFS
Fiscal Decentralization	The ratio of total subnational expenditures to total national expenditures	Fraction (0-1)	Calculated from GFS
Interaction Term	Fiscal decentralization multiplied by the industrialization dummy	Fraction (0-1)	Authors' Calculation
Budget Deficit	Current and capital revenue and official grants received less total expenditure and lending minus repayments as a percentage from GDP	Fraction (0-1)	Calculated from World Development Indicators (WDI)
Freedom	A composite index equal to ((14-political rights score – civil rights score)/12). The resulting index ranges from 0 (least free) to 1 (most free).	Fraction (0-1)	Freedom House and Authors' Calculations
Gross Domestic Product Per Capita	Gross Domestic Product divided by total population	One hundred thousand constant US Dollars	WDI
Population	Total population	10 millions	WDI
Population density	Total population divided by land area in square kilometers	Thousands	WDI
Industrial Dummy	1 for members of the OECD, 0 otherwise	0 and 1	Calculated

Table 2
Descriptive Statistics

Series	N	Mean	Standard Deviation	Minimum	Maximum
Expenditure Composition	1149	.334	.147	.052	.654
Fiscal Decentralization	1149	.235	.150	.016	.601
OECD Interaction Term	1149	.152	.185	0	.605
Budget Deficit	1149	-.017	.035	-.179	.142
Freedom	1149	.364	.226	.177	1
Population	1149	.358	.830	.006	7.651
Population Density	1149	.101	.128	.001	.843
Per Capita GDP	1149	.105	.097	.002	.460

Table 3
Sample Countries

Country	Years	Country	Years
Argentina	1978-79; 1981-2002	Australia	1972-2003
Austria	1972-1997	Azerbaijan	1994-1999
Bahrain	1975-1996	Belarus	1992-2002
Belgium	1978-1988	Bolivia	1986-2003
Brazil	1980-1994	Bulgaria	1988-2003
Canada	1974-2003	Chile	1974-88; 1992-2003
Costa Rica	1972-1985; 1987-1996	Croatia	1994-2001
Czech Republic	1993-2003	Denmark	1972-2003
Dominican Republic	1973-1996	Estonia	1991-2001
Fiji	1974-1993	Finland	1972-1997
France	1975-1993	Georgia	1997-2001
Germany	1972-96; 1999-2003	Hungary	1981-2002
Iceland	1972-77; 1979-2002	India	1974-1985
Indonesia	1975-1998	Ireland	1972-1997
Israel	1974-2002	Kazakhstan	1997-2003
Kenya	1972-84; 1986-1994	Kyrgyz Republic	1995-2001
Latvia	1994-2003	Lithuania	1993-2003
Luxembourg	1972-88; 1990-95;1998-99; 2000-2003	Malaysia	1972-81; 1985-1997
Mauritius	1980-85; 1987-99; 2002-03	Mexico	1972-2000
Moldova	1996-2003	Mongolia	1992-98; 2000-2002
Netherlands	1975-1997	New Zealand	1992-2001; 2003
Norway	1972-77; 1980-2003	Panama	1973-1994
Paraguay	1973-80; 1984-87; 1989-1993	Philippines	1978-1992
Poland	1994-2001	Romania	1981-2001
Russia	1994-95; 1998-2003	Slovak Republic	1996-2003
Slovenia	1993-2003	Spain	1972-85; 1987-2001
Sweden	1972-2002	Switzerland	1972-84; 1991-2001
Thailand	1972-2003	United Kingdom	1974-2000
United States	1972-2001	Uruguay	1973-84; 1989-1997
Zimbabwe	1976-1989		