Who Benefits from Increased Access to Public Services at the Local Level? A Marginal Benefit Incidence Analysis for Education and Basic Infrastructure

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Abstract

Do poor people benefit more or less than the nonpoor from an expansion in access to public services? And do those benefits depend on the existing level of access? Answering these questions is essential to strategies for empowering (or "investing in") poor people, but the lack of panel data or repeated cross-sectional data in poor countries has often made it impossible. This paper proposes a methodology for answering these questions using data from only a

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single cross-section survey. We argue that the methodology may be useful for monitoring the allocation of public expenditures in a context of decentralization, and we demonstrate this by applying it to local-level data from Bolivia and Paraguay. The results indicate that the marginal benefit incidence is higher (or at least not systematically lower) for the poor than for the nonpoor in education, but this is not the case for many basic infrastructure services. More generally, the poor seem to gain access only once the nonpoor already have high levels of access. This suggests that pro-poor policies must be implemented if the poor are to reap the benefits of gains in access faster.

Latin America has made substantial movement toward decentralization during the 1990s (Burki, Perry, and Dillinger 1999). As a result, expenditures for education, health, and access to basic infrastructure services tend to be managed more and more at the local level. Argentina and Brazil were among the first countries to decentralize, and other countries have followed suit. The best-known recent example is probably Mexico (Giugale and Webb 2000), although smaller countries, such as Bolivia and Paraguay, have also adopted decentralization laws.

Two of the main arguments in favor of decentralization are related to the ideals of efficiency and empowerment. From an efficiency point of view, it is often argued that local authorities have better information than central governments for deciding what types of programs and policies to implement, and how to target these interventions so that the poor benefit from them. From an empowerment perspective, it is also argued that providing resources and delegating decisions at the local level is good in itself because it lets local communities decide what they want and how to achieve their goals. When mechanisms are designed to channel more resources to poorer municipalities, decentralization has the potential to empower the poor.[1]

Although the flow of financial resources to local authorities has increased considerably in Latin America over the last decade, good accountability mechanisms by which the allocation of the funds at the local level may be monitored are still missing. In Mexico, for example, allocations to states and municipalities for new basic social infrastructure are now based on a formula that takes into account unmet basic needs. The formula has dramatically increased funding for the poorest

1. For a discussion of empowerment in the context of poverty reduction, see World Bank (2002).

states. One remaining challenge, however, is to design appropriate institutional management and control mechanisms to ensure that the funds are well spent. Many local governments lack the expertise and personnel to manage the funds, and few resources have been made available to help them hire new staff, train existing staff, or modernize their administration. Another potential danger lies in the risk of a political use of the funds at the local level, especially in states and municipalities where control mechanisms by civil society are weak.

Another important issue with the trend toward decentralization in Latin America is whether the funds allocated to local authorities benefit the poor, which would "empower" them. To measure who benefits from an increase in access to public services made feasible by the financial transfers to local authorities, it was necessary to conduct a marginal benefit incidence analysis. While traditional benefit incidence analysis provides information on who the current beneficiaries of access to public services are, marginal benefit incidence analysis focuses on the beneficiaries of improvements in access. In principle, to measure the distribution of gains in access, panel data—or at least repeated cross-sectional data—are necessary. In many countries, however, such data are not available, or are not comparable over time. The question, then, is whether marginal benefit incidence can be measured with a single cross-section of data. Following work by Lanjouw and Ravallion (1999), this paper argues that it is indeed feasible to measure marginal benefit incidence with a single cross-section of data. A key difference between this paper and previous work is that within the context of decentralization, we focus on marginal benefit incidence at the local, rather than at the national, level. Another difference is that we analyze marginal benefit incidence in a broader social welfare framework that takes into account relative deprivation, whereby individuals and households assess their level of well-being not only in absolute terms, but also by comparing themselves to others, the "others" being defined here as their geographic neighbors.

Our empirical work is based on household survey data from Bolivia and Paraguay, two countries that made substantial efforts toward decentralization in the 1990s.[2] The administrative structure of Bolivia consists of 9 departments and 311 municipalities. Decentralization has

2. For the brief review of the decentralization process in the two countries that follows, we are indebted to Diego Zavaleta for Bolivia and Estanislao Gacitua-Mario for Paraguay.

been promoted in this country through three main laws. First, in 1994, the Popular Participation Law doubled the share of national income channeled to local authorities, and modified the allocation mechanism from a formula based on local tax generation to a distribution according to population. The law also transferred to local authorities the management of the health and educational infrastructure, as well as that of local roads and sanitation systems. Second, the Administrative Decentralization Law adopted in 1995 redefined the departmental level by merging existing public organizations into prefectures. The law also transferred public investment responsibilities and resources to the departments, and it created coordination mechanisms with local (that is, municipal) authorities. Third and last, the National Dialogue Law adopted in July 2001 completed the transfer of the management of current expenditures for education and health to the municipalities. As in Mexico, the law also established a resource allocation criterion whereby municipalities with high rates of poverty receive a larger share of the debt relief transfers provided by the international community to the country as part of its participation in the Highly Indebted and Poor Countries (HIPC) initiative.

In Paraguay, departments and municipalities have also acquired important responsibilities and autonomy. Paraguay is composed of 16 departments, plus the capital city of Asunción, and 220 municipalities. According to the 1992 constitution, departments and municipalities have political, administrative, and financial autonomy. The departmental government consists of a governor and a departmental council (*junta departamental*) elected by popular vote to serve 5-year terms. The municipal government consists of a mayor (*intendente*) and a municipal council (*junta municipal*). The functions of the departments include (a) the coordination with the municipal governments of the delivery of public services, such as water, electricity, and others, that by their characteristics involve more than one municipality; (b) the preparation with the *junta departamental* of departmental development plans with a budget; and (c) the coordination with the central government of the provision of health and education services. Municipal governments are responsible for urban development and zoning, public education, health, water, sanitation, and social services, as well as the maintenance of municipal roads and public infrastructure.

Because Bolivia and Paraguay have both made important strides in the decentralization process, they represent interesting case studies for analyzing the marginal benefit incidence analysis of public services at the local level. It is important, however, to stress several of the limita-

tions of this paper. The main limitation is that we do not claim that the analysis provided here constitutes a thorough evaluation of the local allocation mechanisms observed in the two countries. A more detailed analysis would have to be undertaken to perform such an evaluation, especially given that there may be a disconnect between the responsibilities granted in principle to local authorities and the reality.[3]

A second limitation of the paper is that we focus on the measurement of the marginal benefit incidence at the local level rather than on the determinants of the local allocation of resources. As noted by Ajwad and Wodon (2001), a sizable literature explains the allocation of public services across and within jurisdictions. Tiebout (1956) has argued that if the residents of different areas value public services at different levels, varying levels of public provision should be allocated across areas, with voters sorting themselves into areas where the level of public goods and services maximize their utility (for more recent work along these lines, see Brueckner (2000); Hoxby (2000); Behrman and Craig (1987)). An unequal allocation of services between or even within areas (say, by municipality within a department) may also result from assigning weights to different groups in the objective function of local governments (for example, Ravallion and Wodon 2000, Ajwad 1999, Shoup 1989). Another strand of research argues that if the cost of providing public services varies from one area to another, this may also lead to different levels of provision across and within areas (for example, Hoxby 1999; Ajwad and Wodon 2001). This unequal allocation may be observed even if voters are homogenous in their preferences and governments weigh welfare gains equally across regions.

Finally, a cautionary note should be struck about the difference between locally based and nationally based marginal benefit incidence analysis. In general, one cannot assume that the results of a locally based analysis apply at the national level and vice versa. Assume, for example, that the unit of analysis at the local level is the department, such that households are ranked in various income groups (say, quin-

3. In Paraguay, for example, the decentralization process has been hindered by a lack of financial resources, a lack of professional staff, and a lack of clear organic laws. As mentioned earlier, departmental governments should in principle get substantial resources from the central government. In reality however, even though departmental funding has increased, the central government continues to control most of the resources, and transfers at the local level do not necessarily take needs into account.

tiles) within their department. This method of ranking has its benefits in the context of the evaluation of local allocation patterns. It must be noted, however, that although the poorest household in the richest department may be richer than the richest household in the poorest department, they will be treated in the same way in a locally based analysis, which may not be appropriate for an assessment of marginal benefit incidence at the national level. On the other hand, in a decentralized environment, or in a cross-country study, we believe that a local ranking is more appropriate.

An important result is that marginal benefit incidence at the local level appears to be strongly pro-poor only when the level of access (the benefit incidence) is very high. In primary education for example, where access rates are high, the poor do benefit much more than the nonpoor from increases in access. By contrast, for telephones, where access rates remain low, the nonpoor benefit from the bulk of the gains in access. Thus, a threshold effect exists (as pointed out by an anonymous referee), whereby the poor gain in access only once the nonpoor already have fairly high levels of access. This does not imply that local authorities favor the nonpoor. As discussed in Ajwad and Wodon (2001), the observation that, in general, gains in access to education are more pro-poor than gains in access to basic infrastructure is consistent with a policy by local authorities to maximize local access rates (that is, a policy that specifically targets neither the poor nor the non-poor). The results, however, do suggest that active pro-poor policies may be needed if the poor are to reap the benefits of increases in access earlier in the process of expanding access.

The paper is structured as follows. The first section presents a simple social welfare framework in which to consider marginal benefit incidence analysis. Together with a technical appendix, the next section presents the methodology used to estimate the marginal benefit incidence of public services. This is followed by the results for Bolivia and Paraguay. The paper concludes with a summary of the findings.

Analytical Framework

In this section, we provide a simple analytical framework for analyzing the inequality in the distribution of access to basic services and the impact on inequality of the distribution of new access.[4] The objective

4. The framework follows Siaens and Wodon (2002).

is to provide summary statistics to identify the current beneficiaries of access, and the beneficiaries of an increase in access. To use the tools developed for traditional welfare analysis, the simplest way to proceed is to assume that we know the value of access to a service, and that this value has been incorporated into the income or consumption aggregate of the household. In other words, because access to primary education for children or a connection to the electricity grid has a certain value for a household, this value is considered an income source. We also assume that access means usage (because it is usage that typically generates value), such that take-up of the service among those who have access does not need to be considered. Finally, we do not discuss the fees that users may have to pay for access. The bottom line of all these assumptions is that we limit our analysis to the distributional characteristics of who has access now and who gains access at the margin when access rates are improved.

If we denote by $\bar{y}$ the mean income (per capita or per equivalent adult) in the population and by F(y) the normalized rank of a household (weighted by the household's size and expansion factor) in the distribution of income (this rank takes a value of zero for the poorest household and one for the richest), the Gini coefficient of inequality, denoted by G_y, is defined as

$$G_y = \frac{2\,\mathrm{cov}\left[y, F(y)\right]}{\bar{y}} \tag{1}$$

When combined with mean income, the Gini coefficient can be used to derive the following social welfare function:

$$W = \bar{y}\left(1 - G_y\right) \tag{2}$$

In this function, a higher mean income leads to a higher level of social welfare. Higher inequality lowers social welfare. Sen (1976) and Yitzhaki (1982) provide different rationales for the use of this welfare function. In the case of Yitzhaki, the rationale relies on relative deprivation theory, whereby people assess their welfare in part by comparing themselves with others, which seems appropriate in a decentralization context if the peer comparison group is geographically defined.[5]

5. For a derivation of the connection between relative deprivation and the Gini coefficient, see Chakravarty (1990) and Yitzhaki (1982). Ebert and Moyes (2000) offer an axiomatic characterization.

The benefits from access to a service are denoted by x^A. For simplicity, we assume that the level of the benefits, denoted by B, is the same for all those who have access.[6] That is, if A is a dichotomous variable that denotes access, following Siaens and Wodon (2002), we have the following:[7]

$$\begin{cases} x^A = B \text{ if } A = 1 \\ x^A = 0 \text{ if } A = 0 \end{cases} \tag{3}$$

The Gini income elasticity (GIE hereafter) of the benefits from access to the service is then

$$\eta^A = \frac{\text{cov}\left[x^A, F(y)\right]}{\text{cov}\left[y, F(y)\right]} \frac{\bar{y}}{\bar{x}^A} \tag{4}$$

where $\bar{x}^A$ is the mean benefit from access computed across the population as a whole, including those who do not have access (that is, if the share of the population with access is denoted by p, $\bar{x}^A$ = B * p). When considering a new project, only the additional access provided by the project should be taken into account in the evaluation of the project's impact on the distribution of income. Yet equation (4) is useful to assess the project's distributional implications when new access is distributed in the same way as current access. Using a result from Yitzhaki (1999), it can be shown that if those gaining new access to the service have the same position in the distribution of income as those who currently have access, increasing access at the margin by multiplying the share of households with access by 1 + Δ, with Δ small, will generate a gain in social welfare equal to

$$dW = \left(\bar{x}^A \Delta\right)\left(1 - \eta^A G_y\right) \tag{5}$$

Of course, new access need not be distributed in the same way as current access. Imagine, for example, that new access to the service is distributed randomly among the households without access. In this

6. For a discussion of the impact of considering different values of the benefits for different households, see Wodon and Yitzhaki (2002a, 2002b).

7. If the willingness to pay for a service varies between households, the value of access to a service should not be constant across the sample (Siaens and Wodon 2002). Here, however, we focus on access as a dichotomous variable, without taking into account potential differences in the value of access between households.

case, the GIE for the benefits of new access would be equal to the following:[8]

$$\eta^{NA} = \frac{\text{cov}\left[x^{NA}, F(y)\right]}{\text{cov}\left[y, F(y)\right]} \frac{\bar{y}}{\bar{x}^{NA}} \tag{6}$$

where

$$\begin{cases} x^{NA} = 0 \ \textit{if} \ A = 1 \\ x^{NA} = B \ \textit{if} \ A = 0 \end{cases} \tag{7}$$

To find the impact on social welfare of the distribution of new access specified by (7), it suffices to replace η^{A} by η^{NA} in equation (5). Note also that if p is the population share with access, we have the following:

$$\eta^{A} * p + \eta^{NA} * (1 - p) = 0 \tag{8}$$

Although the distribution of new access could follow the pattern of current access, or of the current lack of access, it could also follow any other pattern. If we denote by x^{MA} (where MA stands for marginal access) the benefits from the actual new pattern of access, the GIE that we are interested in, is

$$\eta^{MA} = \frac{\text{cov}\left[x^{MA}, F(y)\right]}{\text{cov}\left[y, F(y)\right]} \frac{\bar{y}}{\bar{x}^{MA}} \tag{9}$$

Marginal Benefit Incidence Analysis with a Single Cross-Section of Data

With a single cross-section of data, estimating η^{A} and η^{NA} is easy. Information on marginal benefit incidence, however, is needed to estimate η^{MA}. This typically requires panel data, or at least repeated cross-sections to look at the distribution of changes in access over time. Unfortunately, panel data or repeated cross-sections are often not available in developing countries. Even when repeated cross-sections are available, they are often not comparable. This section discusses how to estimate the marginal benefit incidence of new access with a single cross-section of data.

8. In equations (6) and (7), the value of B is not actually part of the income aggregate of those who do not have access, and it remains included in the income aggregate of those who have access through the variable x^{A}. For computing the GIE at the margin, the expression is nevertheless appropriate.

Two papers—Ajwad and Wodon (2001) and Lanjouw and Ravallion (1999)—have proposed methodologies that use a single cross-section of data to identify the distribution of increases, at the margin, in access rates to public services or in outlays for social programs. Both studies used the variation in access rates across regions in a country to capture the expected evolution of access over time, assuming that the distribution of new access in lagging regions will follow the pattern observed in regions where access rates are higher.

At the conceptual level, the approaches used by Ajwad and Wodon (2001) and Lanjouw and Ravallion (1999) differ in the method used for ranking individuals, municipalities, or any other entities that are the basic units of observations. Lanjouw and Ravallion classify individuals as poor or rich according to their rank in the national distribution of income. Ajwad and Wodon classify individuals according to their rank in the local (that is, departmental) distribution of income, rather than at the national level. Under a decentralized system of government, a local ranking may be more appropriate. The social welfare framework presented above also stresses relative deprivation, which leads to a local ranking if the peer groups, according to which individuals assess their welfare, are geographically defined. For an assessment of the national impact of policies, however, a national ranking is probably more suitable.

At the empirical level, two differences exist between the approach of Ajwad and Wodon (2001) and that of Lanjouw and Ravallion (1999). The first difference lies in the manner in which the endogeneity bias in the estimation of the marginal benefit incidence analysis is dealt with. The technique used in both papers consists of regressing the access rate in a given quintile against the mean access rate. The mean access rate, however, includes information from the access rates in each quintile. To purge the mean from this endogeneity, Ajwad and Wodon use the leave-out mean as their right-hand side variable. That is, the access rate in any given quintile is regressed against the average of the access rates across all quintiles, except for the quintile for which the regression is performed. Lanjouw and Ravallion, on the other hand, use an instrumental technique, whereby the actual mean is instrumented by the leave-out mean. The second difference is that Ajwad and Wodon constrain the estimates of the marginal benefit incidence analysis to sum to one, and show that without such a constraint, the estimates will be biased downward.[9]

9. The estimates reported in Lanjouw and Ravallion (1999) are lower than one on average, but it would be easy to apply a similar constraint for their estimation.

This paper uses the method proposed by Ajwad and Wodon (2001). The method is outlined in some detail in the appendix. One last methodological issue must be dealt with before presenting the results. The method for estimating marginal benefit incidence provides information at the quintile level, not at the household level. This is the level of aggregation that must be used to compute the GIE for the distribution of improvements in access. It is well known that using group data implies a downward bias in estimates of inequality because the within-group component of the inequality measure is ignored. Wodon and Yitzhaki (2002c), however, show that using aggregate data for the estimation of the GIE rather than the Gini itself need not necessarily lead to a large bias. In this paper, since we estimate the GIE for marginal increases in access using quintile data, we also estimate with quintile data the GIE for the current distribution of access, and for an increase in access that would be randomly distributed among those who do not currently have access.

Empirical Results

The data employed, for both Bolivia and Paraguay, are nationally representative households surveys. In Bolivia, for education, we use the 1997 *Encuesta Nacional de Empleo*. For access to basic infrastructure, we use the 1999 *Encuesta Continua de Hogares—Condiciones de Vida*.[10] In Paraguay, we use the 1999 *Encuesta Permanente de Hogares*. In each country, the household-level observations are divided into five income intervals, or quintiles, with the ranking being local (the quintiles are defined within departments). As mentioned earlier, Bolivia has 9 departments, and Paraguay has 16. The question we are trying to answer is whether, at the local level, poorer households benefit more or less than other households from an increase in access to a number of public goods or services.

Table 1 presents basic statistics on access. The variables can be divided into two clusters, namely, enrollment in various education cycles and access to basic infrastructure services. In the education cluster, the preschool, primary school, and secondary school net enrollment rates are defined as the number of children of the appropriate age enrolled at each level of schooling divided by the number of stu-

10. We use the 1997 Bolivian survey for the education indicators because in the 1999 survey, due to the formulation of the questionnaire, the measures of school enrollment for the children are affected by holidays.

dents who fall into the appropriate age category. In the basic infrastructure cluster, access rates of electricity, pipe water, sewerage, and telephone are computed by dividing the number of households with access by the total number of households.

In Bolivia, the average enrollment rates are 89.7 percent and 48.7 percent for primary schools and secondary schools, respectively. Preschool enrollment appears to be very low, at 6.1 percent, but this may be because the questionnaire asks about enrollment only among children of at least five years of age. In Paraguay, the average enrollment rates are 22.0 percent, 94.8 percent, and 38.7 percent for preschools, primary schools, and secondary schools, respectively. In Bolivia, 71 percent of all households are connected to the electricity grid, 67 percent have access to pipe water, 40 percent have sewerage access, and about a quarter of all households have a telephone. The proportions for Paraguay are similar with access to electricity, water, sewerage, and telephone at 88 percent, 40 percent, 69 percent, and 18 percent, respectively. Table 1 also indicates that access rates vary widely by income quintile. As expected, a strong positive correlation exists between the levels of access to public services and per capita

TABLE 1. BENEFIT INCIDENCE ANALYSIS (SHARE OF POPULATION OR HOUSEHOLDS WITH ACCESS)

Income quintile				***Bolivia***			
	Preschools	*Primary*	*Secondary*	*Electricity*	*Water*	*Sewerage*	*Telephone*
Poorest	0.048	0.852	0.241	0.372	0.382	0.136	0.036
Q2	0.058	0.888	0.425	0.643	0.585	0.246	0.087
Q3	0.066	0.907	0.520	0.808	0.743	0.400	0.191
Q4	0.054	0.923	0.580	0.904	0.827	0.590	0.358
Richest	0.090	0.947	0.686	0.974	0.933	0.801	0.708
Mean	0.061	0.897	0.487	0.711	0.668	0.403	0.246
				Paraguay			
	Preschools	*Primary*	*Secondary*	*Electricity*	*Water*	*Sewerage*	*Telephone*
Poorest	0.212	0.914	0.255	0.790	0.178	0.465	0.032
Q2	0.188	0.926	0.326	0.847	0.312	0.610	0.090
Q3	0.198	0.979	0.358	0.922	0.452	0.766	0.206
Q4	0.277	0.976	0.481	0.943	0.545	0.811	0.264
Richest	0.292	0.982	0.594	0.954	0.701	0.914	0.447
Mean	0.220	0.948	0.387	0.882	0.407	0.688	0.183

Source: Authors' estimation from Bolivia's 1997 *Encuesta Nacional de Empleo,* Bolivia's 1999 *Encuesta Continua de Hogares—Condiciones de Vida*, and Paraguay's 1999 *Encuesta Permanente de Hogares*.

income. Enrollment rates in preschools, primary schools, and secondary schools increase with household income. The same is observed for access to electricity, pipe water, sewerage, and telephones.

The data in table 1 provide measures of mean benefit incidence (current access rates), but they do not inform us about the distribution of marginal gains in access when overall access rates are increased. To obtain marginal benefit incidence indicators, we proceeded as explained in the appendix. The marginal benefit incidence indicators provided in table 2 have been normalized, such that a value of one means that the households in a given income quintile benefit as much as the average household from an increase in access. If the marginal benefit incidence is below (or above) one, it means that the households in that income quintile benefit less (or more) from an increase in access than the average household. For example, the households in the first quintile in Paraguay benefit less than the average household from increases in access (or usage) for preschools, water, and telephone; more than the average household for access to primary education; and about as much as the average household for increases in access to secondary education and sewerage. Importantly, even when

TABLE 2. NORMALIZED MARGINAL BENEFIT INCIDENCE COEFFICIENTS

Income quintile	*Preschools*	*Primary*	*Secondary*	*Electricity*	*Water*	*Sewerage*	*Telephone*
				Bolivia			
Poorest	1.144	1.816	1.327	1.228	1.037	0.801	0.665
Q2	1.287	0.613	1.361	1.414	1.482	0.716	0.234
Q3	1.216	1.180	1.744	1.215	1.312	1.359	1.444
Q4	0.897	0.897	0.581	0.645	0.794	1.348	1.851
Richest	0.457	0.495	-0.014	0.497	0.374	0.776	0.807
Mean	1.000	1.000	1.000	1.000	1.000	1.000	1.000
				Paraguay			
	Preschools	*Primary*	*Secondary*	*Electricity*	*Water*	*Sewerage*	*Telephone*
Poorest	0.785	2.019	0.955	1.218	0.697	0.996	0.368
Q2	0.875	0.558	1.314	1.437	1.056	1.314	0.760
Q3	1.169	0.494	1.208	1.074	1.174	1.120	1.125
Q4	0.894	1.164	0.746	0.744	1.084	0.963	1.318
Richest	1.277	0.764	0.776	0.527	0.989	0.608	1.428
Mean	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Source: Authors' estimation from Bolivia's 1997 *Encuesta Nacional de Empleo*, Bolivia's 1999 *Encuesta Continua de Hogares—Condiciones de Vida*, and Paraguay's 1999 *Encuesta Permanente de Hogares.*

the marginal benefit incidence suggests that the poor benefit less than the nonpoor from gains in access, the poor still benefit more at the margin than they do currently. (See figure 1, which presents graphs of most of the results presented in tables 1 and 2. All estimates in figure 1 are normalized, that is, divided by the mean access or increase in access.)

In most cases, the marginal benefit incidence analysis gives similar results for Bolivia and Paraguay. Improvements in access to primary school are the most pro-poor, simply because most other groups of households already have access. Improvements in access to telephones are the least pro-poor, because in this sector, even those in the highest quintiles still lack universal access. Electricity and secondary schooling tend to be pro-poor at the margin, whereas the distribution of the gains in access for water and sewerage are more evenly distributed.

To summarize the quintile data provided in tables 1 and 2, we present GIEs in table 3. As discussed earlier, the GIE for access captures the current distribution of access. The GIE for lack of access represents how redistributive a marginal increase in access would be if it were distributed randomly among the households that do not currently have access. Because those with access tend to be less poor than those without access, the GIE for the lack of access is smaller (that is, more redistributive at the margin) than the GIE for the current pattern of access. The GIEs for the marginal benefit incidence are our estimates for the distribution at the margin of the gains in access. These GIEs are based on the marginal benefit incidence estimates presented in table 2. In most cases, the GIE for the marginal benefit incidence is within the interval provided by the GIE for the current pattern of access and the GIE for the lack of access. This is not very surprising, given that the richer among those who do not have access have a higher probability of getting access once access rates are improved. In Bolivia, however, for the three education indicators, the GIE for the marginal benefit incidence is slightly more pro-poor than if the gains in access were randomly distributed among those who currently do not have access.

Finally, figure 2 presents a scatter plot with the GIEs for all the services and for the two countries as a function of the mean access rate. A second order polynomial is fitted through the scatter plot to suggest the relationship. Services with low access rates have higher GIEs than services with low access rates. In other words, the higher the mean benefit incidence of the public service, the more pro-poor will be the distribution at the margin of an increase in access. For instance, pri-

FIGURE 1. NORMALIZED BENEFIT AND MARGINAL BENEFIT INCIDENCE FOR VARIOUS SERVICES

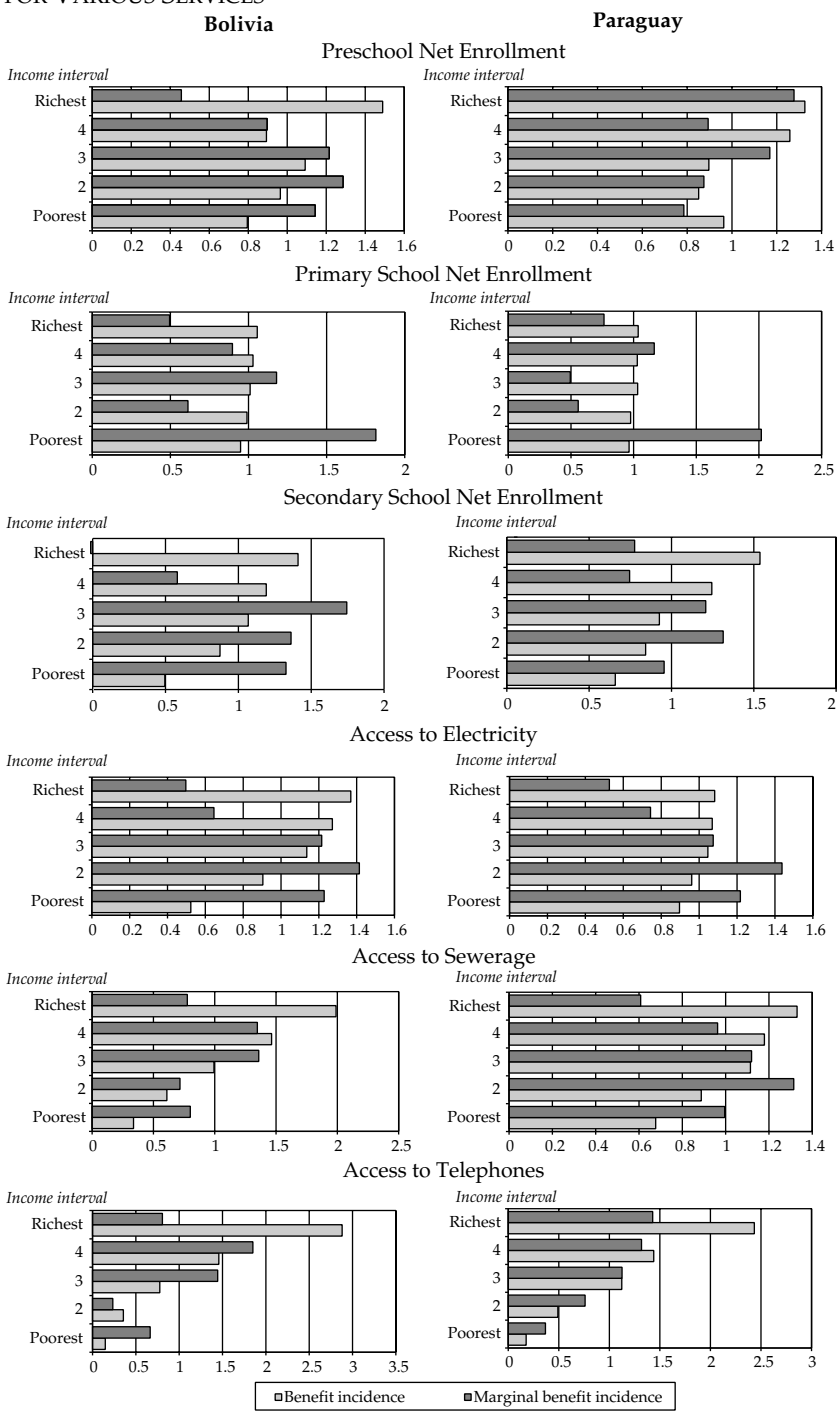
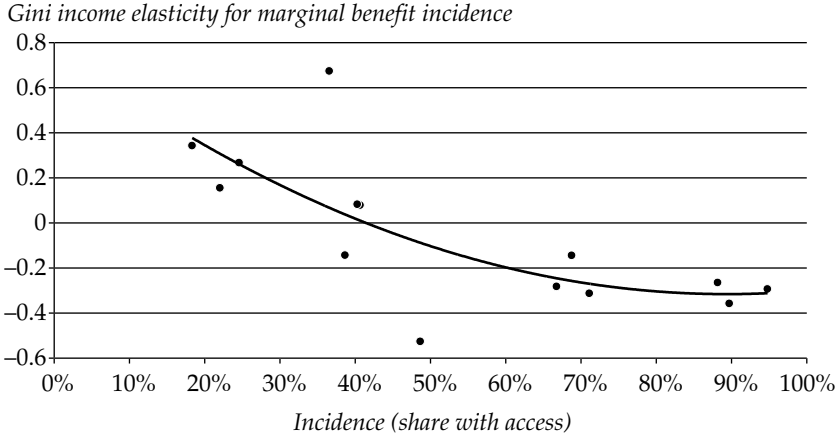


TABLE 3. GINI INCOME ELASTICITIES FOR THE MARGINAL BENEFIT INCIDENCE

		Bolivia	
	With access	*Without access*	*Marginal benefit*
Preschool	0.200	–0.013	–0.268
Primary	0.038	–0.335	–0.358
Secondary	0.326	–0.309	–0.526
Electricity	0.289	–0.712	–0.313
Water	0.282	–0.568	–0.283
Sewerage	0.583	–0.393	0.082
Telephone	0.921	–0.300	0.267
		Paraguay	
	With access	*Without access*	*Marginal benefit*
Preschool	0.175	–0.049	0.155
Primary	0.031	–0.557	–0.294
Secondary	0.334	–0.210	–0.143
Electricity	0.061	–0.456	–0.265
Water	0.402	–0.276	0.078
Sewerage	0.204	–0.450	–0.144
Telephone	0.699	–0.157	0.343

Source: Authors' estimation from Bolivia's 1997 *Encuesta Nacional de Empleo,* Bolivia's 1999 *Encuesta Continua de Hogares—Condiciones de Vida*, and Paraguay's 1999 *Encuesta Permanente de Hogares*.

FIGURE 2. GINI INCOME ELASTICITY FOR THE DISTRIBUTION OF GAINS IN ACCESS AND ACCESS LEVELS



mary schools in Bolivia and Paraguay have enrollment rates of 95 percent and 90 percent, respectively, according to the surveys, and GIEs are –0.294 and –0.386. The negative relation between the benefit incidence and the GIEs suggests that on average, the very poor start to benefit from public services only once the services are widely available to the nonpoor.

Conclusion

Within the context of decentralization in Latin America, the allocation of investments at the local level is an important decision for policymakers. Although funding for municipalities and departments has been increasing over time, good monitoring systems to assess how these funds are spent are lacking. The risk of capture by the better-off of the funds allocated to the social sectors and to the provision of basic infrastructure services may well be larger at the local level than at the national level. This is why it is important to provide good methodologies for measuring the distribution of the benefits from public expenditures at the local level.

This paper has proposed one such methodology. When it is applied at the departmental level (as we did in the empirical work), the methodology provides estimates of how, on average across all departments, increases in access to basic services are distributed within departments. To obtain measures of marginal incidence at a lower administrative level, the methodology could be applied by ranking households within their municipality instead of their department. In any case, the main empirical result of the paper is that the poor, and especially the very poor, appear to benefit from an increase in access to public services only once the nonpoor are already well served. In primary education, for example, the poor benefit more than the nonpoor from gains in access, because coverage is already high. In basic infrastructure services, however, the nonpoor continue to reap a large part of the gains in access.

If the objective is to reach the very poor, the results may inform priority sectors of investments, even though considerations other than marginal benefit incidence estimates should, of course, be reviewed before making sectoral policy choices. The results need not indicate that local governments favor the nonpoor, but they do suggest the need for pro-poor policies to accelerate the speed at which the poor benefit from the expansion of public social services.

Appendix: Estimation Procedure for the Marginal Benefit Incidence Analysis

Following Ajwad and Wodon (2001), consider a country with $i = 1, \ldots, N$ departments, and a number of households within each department. The households are ranked by per capita income and assigned to one of $q = 1, \ldots, Q$ income intervals. The ranking is done locally, which means that the intervals are defined within departments. We denote by x_{ij}^q the benefit incidence of a program or service in household j belonging to interval q and living in department i. This benefit incidence reflects the share of the population with access to the public program or service. The mean benefit incidence in interval q for households in department i is denoted by X_i^q, and the overall department mean is denoted by $\bar{X}_i$. If J_i^q is the number of households in interval q for department i, the two means are respectively equal to the following:

$$X_i^q = \sum_{j=1}^{J_i^q} x_{ij}^q \Big/ J_i^q \tag{A.1}$$

$$\bar{X}_i = \sum_{q=1}^{Q} \sum_{j=1}^{J_i^q} x_{ij}^q \Big/ \sum_{q=1}^{Q} J_i^q \tag{A.2}$$

To estimate the marginal benefit incidence, that is, who gains from an expansion in the program or service, we use the geographic variation in access both between households and between departments as a source of information for understanding the diffusion process that generates access. This is done by regressing the incidence in each of the intervals in the departments against the departmental means, using Q regressions:

$$X_i^q = \alpha^q + \beta^q \left(\frac{\sum_{q=1, j=1}^{Q, J_i^q} x_{ij}^q - \sum_{j=1}^{J_i^q} x_{ij}^q}{\sum_{q=1}^{Q} J_i^q - J_i^q} \right) + \varepsilon_i^q \qquad \text{for } q = 1, \ldots, Q \tag{A.3}$$

To avoid endogeneity, the right-hand side variable is computed at the departmental level as the mean on all the households, except for those belonging to interval q. Pooling all observations from the various intervals together, we estimate one regression:

$$X_i^q = \sum_{q=1}^{Q} \alpha^q + \sum_{q=1}^{Q} \beta^q \left(\frac{\sum_{q=1,j=1}^{Q,J_i^q} x_{ij}^q - \sum_{j=1}^{J_i^q} x_{ij}^q}{\sum_{q=1}^{Q} J_i^q - J_i^q} \right) + \varepsilon_i^q \tag{A.4}$$

In equation (A.4), the intercepts and slopes are allowed to differ for each interval, but there is an implicit restriction. It must be that across the various intervals, the average marginal increase in access from a unitary increase in mean access is one. It can be shown that the restriction is as follows:

$$\sum_{q=1}^{Q} \frac{\beta^q}{Q - 1 + \beta^q} = 1 \tag{A.5}$$

Writing β^Q, the parameter for interval Q in relation to the other parameters, yields the following:

$$\beta^q = \frac{(Q-1)\left(1 - \sum_{q=1}^{Q-1} \frac{\beta^q}{Q-1+\beta^q}\right)}{\sum_{q=1}^{Q-1} \frac{\beta^q}{Q-1+\beta^q}} \tag{A.6}$$

To take into account the restriction (A.6), (A.4) is estimated with nonlinear least squares. It can also be shown that a change in benefit incidence for the households belonging to quintile q in response to an increase in the aggregate incidence is as follows:

$$\frac{\partial X_i^q}{\partial \overline{X}_i} = \frac{Q\beta^q}{Q - 1 + \beta^q} \qquad \text{for } q = 1, \ldots, Q \tag{A.7}$$

The right-hand side values in (A.7) are the estimates of marginal benefit incidence. A value larger (or smaller) than one implies that the corresponding group of households benefits more (or less) than the average from an expansion in public programs and services.

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