Do local Governments maximize access rates to public services across areas?
A test based on marginal benefit incidence analysis

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Abstract

This paper investigates whether the poor benefit more or less than the non-poor from an expansion in public services and whether this depends on the type of service provided. Using data from Bolivia, this study investigates the allocation of education and basic infrastructure services across jurisdictions. Results indicate that the marginal benefit incidence is higher for the poor than for the non-poor in education, but lower in the case of access to infrastructure services. A model is proposed to suggest that the distribution of the observed marginal benefits from an expansion in the public provision of services is consistent with local Governments maximizing average access rates. This maximization appears to occur without policymakers taking into account distributional weights in their implicit social welfare function.

JEL classification: R50, I38, H42

Key words: Regional expenditures, benefit incidence analysis, education, infrastructure, Bolivia

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I. Introduction

Policy makers are often confronted with the problem of allocating public goods and services within their jurisdiction. In the presence of heterogeneous residents, the complexity associated with allocating these public resources is compounded. Examples of public service allocation mechanisms include those designed to maximize the policymaker’s chance of reelection, or those designed to produce an economically efficient distribution, or those designed to equate the value of resources or equate service outcomes.

There is a sizable literature on explaining the allocation of public services across and within jurisdictions. Three explanations for observing varying levels of public services are described below. First, if the residents of different areas value public services at different levels, then varying levels of public provision should be allocated across areas. This rationale was first put forward by Tiebout (1956), who suggested that fully mobile consumers (voters) would sort themselves into areas where the level of public goods and services maximize their utility (for more recent work along these lines, see for example Brueckner, 2000, Hoxby, 2000, Behrman and Craig, 1987). Second, an unequal allocation of services between areas may result from assigning weights to different groups in the objective function of local Governments and other organizations (e.g., Ravallion and Wodon, 2000, Ajwad, 1999, Shoup, 1989). Third, if the cost of providing public services varies from one area to another, this may also lead to different levels of provision across areas (Hoxby, 1999). This unequal allocation may be observed even if the preferences of the consumers in the various areas are the same, and if local Governments weigh welfare gains equally across regions.

This study focuses on the second and third of the above arguments. A simple framework for discussing various types of geographic allocation mechanisms from one administrative level to the level right below is presented. These objectives may for example be to equalize public expenditures or outcomes, or to equalize access rates to public services across heterogeneous sub-jurisdictions. Thereafter, an empirical test of whether a local Government’s observed pattern of expenditures is consistent with maximizing the average access rates of its services across geographic sub-jurisdictions is presented. The hypothesis is tested against three alternatives, namely a pro-poor allocation, a pro-rich allocation, or an allocation that equalizes service outcomes. These alternative hypotheses are a subset of the possible public service allocation outcomes and hence, the true objectives of policymakers may not necessarily be revealed by the analysis.

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2 Differences in access to public services between areas may both influence and result from Government decisions regarding geographic allocations (e.g., Pitt et al., 1995, van de Walle, 1999). There is also a substantial literature on using differences in access are often used for targeting Government and other programs (see, e.g., Wodon, 1997; Hentschel et al., 2000).
Consider a local government’s allocation of resources to education. To achieve the highest average level of education enrollment in public schools, resources would have to be allocated to the geographic areas that show the largest marginal gains in enrollment from spending increases. Local Governments maximizing average enrollment rates would allocate more funding to poor areas in their jurisdiction, possibly to increase the number of schools per unit area, because residents of rich areas tend to send their children to school anyway. This may occur because the rich are generally less constrained by distance and would travel to schools outside of their immediate neighborhood.

In the case of public spending for basic infrastructure services, such as access to electricity. Once a basic infrastructure network exists, it is typically cheaper to connect households in comparatively richer areas than to connect households living in poor areas. Richer areas tend to be located in closer geographic proximity to the existing electricity network than very poor areas, which are generally in sparsely populated, and hard to reach places. Thus, if access to electricity is not sufficiently high, and if the local Government is maximizing average access rates, investments in expanding access to the electricity grid benefit richer rather than poorer areas.

Section II of the paper presents a model of the optimal allocation of public resources for various types of services. The model can be used to model decision rules enabling local Governments to maximize average access rates of services when allocating investments for service expansion across geographic regions. Alternatively, local Governments may choose to take into account distributional weights (say, pro-poor or pro-rich) in their implicit social welfare function, or may equate service outcomes when making allocation decisions. Thus, the outcomes for public investments vary depending on the objective function of local Governments. Section III presents the methodology to empirically test, with a single cross-section of data, whether the poor benefit more or less than the non-poor from an expansion in public services. The objective here is to use the geographic variation in access rates as a proxy for variation through time in order to conduct a marginal benefit incidence analysis. The empirical methodology facilitates a test of whether the observed behavior on the part of local Governments is consistent with the hypothesis that average access rates across services are maximized. The test, using municipal level data on access to education and basic infrastructure in Bolivia, is presented in section IV. A brief conclusion follows.

II. Conceptual framework

This section extends a framework proposed by Ajwad (1999) for analyzing allocation rules for investments in public services by local Governments.

Consider an administratively autonomous unit, namely a department. The department is in turn divided into two municipalities - one with rich residents (R) and one with poor residents (P). The local
Government at the department level is responsible for public investments in two services: the provision of public schools and the expansion of access to basic infrastructure. In addition, it is assumed that two separate budgets are established for each of the services and that the local government has no discretion in allocating its budget between the two services. However, the policymaker has discretion over the allocation of the budgets to the two municipalities.

The department has an exogeneously determined budget constraint, \( E \), for each of the services. This budget can be allocated between the rich and the poor municipalities, subject to \( E = E_R + E_P \), where, \( E_R \) and \( E_P \) are the investments for expanding access in the rich and poor municipalities. The household access rate in each municipality is \( S_i = f_i(E_i), \) for \( i = R, P \). This specification enables municipality characteristics (e.g., wealth, distance from the existing infrastructure grid, etc.) to affect the impact of investment expenditures on access rates. The functions \( f_R \) and \( f_P \) are increasing and strictly concave, such that \( f_i'(E_i) > 0 \) and \( f_i''(E_i) < 0 \) for \( i = R, P \). Therefore, rates of access increase when investment expenditures increase but the marginal gains diminish with expenditures.

For any given level of expenditures, it is assumed that the access rate in the rich municipality is higher than the access rate in the poor municipality. In the case of both education and infrastructure, it is thus assumed that \( f_R(e) > f_P(e) \) for all expenditure levels between zero and \( E \). Thus, access to schools and to infrastructure is higher in the rich municipality. The crucial difference between infrastructure and education services is that for infrastructure, an increase in expenditures raises access rates more in the rich than in the poor municipality, so that \( f_R'(e) < f_P'(e) \) for all \( e \in [0, E] \). The higher marginal impact of expenditures on access rates in the rich municipality may arise because rich households tend to be located closer to the existing infrastructure grid than poor households do. Poor households tend to live in sparsely populated areas, which are often difficult to reach. Therefore the cost of providing access to an additional household living in the rich municipality is lower than the cost of providing access to an additional household living in the poor municipality. To prevent a corner solution whereby all public expenditures are spent in the rich municipality, we assume that the last dollar spent in the poor municipality has a larger impact on access rates than the first dollar spent on the rich municipality, i.e. \( f_P'(E) > f_R'(0) \).

For education, we assume that an increase in public expenditures raises the school enrollment rates more in the poor than in the rich municipality, so that \( f_P'(e) > f_R'(e) \) for all \( e \in [0, E] \). This is assumed to be true for example because those living in the rich municipalities will send their children to school anyway, for example to a school that is located at a distance, if their own municipality has a low density of public schools. In other words, the absence of a conveniently located school in a rich neighborhood is
assumed pose a smaller barrier to education than the absence of a school in a poor neighborhood. As in the case of infrastructure, corner solutions are avoided by assuming that the first dollar spent in the rich municipality increases the school enrollment rate by more than the last dollar added in the poor municipality, so that \( f'_p (E) < f'_r (0) \).

Figure 1 and 2 illustrate the profile of access to schools and infrastructure respectively as functions of local public expenditures. The access rate profile for the rich \((R_0 R_0)\) and poor \((P_0 P_0)\) municipalities are such the slope of the access rate production function in the poor municipality is always greater than the slope in the rich in the case of education, but the reverse is true for education. A combination \((P_0, R_0)\) would result if all the department’s funds were allocated to the poor municipality, while \((P_0, R_0)\) would result if all the funds were spent in the rich municipality.

The resource constraint \( E = E_R + E_P \) and the functions \( f'_i (E) > 0 \) for \( i = R, P \) can be combined to generate a transformation curve for the relationship between the access rates in both municipalities. Writing the access rates as \( S_R = f_R (E - E_P) \) and \( S_P = f_P (E_P) \) in the rich and poor municipalities, and totally differentiating these two functions yields \( dS_R = -f_R (E - E_P) \ dE_P \) and \( dS_P = f_P (E_P) \ dE_P \). Therefore, the slope of the transformation curve is:

\[
\frac{dS_R}{dS_P} = -\frac{f'_R (E - E_P)}{f_P (E_P)} < 0 \quad [1]
\]

With a fixed budget, a higher increase in the access rates through investment expenditures in one municipality implies that the increase in access rates in the other municipality will be lower. The transformation curve is concave since differentiating the above with respect to \( S_P \) yields:

\[
\frac{d^2 S_R}{dS_P^2} = \frac{\left( f'_p (E_P) \cdot f''_R (E - E_P) + f'_p (E_P) \cdot f'_R (E - E_P) \right)}{\left( f'_p (E_P) \right)^2} \cdot \frac{1}{f'_p (E_P)} < 0 \quad [2]
\]

Figure 3 and 4 plot the transformation curves for the access rates in the two municipalities for education and infrastructure respectively. Consider Figure 3. Point A, equivalent to the \((R_0, P_0)\) combination in Figure 1, is achieved if all available funds are distributed to the rich municipality, while point B, equivalent to the \((P_0, R_0)\) combination in Figure 1, results when \( E \) is fully spent in the poor municipality. If the policymaker has a higher implicit weight on the welfare of either of these groups, then one of these outcomes will be observed.

At G, average access rates are maximized (this is the point of tangency with a linear objective function giving equal weights to the poor and rich municipalities). At G, investment productivity is
equalized in the two municipalities; i.e. the slope of the transformation curve is minus one since maximizing the average access rate \( \left[ f_p(E_p) + f_R(E - E_p) \right] / 2 \) requires that \( f_p'(E_p) = f_R'(E - E_p) \).

Point C on the 45° line represents the allocation that equates the access rates in the two municipalities \( (S_R = S_p) \). At point C, the slope equals \( -f_R'(E_R) / f_p'(E_p) \), and given that \( E_p > E_R \), this ratio could be either greater or less than one in absolute value. For education, \( f_p'(e) > f_R'(e) \) and hence, the slope of the transformation curve is less than \(-1\) at C. On the other hand, \( f_p'(e) < f_R'(e) \) for infrastructure and hence, the slope of the transformation curve is greater than \(-1\) at C. Despite the ambiguity associated with the position of G relative to C, there is one conclusion that can be drawn from the model if its is assumed that authorities have one consistent goal regardless of the type of public services provided. Consider the goal of maximizing access rates in the department, regardless of the distributional outcomes.

To maximize average access rates, the Government chooses point G for both education and infrastructure. In the case of infrastructure or any other service for which the marginal impact of spending on access is higher in the rich municipality, G will be uphill from C, so that the rich municipality will be favored. By contrast, G will be downhill from C in the case of education or any other service for which the marginal impact of spending on access is higher in the poor municipality, so that the poor municipality will be favored. Thus, the relative position of G and C depend on whether the rich or the poor experience the highest impacts from investments in their respective municipalities.

The mechanics of the test are as follows. The change in access rates to public services are compared for services whose marginal benefit is higher for the rich for one of the services, while the marginal benefit for the other service is higher for the poor. If the poor municipality benefits more from new investments in education, and the rich municipality benefits more from new investments in infrastructure such as electricity, this will be consistent with the departmental authorities maximizing average access for each of the services.

Given the framework of the model, there are three other possible outcomes. First, increases in public service access benefits the rich for both infrastructure and education. This would suggest that policymakers place a higher weight on the welfare of the rich, possibly due to the lobbying power the rich possess. Second, increases in public service access benefits the poor for both services. This outcome may result if policymakers place a higher welfare weight on the poor or if policymakers pursue a strategy of equalizing outcomes for both services. The latter outcome could occur since current public service access patterns favor rich municipalities and hence, a pro-poor distribution of public services would erode the disparity between the municipalities. Third, increases in access to education benefit the rich while
increases in infrastructure benefit the poor. One possible explanation for this outcome could be that policymakers have a higher weight on the welfare of the rich and that private infrastructure providers serve the rich, but the rich consume public education.

In conclusion, using data on public investments in at least two public services, a test of whether the Government is maximizing average access rates is conducted. One of the public services chosen must have a larger impact on access in poor municipalities, while the other must have a larger impact in richer municipalities. If the allocation of public services follows the cost structure of providing access, it can be inferred that Governments are maximizing average access rates. Conversely, if the allocation of investments does not follow the cost structure and favors instead one municipality versus the other, then the Government could either be employing distributional weights, which favor either the rich or the poor, or may be attempting to equalize access to public services across municipalities.

III. Estimation procedure

To test whether local Governments maximize average access rates across municipalities, it is typically necessary to have panel data with information on both income and access to services for various areas or administrative entities over time. Such detailed data are often not available, especially for developing countries. In the case of Bolivia, a panel data set is unavailable, although reliable municipality level data are available from the census of 1996.

The data restrictions often encountered require a technique for identifying the beneficiaries of public service expansion using only cross sectional data. Wodon and Ajwad (2000) and Lanjouw and Ravallion (1999) propose alternative empirical methodologies that use a single cross section of data to identify the beneficiaries (i.e., the income groups) of increases in overall access rates.\footnote{The authors recognize that many other rational outcomes are ignored in this paper.} Both papers use the geographic variation in access rates across regions in a country to capture the expected evolution over time, had one region been followed over time. Thus, cross sectional variation in access rates are exploited to conduct a marginal benefit incidence analysis study.

The empirical strategy of this paper follows Wodon and Ajwad (2000). Consider a country with \( i = 1, \ldots, N \) departments, and a number of municipalities within each department. In the case of Bolivia, there are nine departments and almost three hundred municipalities. The municipalities are ranked by a
measure of income or wealth. More specifically, the municipalities are assigned to one of \( q = 1, \ldots, Q \) income or wealth-based intervals within each department. We denote by \( x_{ij}^q \) the benefit incidence of a program or service in municipality \( j \) belonging to interval \( q \) of 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 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 municipalities in interval \( q \) of department \( i \), the two means are respectively equal to:

\[
X_i^q = \frac{\sum_{j=1}^{J_i^q} x_{ij}^q}{J_i^q} \tag{3}
\]

\[
\bar{X}_i = \frac{\sum_{q=1}^Q \sum_{j=1}^{J_i^q} x_{ij}^q}{\sum_{q=1}^Q J_i^q} \tag{4}
\]

With \( Q=5 \), for instance, the bottom quintile in a department with 20 municipalities has 4 observations, while the corresponding interval in a department with 30 municipalities has 6 observations. The municipalities are ranked by wealth intervals at the departmental level. This method of ranking has its benefits and limitations. An obvious downside of this ranking is that the poorest municipality in the richest department may be richer than the richest municipality in the poorest department. However, there are instances in which this method of ranking may be more appropriate. In addition to this ranking method being more appropriate under conditions of decentralization, it is appropriate (even at the national level) if welfare improvements were to be evaluated using relative as opposed to absolute deprivation. That is, each municipality compares its level of access to public services not in absolute terms, but in terms of its relative position within a peer comparison group consisting of the other municipalities in the same department.

The method for estimating the distribution of marginal benefit incidence, i.e. who gains from an expansion in the provision of public services, consists of using the geographic variation in access (both between municipalities and between departments) as a source of information for understanding the diffusion process generating access. This is done by regressing the benefit incidence in each of the intervals against the departmental means, using \( Q \) regressions:

\[
X_i^q = \alpha^q + \beta^q \left( \frac{\sum_{q=1, j=1}^{Q, J_i^q} x_{ij}^q - \sum_{j=1}^{J_i^q} x_{ij}^q}{\sum_{q=1}^Q J_i^q - J_i^q} \right) + \epsilon_i^q \quad \text{for } q = 1, \ldots, Q \tag{5}
\]
In the first and poorest interval (q=1), for instance, [5] yields a regression of the mean level of program participation (or access to a public service) in the poorest municipalities in the various departments on the mean level of program participation in the corresponding departments. To avoid endogeneity, the right hand side variable is computed at the departmental level as the mean on all the municipalities except those belonging to interval q.

If all the intervals within a given department have the same number of municipalities (i.e., if \( J_i = i_J \)), we have \( \sum_{q=1}^{Q} X_i^q = Q \bar{X}_i \), and it can be shown that [5] simplifies into:

\[
X_i^q = \alpha^q + \beta^q \left( \frac{Q \bar{X}_i - X_i^q}{Q - 1} \right) + \epsilon_i^q \quad \text{for } q = 1, \ldots, Q \quad [6]
\]

We can pool all the observations from the various intervals together and estimate [6] as a single regression as follows:

\[
X_i^q = \sum_{q=1}^{Q} \alpha^q + \sum_{q=1}^{Q} \beta^q \left( \frac{Q \bar{X}_i - X_i^q}{Q - 1} \right) + \epsilon_i^q \quad [7]
\]

In [7], the intercepts and slopes are allowed to differ for the various intervals, 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. The restriction can be made explicit by totally differentiating \( \bar{X}_i^q = (1/Q) \sum_{q=1}^{Q} X_i^q \), so that:

\[
\sum_{q=1}^{Q} \frac{\beta^q}{Q - 1 + \beta^q} = 1 \quad [8]
\]

Writing \( \beta^Q \), the parameter for the last interval Q, in terms of the other parameters yields:

\[
\beta^Q = \frac{(Q - 1) \left( 1 - \sum_{q=1}^{Q-1} \frac{\beta^q}{Q - 1 + \beta^q} \right)}{\sum_{q=1}^{Q-1} \frac{\beta^q}{Q - 1 + \beta^q} + \sum_{q=1}^{Q-1} \frac{\beta^q}{Q - 1 + \beta^q}} \quad [9]
\]
To take into account the restriction \([9]\), we rewrite \([7]\) as:

\[
X_i^q = \sum_{q=1}^{Q} \alpha_q + \sum_{q=1}^{Q-1} \beta_q \left( \frac{\sum_{i=1}^{Q} X_i^q - X_i^q}{Q-1} \right) + \frac{(Q-1) \left( 1 - \sum_{q=1}^{Q-1} \beta_q \right)}{Q-1} \left( \frac{\sum_{i=1}^{Q} X_i^q - X_i^q}{Q-1} \right) + \varepsilon_i^q \tag{10}
\]

Equation \([10]\) can be estimated with non-linear least squares. Dropping the error terms and rearranging terms in \([6]\) yields:

\[
X_i^q = \frac{\alpha^q + \beta^q (Q / Q - 1) \bar{X}_i}{1 + \beta^q / (Q - 1)} \quad \text{for } q = 1, \ldots, Q \tag{11}
\]

Therefore, a change in program benefit incidence for the municipalities belonging to quintile \(q\) in response to a change increase in the aggregate incidence at the departmental level is given by:

\[
\frac{\partial X_i^q}{\partial \bar{X}_i} = \frac{Q \beta^q}{Q - 1 + \beta^q} \quad \text{for } q = 1, \ldots, Q \tag{12}
\]

The right hand side values in \([13]\) are the estimates of marginal benefit incidence. A value larger (smaller) than one implies that the corresponding group of municipalities benefits more (less) than all municipalities on average from an expansion in public programs and services.

**IV. Empirical results for Bolivia**

The Bolivian data employed is a census of municipalities conducted in 1996 and published by the Finance and Sustainable Development Ministries (Ministerio de Hacienda and Ministerio de Desarrollo Sostenible y Planificacion, 1998). Three groups of municipalities are considered: poor municipalities, rich municipalities, and municipalities with middle-range income levels. Since the ranking of the municipalities (i.e., their assignment to the \(Q\) intervals) is computed within each of Bolivia’s nine departments rather than nationally, the relevant comparison is between poor, middle, and rich municipalities within a given geographic area. Furthermore, the definition of which municipalities are
poor, middle, or rich is specific to each department\(^5\). The question is whether poorer municipalities benefit more or less than other municipalities from a departmental increase in access.

Table 1 presents summary statistics of the variables of interest for the municipalities as a whole and for each of the three groups. The variables of interest can be divided into two clusters for education and basic infrastructure services respectively. In the education cluster, the preschool, primary school, and secondary school participation rates are defined as the number of children enrolled in each level of schooling divided by the number of students who fall into the appropriate age category – gross enrollments.\(^6\) The average participation rates are 37.5 percent, 104.9 percent and 45.4 percent for preschools, primary schools, and secondary schools respectively. In the basic infrastructure cluster, access rates to pipe water, sewerage, electricity and telephone are computed by dividing the number of households with access by the total number of households in the municipality. On average, 43 percent of all households have access to pipe water while 10.6 percent of households have sewage draining facilities. Slightly more than a third (37 percent) of all households have access to electricity and 1.5 percent of all households have access to telephones.

As Table 1 and Figure 5 indicate, the mean access rates by wealth groups suggest, as expected, a strong positive correlation between the levels of access to public services and our measure of wealth. Participation rates in pre-, primary and secondary schools increase with municipality wealth. The same is observed for access to pipe water, sewerage, electricity and telephones. However, these are measures of mean benefit incidence, which do not necessarily provide adequate information as to the marginal gains in access obtained by the various groups of municipalities when access rates are increased. To obtain marginal benefit incidence indicators, we need to estimate regression [10].

The regression results are presented in table 2. The marginal benefit incidence indicators are given in table 3 and the graphical depiction of the marginal benefit and benefit incidence parameters are given in Figure 5. Due to the imposition of constraint [8], the average marginal impacts obtained from the regression estimates are always one. Overall increases in participation rates in pre-, primary and secondary schools appear to benefit poor and middle-income municipalities more than rich municipalities. The middle group shows the highest gains from increases in preschool and secondary school participation rates, while the poorer municipalities gain the most from increases in primary school participation rates.

As discussed in section II, these empirical results suggest that local Governments are maximizing average access rates in the field of education.

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\(^5\) To obtain this measure of wealth, we selected the first factor obtained from a factorial analysis of a large number of variables (but of course not including access to education and electricity) correlated with income and wealth at the municipal level.

\(^6\) These gross enrollment rates can assume values larger than 100 percent due to repetition and delay at entry.
For infrastructure services, poor municipalities exhibit the lowest levels of marginal benefit incidence for access to pipe water, sewerage, electricity, and telephones. For sewerage and telephones, the largest benefits from increases in access at the departmental level are captured by rich municipalities, while increases in access to pipe water and electricity tend to benefit the middle group the most. Again, these empirical results suggest that local Governments are maximizing average access rates in the field of infrastructure.

The higher marginal benefits for poor municipalities in the field of education services would of course be consistent with pro-poor distributional weights in the social welfare function of departmental Governments for these services. Similarly, the higher marginal benefits for rich municipalities in the field of infrastructure services would be consistent with pro-rich distributional weights for these services. But if we assume that distributional weights are consistent across services, then the results suggest that departmental Governments maximize average access rates for their services instead of favoring one special group of municipalities.

To test whether the differences observed between the three groups of municipalities are statistically significant, table 3 also presents the p-values of the test of the differences in the marginal impacts between the three groups. The difference in the marginal impacts between the poor and the rich are significant at the 5 percent level for participation in preschools and primary schools. For infrastructure, with the exception of access to pipe water where differences in marginal benefit incidence are not statistically significant, increases in access to electricity and sewerage are indeed captured more by rich than by poor municipalities.

V. Conclusion

The allocation of investments between municipalities is an important decision for policy makers. This paper presents a theoretical model to suggested that if sub-national Governments are maximizing average access rates to their public services, poor municipalities will benefit more than the non-poor municipalities from an expansion in education services, and less than non-poor municipalities for an expansion in infrastructure services (at least in these areas where access to basic infrastructure services remains far from universal). In addition, an empirical methodology to test these hypotheses with a single cross-section of data is presented.

In education, households living in poor municipalities benefit more than households living in middle-income or rich municipalities from departmental increases in enrollment do. This is observed for pre-schools and primary schools (for secondary schools, differences in marginal benefit incidence is not statistically significant). By contrast, in infrastructure, for sewerage, electricity, and telephone, the non-poor municipalities were found to benefit more than poor municipalities from a service expansion (access
to water is the only service for which poor municipalities benefit as much as other municipalities from an expansion of access).

These results are consistent with the hypothesis that Governments do not use strong distributional weights (whether pro-poor or pro-rich) in their allocation of resources. The results also underscore the fact that differences in so-called program capture can be expected between municipalities and types of services, even at the margin.
References


### Table 1: Summary statistics for access to public services at the municipal level, Bolivia 1996

<table>
<thead>
<tr>
<th>Service</th>
<th>No. Of Observations</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Poorest</th>
<th>Middle</th>
<th>Richest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preschool</td>
<td>291</td>
<td>0.373</td>
<td>0.078</td>
<td>0.268</td>
<td>0.400</td>
<td>0.454</td>
</tr>
<tr>
<td>Primary School</td>
<td>291</td>
<td>1.049</td>
<td>0.194</td>
<td>0.782</td>
<td>1.158</td>
<td>1.218</td>
</tr>
<tr>
<td>Secondary School</td>
<td>291</td>
<td>0.454</td>
<td>0.202</td>
<td>0.196</td>
<td>0.483</td>
<td>0.692</td>
</tr>
<tr>
<td>Water</td>
<td>291</td>
<td>0.431</td>
<td>0.195</td>
<td>0.193</td>
<td>0.431</td>
<td>0.673</td>
</tr>
<tr>
<td>Sewerage</td>
<td>291</td>
<td>0.106</td>
<td>0.109</td>
<td>0.017</td>
<td>0.043</td>
<td>0.262</td>
</tr>
<tr>
<td>Electricity</td>
<td>291</td>
<td>0.372</td>
<td>0.281</td>
<td>0.063</td>
<td>0.315</td>
<td>0.747</td>
</tr>
<tr>
<td>Telephone</td>
<td>291</td>
<td>0.015</td>
<td>0.017</td>
<td>0.000</td>
<td>0.006</td>
<td>0.040</td>
</tr>
</tbody>
</table>


### Table 2: Regression estimates for marginal benefit incidence analysis

<table>
<thead>
<tr>
<th>Service</th>
<th>Poor</th>
<th>Constant</th>
<th>Middle</th>
<th>Rich</th>
<th>Poor</th>
<th>Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preschool</td>
<td>-0.210**</td>
<td>-0.113</td>
<td>0.257**</td>
<td>1.120**</td>
<td></td>
<td></td>
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Source: Authors’ estimation using data from Ministerio de Hacienda and Ministerio de Desarrollo Sostenible y Planificacion (1998). Standard errors in parenthesis. ** indicates statistical significance at the 5% level, and * indicates significance at the 10% level.
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**Source:** Authors’ estimation using data from Ministerio de Hacienda and Ministerio de Desarrollo Sostenible y Planificacion (1998).
Figure 1: Access rates in education as a function of expenditures

Figure 2: Access rates in infrastructure as a function of expenditures
Figure 3: Access rate transformation curve for infrastructure

Figure 4: Access rate transformation curve for education
Figure 5: Benefit incidence and marginal benefit incidence for education and infrastructure

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Gross Preschool Enrollment

Gross Primary School Enrollment

Gross Secondary School Enrollment

Access to Piped Water

Access to Electricity

Access to Telephone Service

Access to Sewerage