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Does School Decentralization Raise Student Outcomes?: Theory and Evidence on the Roles of School Autonomy and Community Participation

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Abstract

Using data on primary schools in 10 Latin-American countries, we estimate the impact of decentralized school decision-making on student performance. We develop a model that shows that local autonomous effort will be jointly determined with student academic performance. The model predicts that least squares estimates are biased toward finding a positive impact of school autonomy on student performance. Empirical tests confirm these predictions. Least squares estimates show a strong positive effect of decentralized decision-making on test scores, but these results are reversed after correcting for the endogeneity of school autonomy. However, results support the role of parental participation in the schools as a positive influence on student achievement.

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Does School Decentralization Raise Student Outcomes?: Theory and Evidence on the Roles of School Autonomy and Community Participation

In Latin America, as in much of the developing regions of the world, schools frequently fail to produce desired levels of literacy and numeracy. Part of the problem is alleged to lie with over-centralized bureaucracies that attempt to control from a distance what can or should occur in classrooms. Schools are not given the administrative and financial flexibility to deliver education relevant to the students they serve. As a response to this perceived failing, countries around the globe have initiated programs designed to encourage school autonomy and/or community participation. Underlying these programs is an assumption that decisions made at the local school level make schools more productive. Yet few studies have been able to derive definitive estimates of the impacts of the policies on student outcomes.

This paper analyzes the impact of school autonomy and community participation on learning, both in theory and in the data. The theory shows that the local school manager would not exert effort to manage the school unless the effort would lead to better outcomes than would occur from implementing centrally dictated pedagogies or learning approaches. As a consequence, the cross-sectional pattern of school autonomy and measures of school outcomes will be biased toward finding a positive impact of decentralized decision-making on student performance. This hypothesis is tested and validated using a data set composed of individual child achievement test scores for 3rd and 4th graders in 10 Latin American countries. However, the impact of parental participation in school performance increases after controlling for sources of bias.

Among the findings of this study:

1) School autonomy and parental participation vary more within countries than between countries, suggesting that decentralization in practice depends more on local choice than on nation-wide decree or legislative fiat.

2) Theory suggests that the only schools that would exert autonomous managerial effort are those with the capacity to manage and that could access school supplies at a lower cost. Therefore, in cross section, revealed preference will generate a positive effect of practiced school autonomy on school outcomes.

3) Consistent with that presumption, empirical estimates show that schools that practice autonomous decision-making generate superior test scores. However, when correcting for the endogenous choice to exert managerial effort, the positive effect disappears.

4) Unlike school autonomy, parental participation has a significant positive effect on school outcomes whether or not parental effort is treated as exogenous or endogenous.

5) Taken as a whole, the study suggests that devolution of power to local schools cannot be accomplished by central mandates, but must take into account local incentives and local capacity to manage schools.

I. Background

The movement toward decentralizing responsibility for schools has become a global phenomenon (Fiske, 1996; Walker, 2002). In developed countries, some form of increased school-based management has been introduced in Australia, Canada, New Zealand, Spain, the United Kingdom, and in at least 44 states in the US. Among the developing countries, Burkina Faso, Brazil, Chile, El Salvador, Honduras, India, and Nicaragua have also introduced new programs aimed at devolving power to the local schools. Interestingly, autocratic governments

such as the military regimes in Argentina and Pakistan have initiated decentralization efforts in their school systems, so a functioning democracy is not a necessary precondition for school decentralization.

These decentralization efforts have taken numerous different forms, including downsizing the central educational bureaucracy and modifying its functions, moving authority and responsibility to local levels of government, introducing school-based management and community-based school financing, performance-based financing schemes, deregulating the choice of school books and materials, and expanding school choice through vouchers, charter schools or open enrollment programs.[1]

These decentralization efforts have also involved great variation in the range and manner of decision-making at the school level (Espínola, 2002). The local decision-maker could be one or more agents including the principal, the teachers, parents and members of the community. The decisions and responsibilities relate to one or more decisions including curriculum planning, setting academic standards, evaluating students, choosing school materials, maintaining the school, and hiring and evaluating personnel. In this study, we abstract from the particular mechanism used to effect decentralization, but rather concentrate on how they are manifested in two measures of the degrees of freedom accorded to the local authority to run the school. The first, school autonomy, is taken as the power accorded the local school administration to make these decisions. The second, community participation, is taken as the power accorded the local parents and/or community members to affect those same decisions. Our aim is to measure the impact of these two loci of control on student outcomes.

[1] For background on these programs, see Peterson and Cambell, 2001; Lauglo, 1995; Whitty, Power, and Halpin, 1998; and McEwan and Carnoy, 2000).

There is no *a priori* reason for these two decisions to be located at one level or another of the education bureaucracy. In fact, these decisions are the responsibility of the central governments in some countries, regional authorities in others, and local authorities in others, and many countries allocate a subset of these decisions to each of these levels (OECD, 1998; 2000; Walker, 2002; Winkler and Gershberg, 2002). However, the recent move toward more local control is motivated by the belief that decentralized control will result in better school outcomes, holding constant the level of resources devoted to the school. Local decision-makers should have more information on local needs and conditions and can adjust resource allocations accordingly. Central dictates that are aimed at maximizing welfare on average may oversupply the service in some areas and undersupply it in others. Local officials have an incentive to act on local needs because they are more prone to pressure by their constituents and they also need to compete against other communities to attract or retain residents. In addition, there is a general suspicion that decisions made from the center are inefficient, given the widespread collapse of centrally planned economies in the late 1980s and early 1990s.

Given these strong prior beliefs regarding the relative efficiency of local rather than centralized school decisions, the empirical record concerning the impact of decentralized decisions on school efficiency is mixed. Several studies have found evidence supportive of local autonomy. Jimenez and Sawada (1999) found that student attendance in El Salvador improved in schools that were subject to reforms that shifted responsibility to the school. McEwan and Carnoy (2000), Carnoy and McEwan (2001) and Vegas (2002) in Chile and King, Ozler and Rawlings (1999) in Nicaragua found that student test scores performance improved in at least some of the schools that were subject to similar interventions. Lindaman and Thurmaier (2002) found a positive relationship between fiscal decentralization and improvements in national

indices of human development. A general conclusion arising from these studies is that reforms that push the locus of decision-making towards the school tends to produce a more optimal mix and allocation of inputs. The more efficient resource allocation should, in turn, improve student behavior and performance.

That said, the relationship between more autonomy and better learning remains far from universal or uniform (Coleman 1990; Cotton n/d, and Savedoff, 1998; Finn, Manno and Vanourek, 2001; Hannaway and Carnoy, 1993). Part of the variation stems from an uneven application and enforcement of norms or legal division of powers. A considerable degree of variation exists between the level of decentralization and autonomy stipulated and codified in a given norm or law (*de jure* autonomy) and what actually occurs in schools (*de facto* autonomy). But even if norms or legal mandates were to be universally applied and enforced, school autonomy does not guarantee good results. Bardhan (2002) argues that autonomous decisions are particularly prone to fail in developing countries. First, populations may not be mobile, so inter-jurisdictional competition in quality of public services is unlikely to be a source of new migrants. Second, local officials may be subjected to undue influence by prominent local families for the allocation of public resources towards their needs. A related problem is that there may be no tradition of monitoring of local officials by local residents, so presumptions of greater accountability with local control may not in fact be true. Finally, local officials may lack necessary experience or skills to effectively manage resources in countries with few well-educated professionals. Any or all of these problems may create problems for decentralized systems.

We examine another reason why empirical studies may have yielded mixed results on whether decentralizing school management makes schools more efficient: that the decision by

the local authority of whether or not to exercise control is itself a choice and not determined exclusively by central mandates or constitutional fiat. Instead, the local authority can choose how much effort to exert in running the school, subject to legal restrictions on local discretion. Even the written law may not dictate local behavior if the central government's ability to enforce those restrictions is not absolute. As a consequence, the exertion of local authority must be treated as an endogenous variable. Estimates that treat the exercise of local authority as exogenous will yield biased estimates which could explain why different researchers find different results. For example, the local municipalities that opted to participate in Colombia's national voucher program were those municipalities that would atypically benefit from the program.[2]

Even experimental installation of a decentralization program will not capture the true effect of local authority on school efficiency because the local school authority may not accept the transfer of responsibility for the school. The findings of King and Ozler (2001) are a particularly appropriate example of this point. Their evaluation of the movement toward *Consejos Directivos* (autonomous school boards) in Nicaragua found no difference in school outcomes between the schools scheduled for the reform and those not scheduled for the reforms, a distinction which they termed *de jure* decentralization. However, significant improvements in student outcomes were found between schools that actually practiced decentralized decision-making *de facto* compared to those that did not. Although not presented in those terms, King and Ozler's distinction between the impact of *de jure* versus *de facto* decentralization on school outcomes can be recast as the difference in estimates between instrumental variables versus ordinary least squares estimates of the impact of decentralization. As we show in this paper,

[2] See King, Orazem and Wohlgemuth (1999) for information on the Colombia voucher program. Hsieh and Urquiola (2001) argue that the apparent positive effects of school vouchers on student outcomes in Chile is due to

these findings hold broadly with a simple theory of optimal local school decisions regarding whether or not to exert autonomous effort to manage the school, and with the evidence of school behavior and school outcomes across the 10 Latin American countries we examine.

The next section presents a theory describing the options available to a local school authority facing an infusion of resources from the central government and a legal structure that sets the decision-making parameters within which the school or the parents must operate in allocating those resources. This theory is then used to guide the estimation strategy used to measure the impact of school autonomy and parental participation on schooling outcomes. The data set we use in the estimation is described in section IV. Section V discusses the empirical findings and the last section suggests ways that the study could be extended.

II. Theoretical Model

We require a model that describes how the central and local authorities divide responsibility for managing the school. The model captures the stylized features of a multi-level school system: the central authority allocates resources to each school and sets rules on how the resources can be spent. The local authority has the option of expending its own resources in order to allocate the resources more efficiently, or it could accept the central dictates regarding resource allocation without expending any local managerial effort. The local decision regarding whether to exercise more control depends on the cost of exerting effort versus the potential gain from that effort in the form of improved student outcomes.[3]

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selection — the best students sort into private schools while the worst students remain in public schools.

[3] We assume that the school manager maximizes the social optimum, and so acts on behalf of the community preferences and not the manager's own. Consequently, we do not treat the manager's decision of whether or not to engage in corrupt practices.

A key variable affecting the decision of whether the school will optimally engage in autonomous decisions is the managerial skill of the principal or other local school managers. Rather than simply enforcing policies made elsewhere, a principal can become a champion and advocate of the school. Working in partnership with the staff, parents or local community, the principal can affect in-school processes, including staff, norms and the overall school climate, principals thus can exert a strong indirect influence on student achievement and outcomes (Rodriguez and Hovde, 2002; Borden, 2002).

Many factors can and do compromise efficiency of local service delivery. Foremost among these is the differential prices that local jurisdictions face in purchasing school inputs, attracting teachers, or acquiring information on new methods or materials. These prices rise with physical and socio-economic distance from the center. Poor, rural or otherwise isolated schools or those with difficult-to-serve populations find it difficult to attract qualified teachers, obtain timely school materials, or obtain in-service training or other academic support. These differential prices affect the ability of local authorities to effectively run the schools.

To begin, assume a school system consists of a central authority and a finite number of schools *N*. Each school's inputs, outputs and prices are denoted by the subscript *i*. Schools are heterogeneous in three dimensions: their managers' ability $h_i > 0$, autonomous effort $a_i \geq 0,$ and their distance to the central authority $d_i > 0$.

Schools maximize a measure of quality of learning, q_i, by investing their school inputs x_i into one of two alternative technologies denoted by superscripts c (centralized) and a (autonomous), where the a technology requires the input of the local manager's ability and autonomous effort. The application of local ability bears an opportunity cost from exerting effort, $w(a_i)$, which represents lost school production because the local authority is dividing

attention between management and school production. This opportunity cost is assumed to be rising in managerial effort ($w'(a_i) > 0$) at an increasing rate ($w''(a_i) > 0$). In contrast, c only requires the application of the central authority's suggested resource allocation which can be accomplished without any application of effort.

The central authority decides whether to let schools to choose technologies freely, or if not, what restrictions to place on local choice. The central authority also chooses a distribution rule that allocates resources or inputs across schools, given a fixed budget equal to *N*.

The price faced by the central authority in purchasing one unit of school input x_i is assumed to be $p_c = 1$. The local authority's relative price in input acquisition could be greater or less than the price faced by the center. The local price is assumed to be an increasing function of the school's distance from the center, such that $p_i = p_i(d_i) > 0$, and $p_i'(d_i) > 0$. For simplicity it is assumed that distribution of school inputs is costless for the central authority.

Without loss of generality, the central and local school technologies are given by:

$$\begin{aligned} &\text{Central technology: } q_i^c = x_i, \text{ and} \\ &\text{Local technology: } q_i^a = h_i x_i a_i - w(a_i) \end{aligned} \qquad (1)$$

Which technology is selected by the ith school depends on the centrally imposed rules regulating local school autonomy, and on the relative return to local autonomy which depends on h_i, d_i, a_i and their related impacts on q_i^a, p_i, and $w(a_i)$.

Scenario 1: The central authority allows schools to freely choose between technologies, but it transfers a unit quantity of school input, $x_i = 1$, to every school i. School i has the option of accepting the central allocation without exerting any effort or to apply their own expertise to the resource allocation, $x_i = 1$. Notationally, they choose a_i to solve:

$$\underset{a_i}{Max}\ \{q_i^c, q_i^a\} = \underset{a_i}{Max}\ \{1, h_i a_i - w(a_i)\} \qquad (2)$$

When the locally autonomous technology is selected, the first-order condition setting the optimum local effort, a_i^*, is

$$h_i = w'(a_i) \qquad (3)$$

which implies that the local authority will allocate effort so that its marginal product equals its marginal cost. Because of the higher return to effort, more able local managers exert more effort. The second order condition, $\frac{\partial^2 q_i}{a_i^2} = w''(a_i) < 0$, so the solution is always a maximum. Therefore, the local school authority's solution is

$$\begin{aligned} a_i &= 0 \text{ if } h_i a_i - w(a_i) \le 1 \\ a_i &= a_i^*, > 0 \text{ if } h_i a_i - w(a_i) > 1 \end{aligned} \qquad (4)$$

If every school adopted the centrally dictated technology, they would each set a_i =0, produce $q_i^c = x_i = 1$, and the aggregate production level would be *N*. If schools exert autonomous effort, aggregate output will be greater. Denote the first m^1 schools as those for which $q_i^1 = h_i a_i - w(a_i) > 1$. Under this scenario: total output for the school system, $q^1 = N - m^1 + \sum_{i=1}^{m^1} h_i a_i - w(a_i)$. By revealed preference, $q^1 > N$,

Keeping school inputs constant across schools, all those schools deciding to operate under the locally autonomous technology would produce higher quality learning than their non-autonomous counterparts. A consequence of this is that an ordinary least squares regression of q_i on x_i and a_i will yield a positive coefficient on a_i. However, this is not the true effect of

local effort a_i on q_i because we only observe $a_i > 0$ for the schools for which h_i is most productive.

Scenario 2: The central authority imposes the autonomous technology on all schools and allocates $x_i = 1$ for all i.

In this case, all schools will set a_i^* so that $h_i = w'(a_i)$. An implication is that $q_i^2 \leq q_i^1$, where equality holds only for those schools with $h_i a_i - w(a_i) \geq 1$. Under this scenario, total output for the school system $q^2 = \sum_i h_i a_i - w(a_i) < q^1$. In fact, depending on the number of schools that are constrained to exert autonomous effort suboptimally under Scenario 2 who would have decided not to choose autonomy under Scenario 1, q^2 could be lower than N. In other words, requiring autonomous effort by local schools could lower school outcomes below that level that would be achieved if the central authority imposed the central technology upon all schools.

Keeping school inputs constant across schools, imposing school autonomy upon all schools will produce lower quality of education in those schools with lower managerial ability, and could reduce aggregate student performance in the system.

Scenario 3. The central authority allows schools to freely choose between technologies. It allocates $x_i = 1$ to those schools that opt for the central technology, and makes a transfer of $\tau_i = 1$ to those schools that choose the autonomous technology.

In this case, school i has to solve:

$$\underset{a_i}{Max} \left\{ q_i^c, q_i^a \right\} = \underset{a_i}{Max} \left\{ \frac{h_i}{p_i} a_i - w(a_i) \right\} \qquad (5)$$

Schools that opt for the autonomous technology will equate $\frac{h_i}{p_i} = w'(a_i)$, where $\frac{1}{p_i}$ is the real value of inputs purchased by the local authority using the revenue transfer $\tau_i = 1$. Notice that even if $p_i > 1$, the local authority may still decide to choose the autonomous technology if local effort is sufficiently productive. The probability that the local authority will set $a_i > 0$ increases as h_i rises and as d_i falls. Denote the first m^3 schools as those for which $\frac{h_i}{p_i} a_i - w(a_i) \geq 1$. Under this scenario: $q^3 = N - m^3 + \sum_{i=1}^{m^3} \frac{h_i}{p_i} a_i - w(a_i)$.

Whether Scenario 3 results in higher average quality of learning than under Scenario 1 depends on how many schools can obtain school inputs cheaper than the central authority, and on how much cheaper. This implies that it is optimal for the central authority to transfer inputs if it can acquire inputs relatively efficiently, but it should transfer revenue to the local authorities if the latter can acquire inputs more efficiently. As distance from the center increases (or alternatively, as populations become more dispersed) the transfer of school inputs under Scenario 1 is more likely to dominate.

III. Estimation Issues

Our primary interest is in determining how school autonomy and parental participation in school affect schooling outcomes. Past studies of school productivity (Hanushek, 1986) have pointed to child, household, teacher and school characteristics in explaining school performance. This study adds measures of local control over the school as additional inputs into the educational production function. To be precise, an observed test scores for child i in school j in country k can be described by an equation of the form

$$q_{ijk} = f(z_{ijk}, x_{jk}, a_{1jk}, a_{2jk,,} \eta_{ijk}) \quad (6)$$

where q_{ijk} is the ith child's test score in school j and country k; z_{ijk} includes attributes of the child's parents, household and community; x_{jk} represents the level of educational materials provided in school j; a_{1jk} is the autonomous managerial effort exercised by the jth school principal in country k; and a_{2jk} is the autonomous effort exercised by the parents and the local community in managing the jth school in country k. The term η_{ijk} is a random error in the child's test score.

In principle, one could estimate a linearized form of (6) using an ordinary-least squares. However, the theory suggests that $x_{jk,}$ $a_{1jk,}$ and a_{2jk} are chosen in part based on their anticipated impacts on school outputs, and so all are jointly selected with $q_{ijk.}$ The reduced form equations for $x_{jk,}$ $a_{1jk,}$ and a_{2jk} will be of the form:

$$\begin{aligned} x_{jk} &= x(Z_{jk}, X_{jk}, A_k, d_{jk}, h_{jk,,} \varepsilon_{xjk}) \\ a_{1jk} &= a_1(Z_{jk}, X_{jk}, A_k, d_{jk}, h_{jk,} \varepsilon_{1jk}) \\ a_{2jk} &= a_2(Z_{jk}, X_{jk}, A_k, d_{jk}, h_{jk,} \varepsilon_{2jk}) \end{aligned} \quad (7)$$

where Z_{jk} is a vector of parent, school and community attributes in the local jurisdiction; X_{jk} is the central authority's allocation of inputs or revenues to the local jurisdiction; $A_{k,}$ is a vector of rules that limit or enhance the local authority's range of actions in managing the school; d_{jk} is a vector of measures of the physical or socioeconomic distance from the center; $h_{jk,}$ is the managerial capacity of the local authority; and the ε_{ijk} are a vector of random error terms. Because student outcomes depend on $x_{jk,}$ $a_{1jk,}$ and a_{2jk}, the error terms ε_{ijk} in (7) will be correlated with the error term η_{ijk} in (6), and least squares estimation of (6) will yield biased coefficients. However, $A_{k,}$, d_{jk}, h_{jk} exogenously shift the probability of local autonomous effort exercised by the principal or the local community and the level of school inputs used in the school. The empirical work that

follows uses measures of these variables as instruments to identify $x_{jk,}$ $a_{1jk,}$ and a_{2jk} in order to estimate (6). We review the estimation strategy in greater detail below after we introduce the features of the data set.

IV. Data

We decompose local autonomy into two parts, the autonomy exercised by the principal, and the degree of the participation of the local parents and community. To investigate their impact, we rely on a multi-country survey carried out in 1997 over 10 Latin American countries by the Latin-American Laboratory of Quality of Education (LLECE). Our sample includes 3rd and 4th graders in Argentina, Bolivia, Brazil, Chile, Colombia, the Dominican Republic, Honduras, Paraguay, Peru, and Venezuela.[4] The samples were stratified to conform roughly to the distribution of children in public and private schools and in urban and rural areas in each country.[5]

In addition to collecting test scores on sampled children in each school, self-applied questionnaires were given to the school principal, to the teachers, to parents (or legal guardians) of the tested children, and to the children themselves. In addition, surveyors collected information on the socioeconomic characteristics of the community. Appendix Table 1 reports the variable definitions and information sources and Appendix Table 2 reports the sample statistics for those variables. For apparently random causes, the number of observations for

[4] The LLECE also collected data on Costa Rica, Cuba and Mexico. The LLECE did not include the Costa Rica observations in the data set because they felt the data were unreliable. We exclude Cuba from the main analysis because we judge this information unreliable. Cuba, with the most centrally directed economy and lacking a democratic government nevertheless has unusually high levels of school autonomy and parental participation. Moreover, the data did not include any information on age on children in Mexico and Mexico is therefore not included in the estimations.

[5] For a detailed description of the a priori exclusions in each country, consult Table 6 of the Technical Bulletin of the LLECE.

children taking the mathematics and language exams differed, but sample statistics did not differ much between the groups of students taking the two exams.[6]

A. Empirical definitions of autonomy, participation and school supplies

The LLECE survey contains multiple measures of the level of autonomy that exists at the school level over resource allocation and on the level of parental or community influence over the school. Autonomy questions were directed to the principal regarding the degree of autonomy exercised by the school in hiring staff, allocating the budget, designing curriculum, disciplining and evaluating students, and organizing extra curricular activities.[7] Schools have the least autonomy in hiring and paying teachers. Schools also report having relatively low autonomy in selecting textbooks and allocating budgets. Autonomy with respect to discipline appears to be largely a matter determined within the school.

Our measure of school autonomy, $a_{1jk,,}$ is the weighted sum of these responses where the weights were generated by estimating the first principal component of the principals' responses. As reported at the top of Table 1, the first principal component explained 58% of the covariation of the eight responses used in the LLECE sample. All responses entered with positive weights. None of the later results we report were sensitive to variation in the factors used in the generation of the school Autonomy measure.

Participation, a_{2jk}, is taken as the weighted sum of teacher responses to questions regarding parental participation in the school. As before, the weights are set by principal components analysis, with a single factor loading capturing almost all the covariation in the responses.

[6] Each child was supposed to take both exams, but some only took one. In addition, there were apparently randomly occurring problems with matching test scores to parent, teacher and school variables.

[7] While the questions are not necessarily reflective of the principal's own exercise of authority as opposed to that exercised by the school staff as a whole, it is convenient to refer to the principal as the school manager.

We also include a factor analysis of a series of teacher responses to questions regarding the inadequacy of school supplies, which we take as an inverse measure of x_{jk}. Teachers indicated the extent to which various facilities and academic materials were insufficient for academic purposes. Wealthier schools or schools closer to the center should have superior facilities and educational materials, but creative applications of parental and principal effort may be sufficient to create adequate supplies for poorer and more remote schools.

The bottom of Table 1 includes the instruments used to measure Shortage. The first factor loading from the iterated principal components explained 60% of the covariation across the eight instruments used. Responses indicated widespread shortages of textbooks, but fewer problems with other supplies.

B. Stylized facts regarding autonomy, participation and shortage

We had thought that our measures of autonomy and participation would be mutually reinforcing so that schools with more autonomy would also invite more parental input. However, the pattern across our sample suggests that the two measures of local effort are virtually independent.[8] The simple correlation between the two measures across countries is only weakly positive. While it is possible that other measures of parental participation would be more strongly tied to school autonomy[9], in this data set, parental incentives to participate in the school are apparently not closely tied to the incentives for principals to exert autonomous effort.

The pattern of results across countries is also surprising. Cuba, with the most centrally directed economy and lacking a democratic government nevertheless has unusually high levels

[8] It is possible that parental and principal managerial effort would be substitutes rather than complements, in which case the simple correlation between parental and principal managerial effort would be negative.

[9] Our measure concentrates on parental interest in education and participation in school activities. Questions do not concentrate on parental participation on school committees, fund-raising campaigns or other more formal participation in school management that might be more complementary with the principal's efforts to manage the school.

of school autonomy and parental participation. Apparently, the exercise of local autonomous effort is not driven exclusively by centrally dictated rules, but is subject to local discretion.

Further evidence in that regard is found from ANOVA estimates reported at the bottom of Table 1. Many recent efforts to devolve control of schools from central to local authorities have involved the passage of new laws mandating the transference of power from the center to the periphery. If this assignment of responsibility by fiat were truly effective, we would expect that most of the variation in school autonomy in our data set would be across countries and not within countries. To the extent that the legal environment also dictates parental freedom to participate in local schools, we might expect much of the variation in parental participation to occur across countries and not within countries. These expectations are soundly rejected. Only 5% of the variation in school autonomy, 4% of the variation in participation and 18% of the variation in shortages could be explained by differences across countries in the LLECE data. In other words, 95% of the variation in autonomy, 96% of the variation of participation, and 82% of the variation in input shortages occur within countries. Thus, the exercise of autonomy and parental participation and the likelihood of adequate teaching supplies do not appear to be solely due to countrywide policies; they are instead determined primarily by local decisions.[10]

These findings are striking. If all countrywide factors including legally mandated locus of power for schools explain only a small fraction of the variation in local exercise of control over schools, then *de facto* power at local levels must come from sources other than those purely legislative in nature. Apparently, even in centralized systems, schools where children are not learning at expected levels may refuse to comply with central mandates that seem to compromise the effectiveness and/or efficiency of the teaching-learning process. Alternatively, in a

decentralized system, schools that do not feel capable of allocating school resources may simply adopt central policies or guidelines, lending the appearance of a centralized system.[11]

V. Regression Analysis

We now return to the estimation of the educational production function described by equation (6). We are concerned that local decisions regarding the adequacy of local school inputs, x_{jk}, local effort to exert school autonomy, $a_{1jk,}$ and local parental effort to participate in the school, a_{2jk}, may all be endogenous. The theory suggests that plausible instruments can be derived from measures of $A_{k,}$ d_{jk}, h_{jk}.

Our measures of A_k include measures of official educational policy regarding the locus of control and measures of the country's ability to enforce those policies. First, we established whether the legal center of control at the time of the LLECE survey was at the local, regional or national level, using a desk survey of the laws regarding responsibility for school personnel, school facility maintenance, and school curriculum. These measures, *Personnel*, *Maintenance*, and *Curriculum* vary from one to three with the highest values indicating that the legal locus of control exist at the national level and the smallest values indicating local control. The second measure of legal authority is taken from Kaufmann, Kraay, and Lobatón (2002) who derive estimates of the political environment of each country. The three measures we use included *Stability*: the likelihood that the current government system will persist; *Regulation*: the

[10] Ironically, this suggests that a school may choose not to exercise any authority over school policies, even when the opportunity exists. This lack of authority appears to be a function of discretion or management. We will return to this inconsistency later in the empirical estimation.

[11] An example of heterogeneous response to a central government policy was analyzed by King, Orazem and Wohlgemuth (1999). Colombia's central government created a plan hoping to induce municipal governments to offer private school vouchers. Many municipalities opted not to participate and many schools decided not to accept voucher students. Apparently, decentralization works best when it is compatible with actions the local authority was planning on undertaking in the first place.

stringency of the country's regulations on private enterprise; and *Rule of Law*: a measure of the country's ability to enforce its laws.

Our measures of d_{jk} were limited to a series of dummy variables indicating community size. Variation in prices faced by local schools in accessing school inputs are expected to differ by the remoteness of the community. However, test scores are also likely to vary across communities of differing size, so our measures of d_{jk} do not offer additional identification. Nevertheless, we single these measures out because they will help illustrate how the practice of decentralized decisions varies across different schools.

Finally, variation in local school managerial capacity h_{jk} is captured by a series of principal attributes including the principal's education, experience, training and mixture of responsibilities. The presumption from the theory is that more able principals are more willing to exert effort to allocate resources effectively, motivate the local community to participate in the school or to supply resources, and more able to avoid restrictive national policies. More able principals can combine available central and local resources to maximize the final product: student learning. This capacity of principals, too, varies across schools and with distance. Descriptions of the specific measures of principal skills used are included in Appendix Table 1.

Variation in parental and community managerial capacity is captured by measures of parental education and household attributes. The latter would also be expected to have a direct impact on their children's test scores, and so cannot be used to identify the endogenous variables. It is also possible that the principal's attributes may directly affect student outcomes, in which case they cannot be used as identifying variables. However, as we show below, none of our conclusions are sensitive to the inclusion or exclusion of principal attributes as identifiers.

A. Exogenous autonomy and participation

We first discuss the results from direct estimation of equation (6) without attempting to correct for endogeneity. These results are reported in the columns labeled 1 in Table 2. The results seem to accord well with the more common findings in other studies of school output in developing countries.[12] Boys do better in math while girls do better in language. Children do better in households with both parents present, with educated parents, with fewer siblings, and with books in the home. Better-educated teachers produce better-educated students. More uniquely, the results suggest that child labor lowers test scores and that female teachers outperform male teachers. With the exception of this last result, these findings are robust to changes in specification.

Turning to our measures of decentralization, we find that autonomy has a positive and significant effect on test scores when autonomy is treated as exogenous. When parental participation is treated as exogenous, it raises mathematics test scores significantly, but has a surprising significant negative effect on language scores. The shortage measure lowers test scores when treated as exogenous.

B. Estimates controlling for endogeneity

Results controlling for endogeneity are reported in the columns labeled 2 in Table 2. Applying the instruments makes the estimated adverse impact of *Shortage* larger, reinforcing the importance of adequate school facilities and supplies. Instrumenting parental participation results in a uniformly positive and significant effect on both mathematics and language scores. However, the sign on school autonomy turns negative for both mathematics and language tests. This last result is consistent with results reported for Nicaragua by King and Ozler (2001) who

[12] See Hanushek (1995) and Kremer (1995) for a discussion of the findings across numerous studies of educational production functions in developing countries.

found that actual (*de facto*) reported autonomy raised test scores while legal (*de jure*) authority for local control had no impact. It appears that the coefficient on actual practice of school autonomy is biased upward, as suggested by the theoretical result that a principal would only have an incentive to exert autonomous effort in schools where such effort could raise student performance. On the other hand, the coefficient on actual practice of parental participation in the school appears to be biased downward. Taken literally, this last result suggests that parents are more prone to exercise autonomy when the school is doing poorly, or alternatively, that parents do not have an incentive to intervene in school management when they perceive their children are performing well.

More insight into the impact of school autonomy and parental participation on student participation can be obtained from the simulations shown in Figures 1 and 2. These simulations show how predicted test scores vary according to measures of school autonomy or parental participation, holding all other child, parent, household, teacher, school and community variables fixed at their sample means. Figure 1 shows that when school autonomy is treated as exogenous, the most autonomous schools score about 4% higher than the least autonomous schools on both the mathematics and language exams. Correcting for the endogeneity, the most autonomous schools score 13% lower on the mathematics exam and 12% lower on the language exam compared to the least autonomous schools. In other words, all of the apparent positive effect of school autonomy on student performance is due to self-sorting of schools into the autonomous group who were atypically able to benefit from autonomous decisions.

Figure 2 shows that encouraging parental participation may be a more promising avenue for improving school outcomes than mandating school autonomy. Treating parental participation as exogenous, the schools with the greatest parental input have 5% lower language scores and

6% higher mathematics scores than otherwise identical children and schools with the least parental inputs. Controlling for endogeneity, the productivity differential associated with parental inputs rises to a positive 13% in language and 25% in mathematics.

C. Robustness

Several alternative specifications were attempted to examine how sensitive the results were to alternative assumptions regarding identification, and the use of one versus more measures of autonomy. A summary of these results is contained in Table 3. Each set of results contains the reference coefficients on *Autonomy* and *Participation* from Table 2, and estimates alternately excluding either measure of local managerial effort. We also include estimates that exclude the measures of principal attributes as instruments for *Autonomy* and *Participation.* All other variables included in Table 2 are included in these regressions but are suppressed for space. The full specification results are available on request.

When parental participation is included alone without school autonomy or when school autonomy is included alone without parental participation, the conclusions remain unchanged. The coefficients retain sign, significance and magnitude compared to their corresponding estimates from Table 2. Correcting for endogeneity, parental participation continues to have a positive and significant effect when treated in isolation, while school autonomy continues to have a negative and significant effect.

The results in the fourth column of the instrumental variables set result from including only the legal environment variables, $A_{k,}$, as instruments, excluding the measures of h_{jk}. If principal attributes have a direct impact on test scores, they cannot be used as instruments. As is clear from Table 3, the results for instrumented parental participation and autonomy are not sensitive to the choice of instruments. The conclusions that least squares estimates of the impact

of school autonomy on student performance are biased upward and those of parental participation are biased downward are robust to choice of instruments.

D. Determinants of school autonomy and parental participation

It is also interesting to evaluate the reduced-form equations (7) explaining variation in school autonomy, parental participation, and shortage of school materials. These equations are reported in Table 4. Principal characteristics h_{jk} were strongly tied to the degree of autonomy and participation practiced at the school. Compared to principals with general degrees, principals with degrees from teacher's colleges exercised less autonomy and experienced more shortages, but they also induced more parental participation. Principals' prior teaching experience increased autonomy and participation, but having more experience as a principal had the opposite effect. Principals who also had teaching responsibilities acted more autonomously, induced more parental participation and had fewer shortages. Principals who attended training related to their administrative responsibilities exercised more autonomy and experienced fewer materials shortages with no apparent effect on parental participation.

The country's written laws A_k regarding legal authority for school management affected autonomy, participation and shortage, but not in easily explainable ways. More centralized legal responsibilities for school personnel decisions had the odd effect of inducing more localized control and more shortages. More centralized legal responsibility for school maintenance lowered local autonomous effort by both principals and parents, and centralized locus of authority over curriculum also lowered principal's managerial efforts. Measures of the government's stability, regulations, and rule of law had opposite effects on autonomy and participation. It is enough to say that the legal environment matters, but not in a way that suggests how a central policy should be structured to encourage more autonomy or parental

participation. Given that most of the variation in local effort to manage the schools was within rather than across countries, it is unlikely that national policies offer a viable avenue for driving decentralization, even if the impacts were more consistent.

There is evidence that local autonomous managerial effort requires a community with a more developed human capital base, Z_{jk}. School autonomy is practiced more commonly in communities with more educated parents or parents with more books in the home, with more educated teachers, in bigger schools, and in more populated communities. In most cases, these factors were also associated with more parental participation and fewer shortages of school materials.

VI. Conclusions

The main findings of the paper are summarized at the end of the introduction and so will not be repeated here. Our findings suggest that more autonomous schools appear to perform better, but that the practice of autonomy appears to be only loosely related to national policies regarding the locus of control over the schools. Furthermore, the actual practice of autonomy is most likely in schools that can profit from that autonomy, and so we cannot project results to schools that are not currently autonomous. Consequently, a national policy mandating decentralization by itself will likely be ineffective, and may lower school outcomes overall if it forces schools with weak managerial potential to adopt local managerial effort.

Our results accord well with concrete examples from the Region. In Nicaragua, it was precisely the better-performing schools that were accorded autonomy first. In Bogota, Colombia, the city was legally obligated to reorganize its administrative and fiscal rules prior to decentralizing its education system to insure local capacity to manage schools. Similar findings

suggest that communities or students who take advantage of vouchers are also those who would atypically benefit from the program.

Anecdotal evidence suggests that decentralization in Nicaragua and Bogota made already better-performing schools even better. However, one cannot presume that their experiences would generalize to all schools, independent of local capacity to manage. Most institutions at the lower end of public bureaucracies, such as schools, tend to be weak, lacking the leverage, skills and capacities to challenge bureaucratic rigidities in input allocation, personnel decisions, and curricular decisions. Absent any means of insuring the existence of a threshold level of these needed managerial skills, no policy granting greater autonomy is likely to result in much gain.

The case for parental participation in schools is more promising. Cross sectional regressions of student academic performance on parental participation are biased against finding a relationship, apparently because parents are more likely to intervene when the school is performing badly. Correcting for endogeneity, the impact of parental participation on student test scores turns strong and positive. This suggests that policies that increase incentive for parents to participate in the schools can have a significant positive effect on their children's achievement.

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Figure 1: Predicted Test Scores by Level of School Autonomy
based on OLS and IV estimates from Table 2 evaluated at sample means

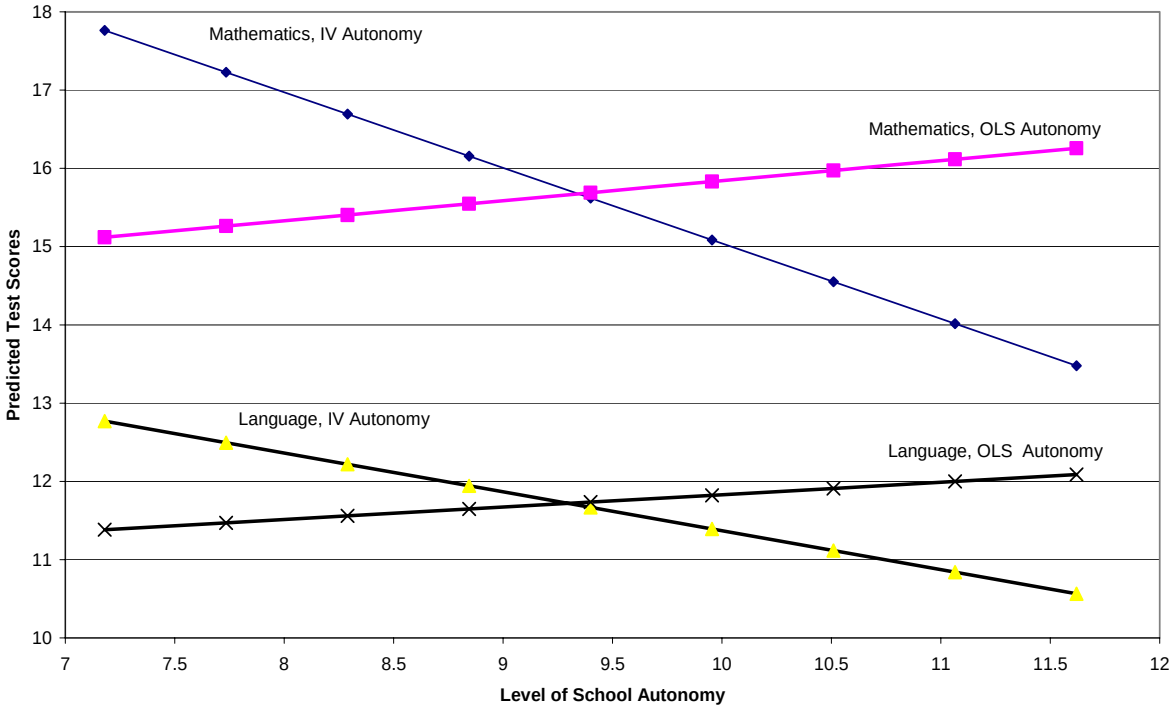

Figure 2: Predicted Test Scores by Level of Parental Participation
based on OLS and IV estimates from Table 2 evaluated at sample means

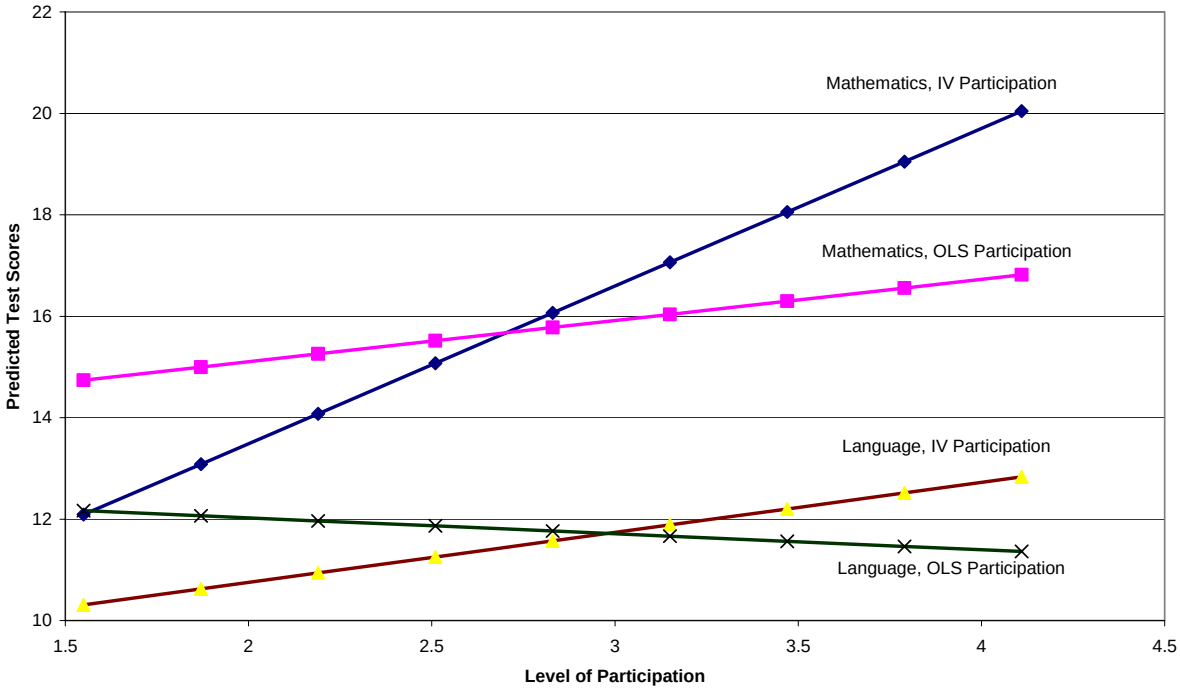

Table 1 – Summary information on construction of measures of autonomy, participation, and school shortages

A. Responses used in the creation of the Autonomy variable

Asked of principal: With 1= no autonomy; 2= some autonomy; and 3= high autonomy; what degree of autonomy does school have in:

hiring personnel? (1.70; 0.55)[a]
allocating budget? (1.86; 0.59)
choosing textbooks and materials? (2.32; 0.50)
admissions, suspensions or expulsions? (2.39; 0.44)
student promotions? (2.77; 0.26)
setting disciplinary regulations? (2.54; 0.58)
setting curricular priorities? (2.55; 0.62)
planning and executing extracurricular activities? (2.68; 0.51)

First factor loading using the iterated principal factor method explained 58% of the covariation across the eight autonomy indicators.

B. Responses used in the creation of the Participation variable

Asked of the teacher: With 1= low; 2= medium; and 3= high; what is the level of parental participation in:

school activities? (1.72; 0.77)[a]
interest in the child's development? (1.79; 0.77)

First factor loading using the iterated principal factor method explained 100% of the covariation across the three participation indicators.

C. Responses used in the creation of the Shortage variable

Asked of the teacher: With 1= adequate and 2=inadequate; what is the level of:

classroom lighting? (1.25; 0.48)[a]
classroom temperature? (1.41; 0.41)
classroom hygiene? (1.20; 0.49)
classroom security? (1.30; 0.60)
classroom acoustics? (1.44; 0.42)

Asked of the teacher: With 0= yes and 1= no; do the students have:

language textbooks? (0.17; 0.55)
math textbooks? (0.33; 0.64)

Asked of the teacher: With 0= yes and 1= no; are there enough textbooks so that the students have:

one textbook each? (0.42; 0.58)

First factor loading using the iterated principal factor method explained 60% of the covariation across the eight inadequacy indicators.

D. ANOVA Evaluation of Autonomy, Participation and Inadequacy variables

ANOVA analysis of Autonomy:	95% of the variation in Autonomy is within country 5% of the variation in Autonomy is across countries
ANOVA analysis of Participation:	96% of the variation in Participation is within country 4% of the variation in Participation is across countries
ANOVA analysis of Inadequacy:	82% of the variation in Inadequacy is within countries 18% of the variation in Inadequacy is across countries

[a] Average value and factor loading in parenthesis.

Table 2 - Least Squares and Instrumental Variables Equations Explaining Test Scores

		Mathematics		Language	
	Variable	Least squares[a]	Instrumental Variables[b]	Least squares[a]	Instrumental Variables[b]
	Autonomy	0.256*	-0.965*	0.158*	-0.497*
		(0.029)	(0.124)	(0.019)	(0.079)
	Participation	0.812*	3.107*	-0.314*	0.985*
		(0.055)	(0.373)	(0.040)	(0.240)
	Shortage	-0.288*	-0.396*	-0.275*	-1.543*
		(0.045)	(0.161)	(0.029)	(0.098)
Child	Age	0.068	0.111*	0.047	0.005
		(0.037)	(0.045)	(0.025)	(0.027)
	Boy	0.727*	0.861*	-0.331*	-0.313*
		(0.091)	(0.100)	(0.059)	(0.065)
	No Preschool	-0.715*	-0.588*	-0.277*	-0.316*
		(0.115)	(0.133)	(0.076)	(0.084)
	Work Outside	-1.305*	-1.278*	-1.082*	-1.085*
		(0.061)	(0.069)	(0.040)	(0.044)
Parent/Household	P Educ	0.646*	0.907*	0.652*	0.891*
		(0.370)	(0.405)	(0.203)	(0.223)
	P Books	1.162*	1.118*	0.836*	0.956*
		(0.060)	(0.083)	(0.039)	(0.048)
	P Spanish	0.682*	-0.172*	0.890*	0.192
		(0.268)	(0.312)	(0.176)	(0.201)
Teacher	T Educ	0.089	0.238*	0.296*	0.341*
		(0.091)	(0.100)	(0.058)	(0.065)
	T Male	-0.694*	-0.045	-0.420*	-0.418*
		(0.112)	(0.136)	(0.073)	(0.088)
School	Enr/100	0.143*	0.161*	0.019*	0.057*
		(0.013)	(0.016)	(0.009)	(0.010)
	Span Enr/100	-0.199*	-0.221*	0.011	-0.020
		(0.015)	(0.017)	(0.009)	(0.011)
Community	Citytown	-0.030	0.280*	-0.176*	-0.060
		(0.122)	(0.146)	(0.071)	(0.081)
	Rural-adj	-1.419*	-1.505	-1.344*	-1.797*
		(0.123)	(0.152)	(0.097)	(0.121)
	Rural-iso	0.146	-0.912*	0.602*	0.503*
		(0.323)	(0.372)	(0.207)	(0.248)
	Constant	8.740*	14.266	10.402*	18.098*
		(0.722)	(2.124)	(0.463)	(1.165)
R^2		0.181	0.167[c]	0.179	0.180[c]
N		17000	17000	19868	19868

Corrected standard errors in parenthesis. * indicates significance at the .05 level. Regressions also include dummy variables controlling for missing values. [a] Autonomy and participation treated as exogenous. [b] Instrumental variables estimation treating autonomy, participation and shortage as endogenous, using the instruments listed in Appendix Table 1. [c] R-square from two-stage estimation.

Table 3 – Comparison of Regression Coefficients of Different Models of the Effect of Autonomy and Participation on Test Scores.

	Mathematics						
	Least Squares			**Instrumental Variables**			
Variable	**Autonomy and Participation**	**Autonomy**	**Participation**	**Autonomy and Participation**	**Autonomy**	**Participation**	**Autonomy and Participation[a]**
Autonomy	0.256*	0.316*		-0.965*	-0.981*		-1.370*
	(0.029)	(0.029)		(0.124)	(0.121)		(0.185)
Participation	0.812*		0.878*	3.107*		3.151*	4.511*
	(0.055)		(0.054)	(0.373)		(0.361)	(0.446)
	Language						
	Least Squares			**Instrumental Variables**			
Variable	**Autonomy and Participation**	**Autonomy**	**Participation**	**Autonomy and Participation**	**Autonomy**	**Participation**	**Autonomy and Participation[a]**
Autonomy	0.158*	0.184*		-0.497*	-0.594*		-0.312*
	(0.019)	(0.019)		(0.079)	(0.074)		(0.120)
Participation	-0.314*		-0.370*	0.985*		1.436*	1.323*
	(0.040)		(0.039)	(0.240)		(0.227)	(0.254)

Corrected standard errors in parenthesis. * indicates significance at the .05 level. Regressions also include all other variables reported in Table 2.

[a] These variables only include the Legal Structure variables as instruments, excluding Principal's Attributes.

Table 4 – Least Squares Regressions Explaining Autonomy, Participation and Inadequacy

	Variable	Autonomy	Participation	Shortage
Principal's attributes	Pr Educ	-1.383*	0.408*	0.527
		(0.192)	(0.105)	(0.120)
	Pr Texp	0.013*	0.006*	-0.010*
		(0.001)	(0.001)	(0.001)
	Pr Prexp	-0.013*	-0.001*	0.002*
		(0.001)	(0.000)	(0.001)
	Pr Teach	0.296*	0.052*	-0.319*
		(0.032)	(0.017)	(0.020)
	Pr Training	0.037*	-0.001	-0.019*
		(0.003)	(0.001)	(0.002)
Legal Structure	Personnel	0.838*	0.193*	1.216*
		(0.122)	(0.067)	(0.076)
	Maintenance	-1.052*	-0.115*	0.394*
		(0.069)	(0.037)	(0.043)
	Curriculum	-0.698*	0.013	-0.569*
		(0.090)	(0.049)	(0.055)
	Stability	0.207*	-0.009	-0.661*
		(0.071)	(0.039)	(0.045)
	Regulation	0.831*	-0.902*	-1.011*
		(0.132)	(0.072)	(0.083)
	Law	-0.782*	0.446*	1.010*
		(0.115)	(0.063)	(0.072)
Parent/Household	P Educ	0.417*	0.061	-0.000
		(0.097)	(0.053)	(0.061)
	P Books	0.256*	0.129*	-0.115*
		(0.016)	(0.009)	(0.010)
	P Spanish	-0.250	0.203*	-0.357*
		(0.071)	(0.039)	(0.045)
Teacher	T Male	0.218*	-0.084*	-0.089*
		(0.030)	(0.017)	(0.019)
	T Educ	0.100*	-0.051	0.044*
		(0.026)	(0.014)	(0.016)
School	Enr/100	0.031*	0.016*	-0.009*
		(0.004)	(0.002)	(0.002)
	Span Enr/100	0.001*	0.000	0.001
		(0.004)	(0.002)	(0.003)
Community	Citytown	-0.060	-0.247*	0.297*
		(0.032)	(0.017)	(0.020)
	Rural-adj	-0.334*	-0.215*	0.228*
		(0.033)	(0.018)	(0.021)
	Rural-iso	-1.112*	-0.176*	0.666*
		(0.086)	(0.047)	(0.054)
	Constant	11.380*	2.652*	2.070*
		(0.283)	(0.155)	(0.178)
	R^2	0.196	0.120	0.261
	N	17000	17000	17000

Standard errors in parenthesis. Regressions also include child attributes and dummy variables controlling for missing values. * indicates significance at the .05 level. Regressions using the language sample are similar.

Appendix Table 1 - Variable Description

Endogenous variables	
Math Score	Mathematics test score out of 32 possible (C)
Language Score	Language test score out of 19 possible (C)
Autonomy	Composite variable measuring the level of school autonomy (Pr)
Participation	Composite variable measuring the level of parental participation (T)
Shortage	Composite variable measuring the inadequacy of school supplies and facilities (T)
Exogenous variables	
Child	
Age	Student age (years) (C)
Boy	Dummy if student is a boy (C)
No Preschool	Student did not attend preschool/kindergarten (C)
Work Outside	Index of how often student works outside the home (0= almost never, 2= often) (C)
Parent/Household	
P Educ	Average education of parent(s) or guardian(s) (P)
P Books	Number of books in student's home (P)
P Spanish	Dummy if parents speak Spanish(Portuguese) with their children (P)
Teacher	
T Male	Dummy if teacher is male (T)
T Educ	Aggregated teacher education (T)
School	
Enr	Total number of students enrolled (Pr)
Span Enr	Total number of Spanish (Portuguese) speaking students enrolled (Pr)
Community (*Reference:* Urbanized zone in the capital area)	
Citytown	Dummy indicating if school is located in a marginal zone in the capital or in a large city or town with more than 100,000 people (S)
Rural-adj	Dummy indicating if school is located in a town/village with less than 100,000 people or in a rural area in close proximity close to a town (S)
Rural-iso	Dummy indicating if school is located in a rural area with less than 500 people and located more than 50 km from a town (S)
Instruments	
Principal's attributes	
Pr Educ	Dummy if the principal studied to become a teacher (Pr)
Pr Texp	Years of experience the principal has as a teacher (Pr)
Pr Prexp	Years of experience the principal has as a principal at current school (Pr)
Pr Teach	Dummy if the principal engages in teaching at the school (Pr)
Pr Training	Number of courses principal has taken during the last three years to become a better principal (Pr)
Legal structure	
Personnel	Level of centralization in staffing, evaluation, and compensation (1=low, 3=high) (PREAL)
Maintenance	Level of centralization in school maintenance and investment (1=low, 3=high) (PREAL)
Curriculum	Level of centralization in choosing curriculum and textbooks (1=low, 3=high) (PREAL)
Stability	Estimate of the degree of political stability 2000/01 (KKL)
Regulation	Estimate of the degree of regulatory quality 2000/01 (KKL)
Law	Estimate of the degree of rule of law 2000/01 (KKL)

Sources: C: Child survey or test; Pr: Principle's survey; T: Teacher's survey; P: Parent's survey; S: Survey Designer's observation; PREAL: Estimate taken from Partnership for Educational Revitalization in the Americas (PREAL) (2001); KKL: Estimate taken from Kaufmann, Kraay and Zoida-Lobatón (2002).

Appendix Table 2 - Summary Statistics[a]

Variable	N	Mean	Std. Dev.	Min	Max
Endogenous variables					
Math score	17000	15.67	6.29	0	32
Language score	19868	11.72	4.37	0	19
Autonomy	17000	9.34	1.67	4.55	12.15
Participation	17000	2.70	0.87	1.55	4.64
Shortage	17000	3.68	1.09	2.41	6.59
Exogenous variables					
Child					
Age	13082	9.73	1.48	6	18
Boy	16051	0.52	0.50	0	1
No Preschool	15099	0.22	0.41	0	1
Work Outside	15257	0.76	0.79	0	2
Parent/Household					
P Educ	7968	0.96	0.18	0	1
P Books	12843	2.39	0.90	1	4
P Spanish	10686	0.95	0.21	0	1
Teacher					
T Male	16650	0.22	0.41	0	1
T Educ	14599	1.44	0.54	0	2
School					
Enr	17000	592.46	520.44	0	6026
Span Enr	17000	393.16	469.03	0	6026
Community					
Citytown	17000	0.28	0.45	0	1
Rural-adj	17000	0.35	0.48	0	1
Rural-iso	17000	0.02	0.15	0	1
Instruments					
Principal's attributes					
Pr Educ	17000	1.00	0.06	0	1
Pr Texp	17000	15.04	8.49	0	47
Pr Prexp	17000	8.53	14.73	0	99
Pr Teach	17000	0.22	0.41	0	1
Pr Training	17000	5.49	4.86	0	30
Legal structure					
Personnel	17000	2.26	0.52	1.50	3
Curriculum	17000	2.33	0.65	1.50	3
Maintenance	17000	1.88	0.54	1	2.5
Stability	17000	-0.01	0.64	-1.36	0.87
Regulation	17000	0.42	0.33	-0.43	1.10
Law	17000	-0.24	0.54	-1.06	1.19

[a] These are the sample statistics from the group for which we have mathematics test scores. Sample statistics for the language test sample are almost identical.