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RAISING PRIMARY SCHOOL ENROLMENT IN DEVELOPMENT COUNTRIES: THE RELATIVE IMPORTANCE OF SUPPLY AND DEMAND

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ABSTRACT

Few policies are as universally accepted as raising primary school enrolment in developing countries, but the policy levers for achieving this goal are not straight forward. This paper merges household survey data with detailed school supply characteristics from official sources, in order to estimate the relative impact of demand- and supply-side determinants of rural primary school enrolment in Mozambique. Policy simulations based on a set of "plausible" interventions show that demand-side interventions, particularly those aimed at raising rural adult literacy, will have the biggest impact on primary school enrolment rates.

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1. INTRODUCTION

Few policies, if any, are as universally accepted as that of raising primary school enrolment in poor countries. Virtually every *World Development Report* published annually by the World Bank has recognized, in one form or another, the importance of primary schooling as an input to the social and economic progress of poor countries.[1] And within the academic literature, a host of studies have documented the market and nonmarket returns that come from completing primary schooling, both in poor and rich countries alike.[2]

But raising primary school enrolment in developing countries is easier said than done. The relative importance of school supply versus household demand factors remain controversial, with serious implications for education policy.[3] For example, if children's enrolment rates are not responsive to local school infrastructure, government interventions aimed at increasing access to schools will have very limited impact on overall schooling levels, thus effectively reducing the set of options available to policymakers. And even if regional variations in schooling infrastructure can be related

[1] Within the overall policy goal of raising primary school enrolment, raising *girls* enrolment has received special attention, due to the large positive externalities of female education on children's and adult's health, adult fertility, and infant mortality.

[2] For developing countries see Glewwe (1999), Handa (1999), and Lam and Duryea (1999). For developed countries see Rosenzweig and Schultz (1983).

[3] See Simmons and Alexander (1978 for a discussion of this issue and review of the literature.

to household schooling choices, as several studies have shown,[4] efficient policy decisions require knowledge of the particular dimensions of school infrastructure that matter most. This latter issue is contentious in both developing and developed countries alike, and has been the topic of several recent articles seeking to measure the type of schooling infrastructure (access, quality, etc.) that makes a difference for household schooling choices.[5]

This study makes three main contributions to the literature on primary school enrolment policies and school infrastructure in developing countries. First, the impact of school characteristics on household primary school enrolment decisions are measured using a diverse set of school "quality" indicators. Aside from information on distance to the nearest school, detailed information on school characteristics is hard to find in developing countries, and as a result the available published literature is small relative to that for developed countries.[6] This study thus provides an additional set of estimates with which to assess the role of specific supply-side factors in determining student outcomes. Moreover, school characteristics are measured with the actual data that Mozambique's Ministry of Education uses to formulate its regional and national targets, and to develop

[4] These studies show that community or regional fixed effects are significant determinants of household schooling choices. For examples, see Pradhan (1998) for Indonesia, Handa (1996) for Jamaica, and Alderman et al. (1996) for Pakistan.

[5] Recent studies that measure the effect of various school characteristics in developing countries include Lavy (1996) and Glewwe et al. (1995); for developed countries, see Card and Kruger (1992), Betts (1995), and Goldhaber and Brewer (1997). The overall importance of school quality is discussed in Hedges, Laine, and Greenwald (1994), Hanushek (1995), and Kremer (1995).

[6] Recent studies that provide estimates of detailed school "quality" indicators on student educational achievement in developing countries include Glewwe and Jacoby (1994) for Ghana, Glewwe et al. (1995) for Jamaica, and Tan et al. (1997) for the Philippines.

its five-year plans, thus enhancing the policy relevance of the work. Second, unlike most previous studies in this area, the interaction between school and household characteristics are explored to see if complementarity or substitutability exists between these two sets of factors in determining school enrolment.[7] The existence of significant interactions can provide important clues about who benefits the most from school supply interventions, and where programs or resources should be placed in order to benefit the most vulnerable. For example, a significant positive interaction between household income and school access in a particular region implies that building additional schools in this region will benefit *richer* households more than poorer ones. However, policymakers may want to target regions where the *poor* are more likely to benefit from the provision of schools, hence knowledge of specific interactions can provide useful information to help prioritize program placement.

Third, policy simulations are presented based on separate and "plausible" supply- and demand-side interventions, and used to evaluate which type of intervention will have the largest impact on primary school enrolment rates. The standard "policy analysis" contained in studies on school supply typically evaluates the effect on the outcome of interest (for example, test scores or grade attainment) for a given change in a statistically significant school supply variable (e.g., travel time to school) by multiplying the given change by the relevant coefficient. Although statistically valid, the policy relevance of this exercise can be enhanced significantly by recognizing that governments in the short

[7] Birdsall (1985) is one of the few studies that also looks at interactions among supply and demand factors in determining schooling outcomes.

or medium run cannot supply 10 more books to every school, nor fix every leaking roof in the country. A typical policy intervention in the short run will involve adding more teachers in some regions and not others, or building a few schools in a few regions. This paper estimates the change in primary school enrolment that would come about from a set of more realistic interventions such as building a few schools in specific regions, or targeting adult education or income generating programs only among the poorest households. These simulations arguably provide a better picture of the expected benefits of the type of interventions available to developing country governments in the short and medium term.

The data used in this paper are from Mozambique, a country that has suffered from over 25 years of armed conflict, and which is acknowledged by development experts as one of the world's poorest. Estimates from the rural region of this country show that both demand and supply factors are important determinants of primary school enrolment. On the supply side, dimensions of school quality (the number of trained teachers), efficiency (pass rates), and access, all have significant effects on household enrolment decisions. However, the policy simulations unambiguously show that demand-side constraints, especially the education of adult household members, are the biggest factor in impeding primary school enrolment.

2. DATA ON AND DESCRIPTION OF THE STUDY AREA

THE STUDY AREA

Mozambique is one of only a handful of African countries that was colonized by the Portuguese, and by all accounts, the period of colonization was extremely repressive for native Africans. Only a select few *assimilados* were allowed access to the social and economic benefits that the colonial rulers enjoyed, and independence came in 1975 only after a long war of independence and a change in government in Portugal. Almost immediately after independence, the new Mozambique entered an even more brutal civil war, instigated by guerrillas backed by neighboring South Africa. This war of destabilization resulted in thousands of land mines being placed in rural areas in the central and northern parts of the country. Hundreds of thousands of Mozambicans fled the countryside for the urban centers or neighboring Malawi and Zimbabwe. The signing of the peace treaty in Rome in 1992 essentially marked the second independence of Mozambique, but the over 25 years of armed conflict have left a huge hole in social and economic infrastructure that require immediate attention in order for Mozambique to realize sustainable growth and reduce poverty. A recent study by the Ministry of Finance (1998) estimates that 70 percent of the population lives below the poverty line, with poverty rates even higher in the central and northern zones that suffered most from the civil war.

THE NATIONAL EDUCATION SYSTEM

The national education system's general education program is divided into two levels—primary and secondary. Primary education consists of 7 years of schooling divided into two levels, level 1 up to grade 5 (*escola primaria do primeiro grãu* or EP1) and level 2 from grade 6 to 7 (*escola primária do segundo grãu* or EP2). Secondary education consists of 5 years also divided into two levels or cycles: first cycle secondary from grade 8 to 10 *(escola secundária geral do primeiro grãu* or ESG1) and second cycle secondary from grade 11 to 12 *(escola secundária geral do segundo grãu* or ESG2).

Unlike most African countries, entrance into successively higher levels of schooling is not based on national examinations, but on actual grades and age. Among students with the same grades, those who are younger (and therefore either started on time or did not repeat as often) are given priority. Access to EP1 is not thought to be supply constrained, but there are supply constraints for all other (higher) schooling levels. Fees do not exist in public lower primary schools, but there is an annual matriculation fee of approximately $5. Private EP1 school fees can range from $150 to $600 per year, depending on ownership structure and facilities provided.

HOUSEHOLD DATA

The household data used in this paper come from the first post-war national household survey of Mozambique undertaken in 1996/97 by the National Statistical Institute—the *Inquérito Nacional Aos Agregados Familiares Sobre As Condições de Vida* (IAF). The IAF is a multipurpose household survey much like the Living Standard

Measurement Surveys developed by the World Bank, and contains detailed information on consumption expenditures, as well as modules on health (both adult and child), education, employment, demographic composition, and a community questionnaire for rural areas describing local infrastructure.[8]

The IAF is a three-staged stratified sample. Stage one is the 11 provinces of the country, stage 2 is the *localidad* (*bairro* in urban areas), and in stage 3 households are selected from villages (or blocks in urban areas). The primary sampling unit is therefore the *localidad*, and variance estimates provided in this paper account for the sample design of the survey. The full survey covers approximately 42,000 individuals residing in 8,250 households.

Tables 1 and 2 provide basic indicators of adult and child schooling calculated from the IAF data set. Only 40 percent of adults aged 18-65 can read or write; for women, the literacy rate is even lower (24 percent). Note that women in rural areas have the lowest literacy rates—16 percent for the 18-65 age group. Table 2 indicates that there are significant signs of improvement. The net enrolment rate for primary school is 49 percent, and is slightly lower for girls (45 percent) and rural children (44 percent).

SCHOOL DATA

Information on school infrastructure in the IAF is limited to whether or not a rural village contains a primary school. Detailed information on school characteristics has

[8] This data set has been used by the International Food Policy Research Institute (IFPRI) in collaboration with the Mozambican Ministry of Finance to construct a national poverty line and to develop a poverty profile of Mozambique (Ministry of Finance 1998).

been gathered from the *Direcção de Planificação* of the Mozambique Ministry of Education (MINED). Since 1992 MINED has administered a beginning- and end-of-academic-year questionnaire to each school in the country, soliciting information on enrolment, teachers, teacher qualifications, pass rates, and building characteristics. This information is used by MINED to create and keep track of its internal performance indicators. Coverage is excellent, with over 90 percent of schools returning questionnaires; summaries of these data are published in an annual report by the MINED titled "Educational Indicators."

Raw data from these school surveys for 1995 and 1996 were acquired from MINED and merged at the administrative post level with rural households from the IAF survey.[9] The analysis presented below focuses on the enrolment decision of rural children (representing 80 percent of the primary school-age children in Mozambique) in order to exploit the small information on rural village-level schooling availability provided in the IAF; in all there are 634 villages in the IAF, distributed across 175 administrative posts, 112 districts, and the 10 provinces of the country (excluding the province of Maputo City).[10]

[9] There are three levels of local administration in Mozambique: province, district, and administrative post. The school-level data are therefore aggregated to the lowest administrative unit possible.

[10] In 17 cases, MINED did not have any school information for an administrative post found in the IAF. In these cases, school information from a bordering administrative post was used.

CHOICE OF SCHOOL CHARACTERISTICS

MINED divides its educational performance indicators into three groups, measuring coverage, quality, and efficiency of the school system, and I follow this classification in order for the results to be of policy relevance to the Government of Mozambique. MINED has developed a set of indicators to measure each of the three dimensions of the educational system—where possible, I use these same indicators in the regression analysis, although there is a high degree of collinearity among the indicators, both across and within the three dimensions of coverage, quality, and efficiency.

The basic *quality* indicators used by MINED are the number of trained teachers working in the system, average class size, and the pupil-teacher ratio. I use the number of trained teachers in the administrative post as my basic indicator of teacher quality. However, I also find that gender of the teachers matters, and so show some results that measure the number and proportion of female trained teachers in the administrative post. In addition to teacher training, I include the average pupil-teacher ratio for schools in the administrative post. Class size is not used because many schools in Mozambique are run on a shift system, and so smaller class sizes can be achieved by creating two shifts, but with only a small number of additional teachers (Case and Deaton 1999) report the same phenomenon for South Africa).

MINED measures the internal *efficiency* of the educational system by the pass rate (total pass rate, and pass rates by gender and subject), and the proportion of students who are repeating a class. The pass rate and repeat rate are highly collinear so I focus on the former, and construct the average pass rate of schools in the administrative post *in the*

previous year as my measure of school efficiency. The previous year pass rate (collected in the end-of-year survey in 1995) is the relevant variable since school enrolment decisions are made at the beginning of the year when the pass rate for the current year is still unknown.

School *coverage* is measured by the number of level one primary schools (EP1) in the administrative post. Given the large variations in the building structure of schools in Mozambique, and evidence from other developing countries on the importance of building characteristics (e.g., Glewwe and Jacoby 1994), I also include the number of school rooms made of cement in the administrative post. Finally, Lavy (1996) argues that the availability of higher levels of schooling can be an important factor in raising primary school enrolment rates, and Appleton et al. (1996) also point out that part of the return to primary school education is that it opens up the possibility of acquiring higher levels of schooling. With these arguments in mind, I construct indicators of whether the administrative post has a second level (EP2) primary school, and a secondary school, to see if these influence the lower primary enrolment decision.

Recall that all school supply variables are measured at the administrative post level, so each household in the administrative post will have the same school infrastructure characteristics. Also included is the indicator of whether or not an EP1 school exists in the village, taken from the IAF community questionnaire—this controls for the very important travel time cost component of school attendance, as well as allows for some village variation in school infrastructure. As in other Sub-Saharan African countries, girls schooling rates lag behind those of boys in Mozambique and is thus of

particular policy importance. I allow the impact of all school infrastructure variables to differ by gender, estimating separate models for boys and girls—significant differences in coefficient estimates by gender are noted where applicable.

Table 3 provides means of the school supply variables used in the regression analysis. These means are calculated over the 175 administrative posts found in the rural sample of the IAF, and show that the mean number of EP1 schools is 21, with an average of one cement room per school. Only 59 percent of the administrative posts have a level 2 primary school (EP2), and only 20 percent have a secondary school.

3. ECONOMETRIC MODEL, SAMPLE, AND RESULTS

ECONOMETRIC MODEL AND SAMPLE

The impact of school characteristics on household schooling decisions is measured via reduced form demand equations for children's schooling of the form

$$S_i = F(X_c, X_h, X_s, u), \qquad (1)$$

where X_c are characteristics of the individual child (age), X_h are household characteristics that capture access to resources, differences in taste for schooling, and opportunity costs, X_s is the vector of school infrastructural characteristics discussed above, and u is a random error term with the usual assumptions.[11] The household-level variables included in the model are the age and sex of the head, whether the head is literate, whether any adult household member has completed grade 7 (EP2), and whether any adult female has

[11] See Strauss and Thomas (1995) for a review of this methodology.

completed grade 5 (EP1). Household resources are measured with per capita daily expenditure on all goods and services, including home production. This is treated as endogenous following the recommendation of Rivers and Vuong (1988), using the cluster median expenditure for identification.[12] Also included are measures of farm assets and production such as total landholdings, access to irrigation, agricultural commercialization, and provincial dummy variables.

For Mozambique (and most African countries), raising primary school enrolment rates is a priority and the focus is therefore on the analysis of school supply effects on the primary school enrolment decisions of rural households. The sample is children of primary school age (7-11 years old), and the dependent variable is whether the child was currently enrolled in school at the time of the survey. Means for these variables are presented in Table 13.

BASIC RESULTS

Results on School Quality

Table 4 presents probit marginal probability estimates of the impact of school quality on EP1 enrolment by gender in rural Mozambique. Column 1 presents the base estimates with quality measured by the number of trained teachers and the average administrative post-level pupil-teacher ratio; the latter is insignificant but the former is

[12] Household consumption decisions also affect leisure consumption, and are made jointly with schooling decisions. Due to this simultaneity problem, median per capita consumption of the village is used to instrument household consumption. This variable is highly correlated with household consumption: the simple OLS coefficient of log (consumption) on log (cluster median consumption) is 0.88.

positive and significant, although the quantitative effect is small.[13] Adding 10 more trained teachers will raise the probability of enrolment by one percentage point. On the other hand, having a school present in the village will raise the probability of enrolment by approximately 20 percentage points for both boys and girls.

When the total number of trained teachers is split into the number of male and female teachers and entered as two variables, only the number of male trained teachers is significant, but this is because there are so few trained female teachers (an average of 11 per administrative post, or roughly 11 percent of all teachers per region).[14] However other indicators of the gender composition of the teaching staff seem to matter. Columns (2)-(4) replicate the base estimates with measures of the proportion of trained female teachers among all teachers, the proportion of all teachers who are female, and the proportion of all female teachers that are trained. Most of these alternative measures of gender composition and training are positive and significant determinants of enrolment, with the largest marginal effects coming from the variable measuring the proportion of trained female teachers among all teachers. The mean of this variable is 0.08—doubling this would increase enrolment by just over 4 percentage points for both boys and girls. The mean proportion of female teachers across the administrative posts is 37 percent—taking this up to 50 percent would increase enrolment by 4 and 5 percentage points for boys and girls, respectively.

[13] When the proportion of teachers who are trained is used, its coefficient is positive but not significant.

[14] The results based on number of male and female trained teachers entered separately, are not shown, but are available from the author on request.

A recent participatory study sponsored by OXFAM (1999) in Mozambique reports that male teachers often force students to perform chores for them such as fetching wood and water, and that parents are reluctant to send girls to school to be taught by male teachers. This is especially true in the heavily Moslem provinces of Zambezia and Nampula, and may explain the strong positive effect of female teachers reported in Table 4.

Results on School Efficiency

Table 5 presents probit marginal probability estimates of the impact of school efficiency (measured by the pass rate of the previous year) characteristics on school enrolment.[15] The total pass rate estimates in column (1) are not significant, but when male and female pass rates are distinguished, female pass rates appear to have a significant positive affect on enrolment probabilities, but not male pass rates. Moreover, the measured effect is not statistically different between boys and girls. Raising the girl pass rate to the level of boys (an increase of 11 percentage points) will raise the probability of enrolment by 12 percentage points for boys and 9 percentage points for girls. The reason why households would respond to the female pass rate and not male is unclear. One explanation might be that the female pass rate is a better indicator of school quality because of girls' overall poorer performance in school.

[15] Estimates for the household-level variables are robust to model specification, and so are suppressed from Tables 5 and 6 for convenience. Full results are available from the author.

The OXFAM (1999) participatory study of household attitudes towards children's schooling indicated that learning Portuguese and learning to '*fazer as contas*' (do accounting) are important motivations for sending children to school. Columns (3) and (4) include the Portuguese language and mathematics subject pass rates as measures of schooling efficiency, but neither of these are significant determinants of EP1 enrolment in the sample.

Coverage of the Educational System (School Access)

Estimation results using indicators of school access within the administrative post are reported in Table 6. The number of schools in the administrative post has a significant effect on boys but not girls enrolment (p-value for difference in effects is 0.04), while the number of cement rooms has a significant effect on girls but not boys enrolment (p-value for difference is 0.08). The possibility of further education also raises the probability of primary school enrolment. The coefficient indicating whether the region has a secondary school is significant for both girls and boys, with enrolment probabilities being approximately 9 percentage points higher in administrative posts with at least one secondary school. The lack of significance of the presence of an EP2 school is somewhat surprising. However, the underlying data indicate that in fact virtually every region (all but one) with a secondary school also has at least one EP2 school, hence the secondary school indicator is picking up the effect of both EP2 and secondary schooling possibilities in the region. When all school access variables are simultaneously included in the model, the EP2 and secondary school indicators become insignificant (column (3),

but the significant effects of the number of EP1 schools (for boys) and cement rooms (for girls) is maintained.

INTERACTIONS WITH HOUSEHOLD CHARACTERISTICS

The influence of community infrastructure (such as school quality) may be different in households with different characteristics. For example, the impact of a village school may be greater for richer households if these households are better able to take advantage of the school. On the other hand, richer households may be able to afford to send children to a neighboring village for schooling, in which case the impact of constructing a school in the village may actually be greater among poorer households, who otherwise would not have sent their children to study. The impact of community infrastructure on household behavior may also depend on the education of adults or parents, due to differences in preferences or access to information. In the child health literature, for example, the impact of mother's education has been found to vary significantly with community characteristics such as sewerage and sanitation conditions (Thomas, Strauss, and Henriques 1991; Barrera 1990).

Both household income (measured by expenditures per capita) and adult education significantly influence schooling choices in Mozambique, and school infrastructure also conditions these choices in rural areas. Does the impact of school infrastructure depend on household characteristics? Are certain households more likely than others to change their schooling decisions in response to variations in school infrastructure? I address these questions by interacting the different school supply

characteristics with household adult education (measured by the literacy of the head) and household income, to see if significant interactions indeed exist between school supply and household characteristics. The interactions are tested sequentially, first by interacting the school supply variables with head's literacy, and then by interacting the same variables with household (log) per capita consumption. Results are presented separately for each of the three dimensions of school supply (quality, efficiency, and access) in Tables 7 through 9.

Starting with school quality, Table 7 presents results of the interactions between each school quality indicator and head's literacy (columns 1-4) and household consumption (columns 5-8). For girls enrolment, the impact of both the proportion of trained female teachers and the proportion of female teachers depend on whether the head is literate or not. The negative coefficient on the interaction term implies that these characteristics are substitutes, and therefore the impact of these dimensions of school quality are significantly greater among households where the head is *not* literate. The results for income in columns 5-8 also show some significant interactions. For girls, the presence of a school in the village and household income are substitutes, hence the positive impact of a school in the village will be greater among *poorer* households. The other significant interaction is between income and the proportion of trained female teachers in the administrative post, the post coefficient in this case implying complementarity (column 6).

Table 8 presents results of the estimates of school efficiency indicators interacted with head's literacy (columns 1-4) and household consumption (columns 5-8). There are

no significant interactions among schooling efficiency, head's education, and household consumption. The negative and statistically significant coefficients for income*village are consistent with those in Table 6—constructing a school in the village will have a larger impact on the enrolment of girls from poorer households compared to richer ones.

The last set of estimates relate to interactions among school access, head's education, and household income, and these are reported in Table 9. Significant interactions exist among several access indicators and household income (columns 4-6). The positive impact of cement classrooms on girls enrolment is enhanced among richer households, given by the positive and significant coefficient on the interaction term in column 4. In column 5, there is a significant interaction effect between presence of an EP2 school in the administrative post and household income for girls, with the positive coefficient implying complementarity. This is probably due to the fact that richer households can better afford to send girls away to an EP2 school once they have completed EP1.

PLACEMENT OF SCHOOL INFRASTRUCTURE

The analysis of the impact of school infrastructure on school enrolment runs the risk of confounding cause and effect if, as one might expect, households with a greater preference for schooling are able to move to areas with better schooling quality. In the United States for example, households demonstrate preference for schooling quality through higher property prices in districts with better schools. In Mozambique and other poor countries, allocation of infrastructure such as school or health services may be

influenced by local demand for services. In such cases, regression estimates that do not account for endogenous program placement will overstate the impact of school characteristics on household educational choices.

Mozambique's history of armed conflict led to destruction of physical infrastructure including schools, roads, and health centers, and formal provision of educational centers by the state was limited to the southern part of the country and to mostly urban zones. During this period very few new schools were constructed, and many of these were constructed through community initiatives that would reflect community preferences for schooling. Since the peace accord in 1992 and the general elections of 1994, there has been a rapid increase in the number of schools constructed in the rural areas, due to both government and NGO interventions. According to the IAF community questionnaire, nearly 40 percent of village primary schools were constructed after 1992.

To evaluate the extent to which our estimates of the impact of school infrastructure on school enrolment reflect endogenous placement effects, selected school supply characteristics are regressed on a set of variables describing the general socioeconomic level of households in the administrative post. These regressions are estimated over the 175 administrative posts in the IAF rural sample, and results for the number of EP1 school (column 1), number of trained teachers (column 2), and the pupil-teacher ratio (column 3), are presented in Table 10. In all three regressions, the set of variables describing the average household socioeconomic level in the administrative post is jointly significant in explaining the variation in the three school quality indicators.

The key characteristic of the administrative post appears to be the proportion of households with an adult female with EP1 education, or the proportion of household heads that are literate. Notice that median per capita consumption of the administrative post is not a significant determinant of school infrastructure. Columns (1a), (2a), and (3a) add district fixed effects (dummy variables) to the regression equations as in Alderman et al. (1996). Inclusion of these district fixed effects eliminates the joint significance of the SES variables—Alderman et al. interpret this result in the Pakistan context to imply that it is inter-district variations rather than variations in administrative post-level household characteristics that determine school infrastructure. However, the statistical validity of this result may be questionable, given that there are 112 districts spread over the 175 administrative posts and thus an average of less than 2 administrative posts per district.

In conclusion, given the process of school infrastructure placement in Mozambique, as well as the regression analysis presented in this section, it is possible that some of the estimated effects of school quality may represent unobserved household- or community-level tastes for schooling.

4. POLICY SIMULATIONS

According to the Ministry of Education's strategic plan, raising basic primary education levels is a priority for Mozambique. In this section I compare the relative impact of demand-side versus supply-side interventions on primary school enrolment

rates in rural Mozambique. The simulations are based on the probit regressions for the determinants of current enrolment of children aged 7-11 years old in rural areas. The school characteristics included in the model are the number of trained teachers and the pupil-teacher ratio, and the number of schools and cement rooms in the administrative post. All the household-level characteristics mentioned above are included in the model, as well as the variable indicating presence of a school in the village. Because of Mozambique's vast size and geographical and economic heterogeneity, I allow the impact of the hypothetical policy interventions to vary by province by interacting the policy variables with provincial dummy variables. I do not find systematic differences in the effect of policy interventions on boys and girls enrolment rates and so provide estimates for the full sample only.

SUPPLY-SIDE SIMULATIONS

The supply-side policy simulations consider the impact on enrolment rates of increasing the number of schools in rural areas in Mozambique. The IAF community questionnaire indicates that approximately 69 percent of rural villages have a basic primary school, and the regression analysis shows that presence of a school in the village is an extremely important determinant of children's enrolment. I calculate the increase in EP1 enrolment that would occur due to three separate interventions: (1) increasing the proportion of villages with EP1 schools to 79 percent, which implies building a school in 6 villages per province; (2) increasing the proportion of villages with EP1 to 89 percent,

which implies building schools in 12 villages per province; (3) increasing the EP1 coverage rate to 100 percent by ensuring that all villages have a primary school.

In order to capture the impact of school characteristics (and not just access) on enrolment, I assume that each school consists of three cement rooms and comes with two trained teachers. The addition of a school in a village will have a direct impact on the village and an indirect impact on all villages in the administrative post through the administrative post-level variables: the number of schools, the number of cement school rooms, and the number of trained teachers in the administrative post. The indirect effects due to changes at the administrative post level are accounted for in the policy simulations.

Results of these simulations are presented in Table 11, which also provides baseline figures for predicted enrolment (calculated from the probit estimates without any simulations) and the EP1 coverage for each province as well as nationally. The numbers in column (3), associated with the policy of increasing EP1 coverage to 79 percent, will increase overall enrolment by 6 percent, but with substantial regional variations. Maputo Province (16 percent), Niassa (10 percent), and Manica (10 percent) would be the biggest beneficiaries of this intervention. Doubling the size of the intervention would roughly double the size of the impact. Constructing 12 more schools per province would increase overall enrolment by 13 percent, with the largest increases in enrolment occurring in Maputo Province (31 percent), Niassa (25 percent), and Manica and Sofala (both with 23 percent).

DEMAND-SIDE SIMULATIONS

The impact of policy interventions designed to influence demand-side (or household) characteristics are based on the same model used in the simulations presented above. Two types of interventions are simulated, one influencing household income (or consumption) and the other influencing adult education. The income-related interventions involve raising the per capita consumption of all households to at least the level of consumption of the 25th percentile of the per capita consumption distribution (Mt. 2,494 per person per day in the IAF, or approximately US$0.25); the second policy is to raise all households to at least Mt. 3,584, which is equal to median consumption in the IAF. Since these interventions only affect poor households, they will not be evenly distributed throughout the country. In particular, the poorer the province, the larger the share of households in the bottom 25th percentile or bottom half of the per capita consumption distribution, and thus the larger the number of households who will be affected by the policy.

Columns (4) and (5) of Table 12 provide estimates of the percentage change in enrolment due to the two income-related policy interventions described above. The overall (national) impact is to raise enrolment rates by 2 and 5 percent, respectively, for policies 1 and 2—these effects are smaller than the estimated enrolment effects of building more schools presented in Table 11. Note that the income policy impact is largest in Sofala and Inhambane, the two poorest provinces. This is due not only to the size of the coefficient of the province*consumption interaction term, but also to the fact that more households in these provinces benefit from the policy.

The previous analysis in this paper indicated that adult household education significantly conditions children's schooling. I simulate the impact on enrolment rates if all household heads in the bottom quartile of the per capita expenditure distribution were literate. As in the income case, the benefits of this intervention will not be distributed equally across provinces. While poorer provinces have more eligible households, the policy only affects heads of household who are not literate and so the proportion of heads who are literate also matters.

Columns (6) and (7) of Table 12 present simulation results based on interventions that raise the literacy level of heads of household in the bottom parts of the per capita consumption distribution. The most important result is that the overall impact of this intervention is substantially larger than the income or school access interventions. Increasing literacy of heads in the bottom quartile would increase overall enrolment by 18 percent; increasing literacy of heads in the bottom half of the distribution would increase enrolment rates by 28 percent.

Once again there are substantial regional variations in the impact of adult education interventions on primary school enrolment. The biggest effects are estimated in Niassa (49 percent), Sofala (37 percent), Tete (31 percent), and Inhambane (31 percent). This is partly due to more beneficiary households in these provinces: Inhambane and Sofala are the two poorest provinces, and Tete and Niassa have the lowest literacy rates for household heads.

These simulations provide an idea of the overall benefit of different policy interventions without considering the cost of these same interventions. A comparison of

the different options indicates that interventions that increase adult literacy (or alternatively, which affect preferences for schooling), will have the largest pay-off in terms of increased enrolment rates. However, this intervention may be much more costly than building schools.

5. CONCLUSIONS

Raising primary school enrolment is a major development imperative, although the interventions that can best raise enrolment are not always straightforward, and can vary both between and within countries. Using the first national household survey of Mozambique, coupled with detailed information on school infrastructure supplied by the Ministry of Education, this paper evaluates the relative importance of supply- versus demand-side factors in determining rural primary school enrolment. Simulations based on a set of "plausible" demand- and supply-side interventions indicate that in rural Mozambique, demand-side interventions will have a bigger impact on enrolment rates than supply-side factors, although the relative cost of these competing interventions is not analyzed. On the demand side, it is the education of adult household members that seems most important in stimulating child enrolment. Making household heads literate in the bottom per capita consumption quartile will raise rural primary school enrolment by 18 percent, with the largest increases occurring in the provinces of Niassa and Sofala. In contrast, building six more schools in each province will raise rural enrolment by only 6

percent, and bringing per capita consumption of the poorest quartile up to Mt. 2,494 per day will raise rural enrolment by a mere 2 percent.

The detailed analysis of the impact of school characteristics on primary school enrolment in rural Mozambique indicates that dimensions of school quality, access or availability, and efficiency, all work to stimulate enrolment, although the effects are small and differ somewhat by gender of child. School quality, measured by the number of trained teachers in the administrative post, has a positive and significant impact on enrolment, but it is the gender composition of the teaching staff that is even more important in determining the household decision to send children to school. Both the simple proportion of teachers who are female, as well as the share of trained female teachers among all teachers are important positive determinants of enrolment rates. Raising the proportion of female teachers from 0.37 to 0.50 in the administrative post will raise enrolment rates by roughly 5 percentage points.

Both school efficiency and availability also have gender-differentiated effects on enrolment rates. For efficiency, raising the female pass rate to the level of boys will raise enrolment for boys and girls by 12 and 9 percentage points, respectively, although the overall pass rate and the boys pass rate do not significantly affect enrolment rates. Finally, the presence of an EP1 school in the village increases enrolment for both sexes by approximately 20 percentage points, and the impact of school availability is enhanced for girls if the school is built with cement.

Few previous studies have considered the possible interaction between school supply indicators and households characteristics. In Mozambique, these exist, but only

for girls enrolment. In terms of policy, the most interesting of these is the negative interaction between presence of a school in the village and household income. This implies that the two factors are substitutes—construction of a village school will increase girls enrolment by more among *poorer* households.

TABLES

Table 1 Adult literacy rates, by age group (percent)

	18-65 Years			66-99 Years		
	Rural	Urban	Mozambique	Rural	Urban	Mozambique
All	32.0	71.0	40.0	29.7	69.2	37.7
Male	52.3	85.1	59.3	42.9	78.4	50.3
Female	15.7	57.6	23.6	17.5	60.2	26.0
Poor	31.2	61.8	36.6	28.4	59.1	34.2

Table 2 Children s current enrolment, by age group (percent)

	7-11 Years			12-17 Years		
	Rural	Urban	Mozambique	Rural	Urban	Mozambique
All	43.9	70.7	49.2	43.3	63.5	48.0
Male	49.1	73.5	53.9	51.5	65.6	54.5
Female	39.0	68.0	44.7	33.2	61.4	40.3
Poor	41.7	63.3	45.5	42.3	54.9	44.8

Table 3 Means for administrative post school characteristics

	Mean
Coverage or access indicators	
Number of EP1 schools	21
Number of cement rooms	22
EP2 school exists	0.59
Secondary school exists	0.20
Quality indicators	
Number of trained teachers	66
Number of female trained teachers/total number of teachers	0.08
Number of female teachers/total number of teachers	0.37
Number of trained female teachers/total number of female teachers	0.15
Efficiency indicators	
Overall pass rate	0.64
Female pass rate	0.57
Male pass rate	0.68
Portuguese pass rate	0.66
Mathematics pass rate	0.68

Table 4 Marginal impact of school quality indicators on EP1 enrolment

	(1)		(2)		(3)		(4)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Log p.c. consumption	0.060	0.062	0.056	0.056	0.058	0.058	0.059	0.060
	(1.77)	(2.01)	(1.64)	(1.79)	(1.70)	(0.86)	(1.74)	(1.93)
Residual[a]	0.112	0.058	0.117	0.063	0.113	0.059	0.112	0.059
	(2.75)	(1.56)	(2.94)	(1.71)	(2.81)	(1.62)	(2.78)	(1.63)
Head literate	0.112	0.148	0.114	0.152	0.118	0.152	0.115	0.152
	(3.84)	(5.72)	(3.87)	(5.77)	(3.97)	(5.76)	(3.90)	(5.79)
Adult with EP2	0.151	0.200	0.153	0.201	0.152	0.200	0.151	0.198
	(3.12)	(4.16)	(3.14)	(4.20)	(3.14)	(4.19)	(3.12)	(4.17)
Female adult with EP1	0.132	0.296	0.126	0.205	0.135	0.212	0.132	0.216
	(2.41)	(4.67)	(2.30)	(4.35)	(2.50)	(4.55)	(2.44)	(4.71)
Age of child in years	0.074	0.049	0.074	0.047	0.074	0.047	0.074	0.047
	(8.88)	(6.61)	(8.97)	(6.29)	(8.93)	(6.33)	(8.86)	(6.29)
Village has school	0.218	0.185	0.228	0.193	0.223	0.189	0.227	0.192
	(6.18)	(5.28)	(6.55)	(5.54)	(6.42)	(5.40)	(6.50)	(5.53)
Pupil-teacher ratio	0.000	0.001	-0.000	0.001	-0.000	0.001	0.000	0.002
	(0.32)	(1.02)	(0.12)	(0.96)	(0.12)	(0.94)	(0.13)	(1.26)
Number of trained teachers	0.001	0.001						
	(4.52)	(2.66)						
Trained female teachers/all teachers			0.523	0.540				
			(2.60)	(2.71)				
Proportion of teachers who are female					0.299	0.418		
					(1.21)	(1.86)		
Proportion of female teachers who are trained							0.313	0.347
							(2.89)	(3.29)
Observations	2,182	2,281	2,182	2,281	2,182	2,281	2,182	2,281
Log likelihood	-1,298	-1,316	-1,304	-1,316	-1,307	-1,318	-1,304	-1,314

Notes: Numbers shown are marginal probabilities derived from probit estimation, with absolute Z-statistics in parentheses. School quality variables are measured at administrative post level, except for presence of school in village. Constant term, provincial dummy variables, land holdings, possession of agricultural equipment, and indicator for commercial crop production not shown. Mean of dependent variable is 0.51 and 0.40 for boys and girls respectively.

[a] T-statistic is test for exogeneity of log p.c. expenditure.

Table 5 Marginal impact of school efficiency indicators on EP1 enrolment

	(1)		(2)		(3)		(4)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Village has EP1 school	0.229	0.189	0.228	0.188	0.231	0.190	0.230	0.190
	(6.64)	(5.33)	(6.58)	(5.32)	(6.68)	(5.36)	(6.67)	(5.35)
Previous year pass rate	0.461	-0.326						
	(1.17)	(0.77)						
Female pass rate			1.103	0.845				
			(3.18)	(2.47)				
Male pass rate			-0.267	-0.699				
			(0.70)	(1.57)				
Pass rate in Portuguese					0.540	0.109		
					(1.44)	(0.28)		
Pass rate in math							0.584	0.007
							(1.57)	(0.02)
Observations	2,182	2,281	2,182	2,281	2,182	2,281	2,182	2,281
Log likelihood	-1,308.4	-1,321.8	-1,301.4	-1,317.2	-1,307.7	-1,322.3	-1,307.5	-1,322.4

Notes: Numbers shown are marginal probabilities derived from probit estimation, with absolute Z-statistics in parentheses. School efficiency variables are measured at administrative post level and are for the previous academic year. Control variables are the same as in Table 4. See text for details.

Table 6 Marginal impact of school access indicators on EP1 enrolment

	(1)		(2)		(3)	
	Boys	Girls	Boys	Girls	Boys	Girls
Village has EP1 school	0.219	0.187	0.226	0.189	0.217	0.184
	(6.27)	(5.30)	(6.35)	(5.23)	(6.11)	(5.16)
Number of EP1 schools in APs	0.003	0.000			0.003	0.0003
	(3.02)	(0.30)			(2.99)	(0.35)
Number of cement classrooms in AP	0.001	0.002			0.000	0.002
	(0.92)	(2.62)			(0.49)	(2.43)
EP2 school in AP			-0.005	-0.035	-0.030	-0.056
			(0.14)	(0.93)	(0.85)	(1.45)
Secondary school in AP			0.096	0.082	0.075	0.036
			(2.00)	(1.96)	(1.50)	(0.82)
Observations	2,126	2,234	2,126	2,234	2,126	2,234
Log likelihood	-1,300	-1,313	-1,275.6	-1,297.1	-1,267.9	-1,289.3

Notes: Numbers shown are marginal probabilities derived from probit estimation, with absolute Z-statistics in parentheses. AP refers to administrative post, and sample is children aged 7-11 in rural Mozambique. Control variables are the same as in Table 4. See text for details.

Table 7 Estimation results of school quality indicators interacted with head s literacy and household income

	Interactions with head's literacy								Interactions with household income							
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Interactions with:	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Village has school	-0.108	-0.057	-0.099	-0.068	-0.098	-0.060	-0.101	-0.066	-0.094	-0.122	-0.103	-0.111	-0.105	-0.115	-0.097	-0.105
	(1.72)	(1.03)	(1.64)	(1.26)	(1.60)	(1.11)	(1.67)	(1.21)	(1.69)	(2.73)	(1.89)	(2.54)	(1.91)	(2.61)	(1.64)	(2.41)
Pupil-teacher ratio	-0.000	-0.000	-0.000	0.000	0.000	0.000	-0.000	0.000	0.000	0.002	0.001	0.001	0.000	0.001	0.000	0.002
	(0.25)	(0.09)	(0.19)	(0.34)	(0.02)	(0.40)	(0.17)	(0.03)	(0.71)	(1.33)	(0.62)	(0.77)	(0.49)	(0.83)	(0.68)	(1.29)
Number of trained teachers	-0.000	-0.000							-0.000	0.000						
	(0.43)	(0.99)							(0.42)	(1.78)						
Trained female teachers/all teachers			-0.027	-0.394							0.042	0.463				
			(0.07)	(1.96)							(0.17)	(2.08)				
Proportion of teachers who are female					-0.127	-0.411							0.100	0.226		
					(0.49)	(2.29)							(0.48)	(1.13)		
Proportion of female teachers who are trained							0.069	-0.087							0.055	0.236
							(0.38)	(0.71)							(0.38)	(1.91)

Notes: Numbers shown are marginal probabilities derived from probit coefficients of the interaction of each variable with literacy of household head (columns 1-4) and household consumption (columns 5-8). Absolute Z-statistics in parentheses. School quality variables are measured at administrative post level, except for presence of school in village. Number of observations, mean of dependent variable, and other control variables are the same as in Table 4.

Table 8 Estimation results of school efficiency indicators interacted with head s literacy and household income

	Interactions with head's literacy								Interactions with household income							
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Interactions with:	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Village has EP1 school	-0.101	-0.058	-0.108	-0.001	-0.096	-0.059	-0.096	-0.059	-0.107	-0.319	-0.112	-0.112	-0.104	-0.110	-0.105	-0.110
	(1.72)	(1.07)	(1.82)	(1.12)	(1.62)	(1.09)	(1.61)	(1.08)	(1.97)	(2.49)	(2.05)	(2.60)	(1.92)	(2.53)	(1.94)	(2.51)
Previous year pass rate	0.318	0.027							-0.068	-0.109						
	(0.58)	(0.06)							(0.14)	(1.35)						
Female pass rate			0.348	0.475							-0.042	-0.691				
			(0.56)	(0.84)							(0.08)	(1.35)				
Male pass rate			-0.051	-0.407							-0.041	-0.063				
			(0.12)	(1.05							(0.10)	(0.15)				
Pass rate in Portuguese					0.507	0.177							0.617	0.233		
					(1.02)	(0.40)							(1.22)	(0.51)		
Pass rate in Mathematics							0.297	0.168							0.420	0.210
							(0.59)	(0.38)							(0.82)	(0.47)

Notes: Numbers shown are marginal probabilities derived from probit coefficients of the interaction of each variable with literacy of household head (columns 1-4) and household consumption (columns 5-8). Absolute Z-statistics in parentheses. School efficiency variables are measured at administrative post level, except for presence of school in village. Number of observations, mean of dependent variable, and other control variables are the same as in Table 5.

Table 9 Estimation results of school access indicators interacted with head s literacy and household income

	Interactions with head's literacy						Interactions with household income					
	(1)		(2)		(3)		(4)		(5)		(6)	
Interactions with:	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Village has EP1 school	-0.099	-0.056	-0.106	-0.063	-0.101	-0.055	-0.109	-1.128	-0.095	-0.108	-0.103	-0.125
	(1.66)	(1.00)	(1.77)	(1.13)	(1.68)	(0.97)	(1.92)	(2.95)	(1.75)	(2.41)	(1.80)	(2.88)
Number of EP1 schools in APs	-0.001	-0.001			-0.001	-0.001	0.001	0.001			0.001	0.000
	(0.86)	(0.92)			(0.63)	(0.89)	(0.78)	(0.38)			(0.60)	(0.02)
Number of cement classrooms in AP	-0.001	0.000			0.001	0.000	0.000	0.003			0.000	0.003
	(1.17)	(0.49)			(0.58)	(0.29)	(0.41)	(2.31)			(0.01)	(2.70)
EP2 school in AP			-0.013	-0.034	-0.001	-0.032			0.031	0.102	0.024	0.066
			(0.22)	(0.61)	(0.13)	(0.54)			(0.56)	(2.08)	(0.42)	(1.33)
Secondary school in AP			-0.059	-0.033	0.047	0.030			-0.027	-0.009	-0.045	-0.092
			(0.96)	(0.67)	(0.73)	(0.52)			(0.47)	(0.17)	(0.76)	(1.75)

Notes: Numbers shown are marginal probabilities derived from probit coefficients of the interaction of each variable with literacy of household head (columns 1-3) and household consumption (columns 4-6). Absolute Z-statistics in parentheses. School access variables are measured at administrative post level, except for presence of school in village. Number of observations, mean of dependent variable, and other control variables are the same as in Table 6.

Table 10: Determinants of school infrastructure in administrative post

Dependent variable:	Number of schools		Number of trained teachers		Pupil teacher ratio	
	(1)	(1a)	(2)	(2a)	(3)	(3a)
Proportion female heads of household	17.872	-5.273	98.479	22.238	18.139	5.254
	(1.59)	(0.31)	(2.50)	(0.37)	(1.70)	(0.57)
Proportion household heads literate	9.574	-1.546	118.067	34.116	-4.952	3.395
	(1.04)	(0.12)	(3.66)	(0.75)	(0.57)	(0.49)
Proportion with adult with EP2	-30.173	0.432	-44.684	-39.888	-28.571	10.809
	(1.89)	(0.02)	(0.80)	(0.65)	(1.90)	(1.13)
Proportion with female adult with EP1	43.904	37.404	62.081	111.029	45.464	-6.108
	(3.08)	(2.06)	(1.24)	(1.75)	(3.37)	(0.62)
Median p.c. consumption expenditure	-0.001	0.000	-0.003	0.003	0.000	0.000
	(0.67)	(0.18)	(0.93)	(0.84)	(0.54)	(0.45)
Mean farm size	-0.027	-0.419	-0.263	-0.751	0.124	-0.780
	(0.03)	(0.25)	(0.07)	(0.13)	(0.12)	(0.86)
R-squared (percent)	10.25	83.39	13.51	84.14	11.82	94.70
F-ratio	3.16	2.49	4.32	2.63	3.71	8.85
P-value for joint significance of the six SES variables (F-test)		0.30		0.27		0.79

Notes: All variables are measured at the administrative post level in rural Mozambique. There are 175 observations. Columns (1a), (2a), and (3a) include district dummy variables.

Table 11 Policy simulations of impact of school supply investment on rural primary school EP1 enrolment (percent)

	Baseline characteristics		Percentage change in enrolment for each policy intervention		
	(1)	(2)	(3)	(4)	(5)
Region	Predicted enrolment	Proportion of villages with EP1 school	Policy 1: Build school in 6 villages per province	Policy 2: Build school in 12 villages per province	Policy 3: Build school in all villages
Niassa	40	75	10	25	33
Cabo Delgado	32	95	1	2	2
Nampula	46	73	5	10	12
Zambézia	40	54	4	9	20
Tete	37	52	8	19	38
Manica	45	67	10	23	33
Sofala	34	57	9	23	29
Inhambane	45	67	4	9	13
Gaza	69	91	5	5	5
Maputo Province	60	38	16	31	52
All Mozambique	43	67	6	13	20

Notes: The simulations are based on the assumption that each school consists of three cement rooms and comes with two trained teachers. Column (1) gives the predicted enrolment for the base model without any simulation. Provincial differences are generated through interactions with province and number of schools in each administrative post, and province and whether village has a school.

Table 12 Policy simulations of impact of household characteristics on rural primary school EP1 enrolment (percent)

				Percentage change in enrolment due to:			
	Baseline characteristics			Income policy		Adult education policy	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Region	Predicted enrolment	Median p.c. expenditure	Percentage of heads literate	Policy 1: Bring p.c. consumption to 25th percentile	Policy 2: Bring p.c. consumption to median	Policy 3: Give literacy to heads in bottom quartile	Give literacy to heads in bottom 50th percentile
Niassa	37	3,588	42	3.8	9.3	49	71
Cabo Delgado	32	4,441	40	-0.3	-1.2	19	27
Nampula	49	4,137	48	-0.3	-0.9	10	12
Zambézia	41	3,659	43	1.9	7.6	10	29
Tete	38	2,878	39	3.0	6.3	31	46
Manica	40	3,721	42	1.9	5.8	13	24
Sofala	32	2,064	49	9.8	16.2	37	42
Inhambane	46	2,643	46	5.3	12.4	31	41
Gaza	71	4,307	54	0.2	0.4	5	5
Maputo Province	64	3,396	52	-0.6	-1.4	15	25
All Mozambique	44	3,584	45	2.0	5.1	18	28

Notes: In column (4), the policy simulation is to bring all households in the bottom quartile up to the consumption of the 25th precentile (Mt. 2,494). In column (5), the policy simulation is to raise consumption of all household below the median to median consumption (Mt. 3,584). In column (6), the simulation is to make literate all heads of household in the bottom quartile of the p.c. consumption distribution. Column (7) is similar to (6) except applied to all heads below median consumption.

Table 13 Summary statistics for children age 7-11

	Girls		Boys	
	Mean	Std	Mean	Std
Log daily per capita consumption	8.154	0.61	8.143	0.64
Landholdings (hectares)	2.564	2.41	2.590	2.70
Have irrigation	0.046	0.21	0.046	0.21
Have agricultural equipment	0.046	0.21	0.042	0.20
Head literate	0.476	0.50	0.454	0.50
Adult in household with EP2	0.078	0.27	0.077	0.27
Adult female in household with EP2	0.109	0.31	0.109	0.31
Head female	0.187	0.39	0.184	0.39
Head's age	45.508	12.80	45.146	12.71
Currently enrolled in school	0.406	0.49	0.498	0.50
School characteristics				
Pupil - Teacher ratio	65.324	18.07	65.157	17.59
Number of trained teachers	79.654	66.47	80.414	66.90
Proportion of trained female teachers	0.096	0.10	0.094	0.11
Proportion of female teachers	0.103	0.12	0.102	0.13
Pass rate	0.644	0.05	0.643	0.05
Girls pass rate	0.581	0.07	0.580	0.07
Boys pass rate	0.676	0.05	0.676	0.05
Portuguese subject pass rate	0.663	0.05	0.661	0.05
Mathematics subject pass rate	0.683	0.05	0.682	0.05
Have school in village	0.685	0.46	0.695	0.46
Number of EP1 schools in administrative post	26.118	21.08	25.945	19.78
Have EP2 in administrative post	0.651	0.48	0.657	0.47
Have secondary school in administrative post	0.272	0.44	0.273	0.45
Number of observations	2,293		2,203	

Note: School characteristics are measured at the administrative post level, except for school in village.

REFERENCES

Alderman, H., J. Behrman, D. Ross, and R. Sabot, 1996, "Decomposing the Gender Gap in Cognitive Achievement in a Poor Rural Economy," *Journal of Human Resources* 31:229-254.

Appleton, S., J. Hoddinott, and J. Knight, 1996, "Primary Education as an Input into Post-Primary Education: A Neglected Benefit," *Oxford Bulletin of Economics and Statistics* 58(1):211-219.

Barrera, A., 1990, "The Role of Maternal Schooling and its Interactions with Public Health Programs in Child Health Production," *Journal of Development Economics* 32:69-91.

Becker, Gary, 1965, "A Theory of the Allocation of Time," *Economic Journal* 75:493-517.

Betts, J. R., 1995, "Does School Quality Matter? Evidence from the National Longitudinal Survey of Youth," *Review of Economics and Statistics* 77(2):231-250.

Birdsall, N., 1985, "Public Inputs and Child Schooling in Brazil," *Journal of Development Economics* 18:67-86.

Card, D., and A. Kruger, 1992, "Does School Quality Matter? Returns to Education and the Characteristics of Public Schools in the United States," *Journal of Political Economy* 100(1):1-40.

Case, A., and A. Deaton, 1999, "School Inputs and Educational Outcomes in South Africa," *Quarterly Journal of Economics* 114(3):1047-1083.

Deaton, Angus, 1997, *The Analysis of Household Surveys* Baltimore, Md., U.S.A.: The Johns Hopkins University Press.

Deaton, Angus, 1995, "Data and Econometric Tools for Development Analysis," in J. Behrman and T.N. Srinivasan (eds*) Handbook of Development Economics Volume 3A*, Amsterdam: North-Holland Press.

Deolalikar, A., 1993, "Gender Differences in the Return to Schooling and School Enrolment Rates in Indonesia," *Journal of Human Resources* 28(4):899-932.

Glewwe, P., 1999, "Why Does Mother's Schooling Raise Child Health in Developing Countries," *Journal of Human Resources* 34(1):124-159.

Glewwe, P., and H. Jacoby, 1994, "Student Achievement and Schooling Choice in Low Income Countries," *Journal of Human Resources* 29(3):843-864.

Glewwe, P., M. Grosh, H. Jacoby, and M. Lockheed, 1995, "An Eclectic Approach to Estimating the Determinants of Achievement in Jamaican Primary Education," *The World Bank Economic Review* 9(2):231-258.

Goldhaber, D., and D. J. Brewer, 1997, "Why Don't Schools and Teachers Seem to Matter? Assessing the Impact of Unobservables on Educational Productivity," *Journal of Human Resources* 32(3):505-523.

Gomes-Neto, João, and Eric Hanushek, 1994, "Causes and Consequences of Grade Repetition: Evidence from Brazil," *Economic Development and Cultural Change* 43: 117-148.

Handa, Sudhanshu, 1999, "Maternal Education and Child Height," *Economic Development and Cultural Change* 47.

Handa, Sudhanshu, 1996, "The Determinants of Teenage Schooling in Jamaica: Rich vs. Poor, Females vs. Males," *Journal of Development Studies* 32:554-580.

Hanushek, E., 1995, "Interpreting Recent Research on Schooling in Developing Countries," The *World Bank Research Observer* 10(2):227-246.

Hedges, L., R. Laine, and R. Greenwald, 1994, "Does Money Matter? A Meta-Analysis of Studies of the Effect of Differential School Inputs on Student Outcomes," *Educational Researcher* 23(3):5-14.

Kremer, M., 1995, "Research on Schooling: What We Know and What We Don't *The World Bank Research Observer* 10(2):247-254.

Lam, D., and S. Duryea, 1999, "Effects of Schooling on Fertility, Labor Supply, and Investment in Children," *Journal of Human Resources* 34(1):160-192.

Lavy, V., 1996, "School Supply Constraints and Children's Educational Outcomes in Rural Ghana," *Journal of Development Economics* 51:291-314.

Ministry of Finance, 1998, *Understanding Poverty and Well-Being in Mozambique: The First National Assessment*, Government of Mozambique, Maputo.

OXFAM, 1999, Access to Basic Education and Health in Mozambique, Oxfam-GB, Maputo, Mozambique.

Pradhan, M., 1998, "Enrolment and Delayed Enrolment of Secondary School Age Children in Indonesia," *Oxford Bulletin of Economics and Statistics* 60(4):413-430.

Republic of Mozambique, (various years) *Educational Indicators*, Ministry of Education, Planning Directorate, Maputo, Mozambique.

Rivers, D., and Q. H. Vuong, 1988, "Limited Information Estimators and Exogeneity Tests for Simultaneous Probit Models," *Journal of Econometrics* 39(3):347-366.

Rosenzweig, M., and T. P. Schultz, 1983, "Consumer Demand and household Production," *American Economic Review* 73(1):38-42.

Schultz, T. Paul, 1988, "Education Investments and Returns," in H. Chenery and T. N. Srinivasan (eds) *Handbook of Development Economics, Volume 1,* Amsterdam: North-Holland Press.

Simmons, J., and L. Alexander, 1978, "The Determinants of School Achievement in Developing Countries: A Review of the Research," *Economic Development & Cultural Change* 26(2):341-357.

Strauss, John, and Duncan Thomas, 1995, "Human Resources: Empirical Modeling of Household and Family Decisions," in J. Behrman and T. N. Srinivasan (eds) *Handbook of Development Economics, Volume 3A*, Amsterdam: North-Holland Press.

Tan, J.-P., J. Lane, and P. Coustere, 1997, "Putting Inputs to Work in Elementary Schools: What Can be Done in the Philippines*?* *Economic Development and Cultural Change* 45:857-879.

Tansel, Ayit, 1997, Schooling Attainment, Parental Education, and Gender in Côte d'Ivoire and Ghana, *Economic Development and Cultural Change* 45:825-856.

Thomas, D., J. Strauss, and M.-H. Henriques, 1991, "How Does Mother's Education Affect Child Height?" *Journal of Human Resources* 26:183-211.

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