The Determinants of Primary School Enrollment and Household Schooling Expenditures in Kenya: Do They Vary by Income?

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I. Introduction

While there is a very large literature on what determines child schooling in developing countries, much of it has ignored income differences in the demand for schooling. This is surprising in view of the empirical fact, observed in most developing countries, that there are large differences in enrollment rates across income groups. *A priori* one would expect not only the *levels* of school enrollment but also the *marginal effects* of factors such as household income, number of siblings, and community schooling infrastructure on school enrollments to vary systematically across income groups. Two additional shortcomings of the existing literature on schooling are that (i) generally few studies have analyzed the determinants of *both* school enrollment (quantity) and household schooling expenditures per pupil (quality), and (ii) there have been limited efforts at identifying the effects of school facilities and teacher-pupil ratios on school enrollments and household expenditures on schooling.[1] All of these are important policy issues. For instance, the merits of expanding the quantity of schooling (say, by increasing the number of school facilities) as opposed to the quality of schooling (say, by increasing the teacher-pupil ratio)[2] are widely debated in policy circles in most developing countries. Unfortunately, these debates are usually not based on any information about how the two sets of policies might differentially affect the schooling outcomes of children from low- versus high-income backgrounds.

This paper has three distinct objectives. First, it attempts to estimate the joint demand for primary school enrollment and schooling expenditures per pupil (which I treat as a measure of schooling quality), using data from Kenya. Second, the paper estimates the differing impacts of additional school facilities and teacher-pupil ratios on the household demand for primary schooling. Third and finally, the paper explores the possibility of systematic income differences in the parameters of the schooling demand relations.

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[1]The studies by Alderman *et al.* (1996a, 1996b), Birdsall (1983), Case and Deaton (1996), Gertler and Glewwe (1990), and Kremer *et al.* (1996) are exceptions. A survey by Hanushek (1995) reviews the evidence from developing countries linking school facilities and expenditures to student outcomes, including test scores. See Schultz (1988) for a review of the economics literature on schooling in developing countries.

[2]See Behrman and Birdsall (1983) for evidence of the importance of schooling quality on rates of return to schooling.

II. Background, Data and Empirical Model

With a total population of 26 million and a GNP of $310 per capita in 1992, Kenya is one of the largest economies in Eastern Africa (World Bank 1994). Like most other countries in the region, the Kenyan economy has remained stagnant during much of the last decade. For instance, Kenya achieved an annual growth rate of per-capita GNP of merely 0.2 percent between 1980 and 1992. Despite the stagnancy of income, Kenya made rapid strides in the expansion of primary education during this period; the gross enrollment rate for primary school-aged children increased from 53 percent in 1970 to 94 percent in 1991. However, there have been indications of major enrollment declines during the 1990s; recent estimates place the gross primary enrollment rate in the range of only 75-80 percent (GOK 1995).

I use the WMS-2 (Second Welfare Monitoring Survey) data collected for Kenya by the Central Bureau of Statistics (CBS). The WMS-2 survey was a cluster-based nationally-representative survey of 59,193 individuals residing in 10,848 households in 1,189 clusters undertaken in July-August 1994. Data were obtained on schooling, health, food and nonfood expenditures, and sources of income. The analysis of school enrollment presented here is based on a sample of 11,452 primary school-aged (i.e., ages 7-14 years) children.

The other data used are district-level (unpublished) data on the numbers of schools, students, and teachers prepared annually by the Ministry of Education and Training.

This paper focuses on the demand for school enrollment and school expenditures for children 7 to 14 years of age.[3] This group corresponds roughly to the primary level of schooling. Since an important objective of this paper is to test for income-group differences in schooling demand, all the coefficients of both relations are allowed to differ by per capita expenditure. The equations to be estimated are:

$$(1) \qquad \Pr(S_i=1) = F(a(Y_i) + \mathbf{b}(Y_i)\,\mathbf{A}_i + c(Y_i)\,Y_i + \mathbf{d}(Y_i)\,\mathbf{H}_i + \mathbf{e}(Y_i)\,\mathbf{C}_i + \mu_i),$$

[3]Although I do not explicitly consider the public-private school choice in this paper, it is subsumed in the per-pupil schooling expenditure variable.

(2) $X_i = a'(Y_i) + \mathbf{b'}(Y_i)\,\mathbf{A}_i + c'(Y_i)\,Y_i + \mathbf{d'}(Y_i)\,\mathbf{H}_i + \mathbf{e'}(Y_i)\,\mathbf{C}_i + \mu'_i$,

(3) $\alpha(Y_i) = \alpha_0 + \alpha_1 Y_i, \qquad \alpha = \{a, \mathbf{b}, c, \mathbf{d}, e, a', \mathbf{b'}, c', \mathbf{d'}, e'\}$

where

i		indexes the individual child,
$F(\cdot)$	=	cumulative logistic distribution,
$Pr(S_i)$	=	the probability of child i being enrolled in school,
X	=	annual school expenditures on child i by household,
A	=	age (linear and quadratic terms) and sex of child i,
Y	=	log annual household expenditure per capita,
H	=	vector of other household characteristics, such as the schooling of the household head and head's spouse,
C	=	vector of community-level characteristics, including the number of schools per 1,000 children aged 7-14 and the teacher-pupil ratio in the district of residence, and
μ, μ'	=	i.i.d. disturbance terms.

Since the school enrollment variable, S_i , is a dichotomous variable assuming the value one if the child was in school during the reference period and zero otherwise, equation (1) is estimated by the maximum likelihood logit estimation method. The vector of household characteristics ($\mathbf{H}_i$) includes the age and schooling of the household head, age and schooling of the head's spouse, numbers of younger and older male and female siblings, distance to water source, and urban/rural residence. In a situation of scarcity, the intrahousehold competition for resources can be an important determinant of schooling. The numbers of younger and older male and female siblings are meant to capture the competition for resources within the household. Another important factor in the African context is proximity to drinking water sources. Since women and children often are responsible for water collection, the proximity to water sources reflects the opportunity cost of time

for women and children.[4] As such, it can have an important influence on the household demand for primary schooling.

There are two variables that I use to proxy schooling infrastructure. The first is the number of primary schools per 1,000 children of primary school age (viz., 7-14 years) in the child's district of residence. The per capita availability of schools in a community might affect individual schooling outcomes directly because of rationing of school spaces, or indirectly via its (inverse) association with the "market" price of schooling and average proximity to schools (both of which would in turn influence the demand for schooling). The other community variable that is included is the teacher-pupil ratio. The teacher-pupil ratio is often used as an indicator of school quality in the education literature. If the quality of schooling services is an important determinant of their utilization, improvements in quality could lead to greater utilization and improved schooling outcomes. Since the denominator of the teacher-pupil ratio is the number of enrolled students in primary schools, there could be a spurious inverse correlation between the probability of school enrollment and the teacher-pupil ratio. Hence, I also use the number of primary school teachers per 1,000 *children of primary school age* as an alternative indicator of the supply of teachers.

An important caveat is that I implicitly assume that the spatial placement of schools and teachers across Kenyan districts is exogenous to the household's child schooling decisions. If schools and teachers are allocated across districts (by the central government or by market forces) on the basis of unobserved education conditions, the estimated effects of school availability and teacher-pupil ratios on individual schooling outcomes may be spurious. However, this problem is not likely to be important in the current context for two reasons. First, teachers in Kenya are supposed to be assigned to various districts by the Teachers' Service Commission on the basis of population norms established years ago -- not on the basis of current enrollments. Second, the

[4]Unfortunately, the WMS data do not indicate the actual distance of households to water sources, but only the amount of time spent by households in water collection.

primary focus of this paper is on how the marginal effects of school facilities and teacher-pupil ratios on primary enrollments and on household schooling expenditures vary across children of different economic backgrounds. In order for the differential effects of community schooling infrastructure by household expenditure to be biased, it would not be sufficient to show that district differences in schooling infrastructure respond to district differences in average (unobserved) schooling status. Instead, schooling infrastructure would have to respond to district differences in the *distribution* of (unobserved) schooling status across economic groups, which is a considerably different proposition.

IV. Primary Enrollment Rates and Schooling Expenditures in Kenya

Figure 1 shows the age-specific enrollment rate in primary schools in urban and rural areas. The net enrollment rate is observed to reach a peak of around 90 percent for the age group 9-11 years in urban areas and a peak of 85 percent for the 11-14 years age group in rural areas. In general, the age profile of primary enrollments in rural areas is lower than and to the right of the corresponding curve for urban areas (the latter indicating delayed entry into primary schools by rural children).

Table 1 shows the gross and net primary enrollment rates by per capita expenditure quintiles and by rural/urban residence. Surprisingly, the differences in enrollment rates across quintiles are quite small; there is a 10 percentage point difference in the enrollment rates of the poorest and the richest quintile in the rural areas. In the urban areas, the difference is even narrower. Even the rural-urban disparity in enrollment rates is relatively small -- no more than 10 percentage points for any given quintile. In the sample, the net primary enrollment rate varies from a low of 70 percent for the poorest rural quintile to a high of 84 percent for the fourth urban quintile. The gross enrollment rate has a somewhat larger variation -- from a low of 76 percent for the poorest rural quintile to a high of 93 percent for the richest urban quintile.[5]

[5]As in most developing countries, the gross primary enrollment rate is significantly higher than the corresponding net rate, indicating delayed entry into primary school and the presence of secondary school-aged children in primary school.

Table 1: Net and gross primary enrollment rates, by per capita expenditure quintile, Kenya, 1994						
Per capita expenditure quintile	Net primary enrollment rate			Gross primary enrollment rate		
	Rural	Urban	Total	Rural	Urban	Total
Bottom	69.97	80.97	71.13	76.02	84.57	77.13
Second	77.73	82.98	78.72	83.17	90.09	84.09
Third	79.74	76.48	80.36	86.24	83.35	85.81
Fourth	80.64	84.20	79.12	85.26	92.83	84.85
Top	81.33	80.14	82.42	86.22	95.77	89.10

As would be expected, household schooling expenditures per pupil vary considerably more across quintiles. Table 2 indicates that the top expenditure quintile in the rural areas spends nearly three times as much per pupil as the poorest quintile. In the urban areas, the richest quintile spends five times as much as the poorest quintile.

Table 2: Annual household schooling expenditures per pupil, by per capita expenditure quintile, Kenya, 1994			
Per capita expenditure quintile	Annual household schooling expenditures per pupil (Ksh.)		
	Rural	Urban	Total
Bottom	390.29	1,970.32	536.72
Second	451.57	1,301.09	501.53
Third	608.61	1,913.85	676.95
Fourth	860.97	2,942.42	1,062.02
Top	992.10	10,029.60	2,409.34

How does the supply of school facilities and the teacher-pupil ratio vary across per capita expenditure quintiles? Since these data are district-level data that are merged with individual-level

data on enrollments and household data on expenditures, one would not expect a strong relationship between schooling infrastructure and household expenditure per capita. Table 3 below confirms this suspicion. Indeed, if anything, the poorest quintiles are observed to have a larger supply of school facilities and higher teacher-pupil ratios than the richest quintiles, although the differences are small. On average, there are 3.6 primary schools per 1,000 children of primary school age (or 280 children aged 7-14 years for each primary school). The average teacher-pupil ratio is 40 primary teachers per 1,000 primary school students (implying an average of 25 students per teacher).

Table 3: Availability of schools per 1,000 primary school-aged children and teacher-pupil ratios in primary, Kenya, 1994

Per capita expenditure quintile	Number of primary teachers per 1,000 primary students	Number of primary schools per 1,000 children aged 7-14 years
Bottom	41.20	3.79
Second	40.82	3.77
Third	40.17	3.69
Fourth	39.66	3.51
Top	37.52	3.00
Total Sample	39.97	3.58

V. Empirical Results

Primary enrollment rate. Table 4 reports the logit estimates of the probability of a child aged 7-14 being enrolled in primary school. As noted earlier, I have presented two sets of estimates - one with the teacher-pupil ratio as a right-hand side variable and another with the teacher-child ratio (i.e., number of teachers per 1,000 children aged 7-14 years) as an explanatory variable. The two sets of estimates are remarkably similar, suggesting that the inclusion of the teacher-pupil ratio does not introduce any additional bias in the estimates. Since much of the existing literature on schooling uses the teacher-pupil ratio, and the teacher-pupil ratio is a more appealing indicator of school

quality,[6] I focus on the estimates with the teacher-pupil ratio on the right-hand side in the discussion below. Table 5 presents the marginal effects and elasticities corresponding to the coefficients reported in the last but one column of Table 4.

The hypothesis that the parameters of the primary enrollment equation do not depend upon log of per capita household expenditure is firmly rejected at less than the 1 percent level of significance. The last two columns in Table 4 report the logit equation estimated after dropping log expenditure-interacted terms whose coefficients were not significantly different from zero at the 10 percent level. What is interesting is that the coefficients of the vast majority of (14 of the 20) explanatory variables depend significantly on per capita household expenditure. In addition to per capita household expenditure, I interact the two district-level schooling infrastructure variables with an urban residence dummy variable. The interactions with urban residence are both highly significant.

The empirical results clearly indicate the importance of intrahousehold competition on schooling enrollment. The number of younger siblings in a household, whether male or female, has a significant negative effect on the probability of a child aged 7-14 enrolling in primary school. However, this effect is attenuated with per capita expenditure. On the other hand, the number of older female siblings has the opposite effects on enrollment, suggesting that in low-income households older female children release younger siblings from household chores that would otherwise keep them away from school. At higher levels of income, this effect is diminished, presumably because there are other members (e.g., servants) who can perform household chores.[7]

[6]The number of teachers per 1,000 children of primary school age is an indicator of the aggregate supply of teachers in a community, rather than an indicator of school quality.

[7]Alternatively, older sisters may participate in the labor market and earn additional income that would enable younger siblings to attend school.

There are several characteristics of the household head and his/her spouse that have significant effects on primary enrollment. The age of the spouse -- but not of the head -- is associated with increased enrollment. While the education of both the household head and his/her spouse have significant effects on enrollment, the nature of the interaction between parental education and per capita expenditure is somewhat unusual. The effect of the household head's education on child enrollment is observed to increase with log per capita expenditure, while that of the spouse's education is observed to weaken. Thus, at low levels of per capita expenditure, improvements in the spouse's schooling will have a larger effect on enrollment than improvement in the head's schooling, while at higher levels of per capita expenditure the relative magnitudes of the two effects are reversed. By now, a very large number of studies from all over the developing world have documented the positive effects of female education on child schooling. What the estimates presented here indicate is that this effect is much stronger for low-income than for high-income households.

Water collection is an important activity in the rural Kenyan context. Rural households spend an average of 40 minutes each day on water collection, while urban households spend only 9 minutes. The empirical results in Table 4 indicate that the amount of time spent daily in water collection -- a proxy for the opportunity cost of time for household members engaged in water collection -- has a significant negative effect on primary enrollment. However, this effect diminishes with per capita expenditure. Since the survey data do not indicate which household members engage in water collection, it is not clear whether it is the higher opportunity cost of time for children aged 7-14 years or the higher opportunity cost for their mothers that reduces primary enrollments.

The total effect of log expenditure per capita on school enrollment cannot be gleaned from the estimated coefficients on log expenditure and log expenditure squared alone, since log expenditure is interacted with almost every explanatory variable in the equation. Table 5 indicates that the marginal effect of per capita expenditure on the primary enrollment rate declines with per capita expenditure. For the poorest expenditure quintile, the expenditure elasticity of enrollment is 0.18, while it is only a third as much (0.06) for the richest quintile.

The effects of the community schooling variables are of most interest in this paper. The number of primary schools per 1,000 children aged 7-14 has a significant positive effect on the

probability of enrollment, although this effect diminishes with per capita expenditure and with urban residence. For the poorest per capita expenditure quintile, the elasticity of primary enrollment with respect to school availability is estimated at 0.37 (Table 5), and this declines to close to zero for the richest quintile. Thus, any policies that serve to expand the number of school facilities will increase the net primary enrollment rate of the poor much more than that of the nonpoor in the rural areas of Kenya. This in turn may imply that primary school spaces are rationed to the poor, or that an increase in the number of schools is likely to lower schooling costs (i.e., the equilibrium "price" of schooling) for poor households and thereby improve their rates of enrollment.

On the other hand, the primary teacher-pupil ratio has exactly the opposite effects on enrollment. It reduces the primary enrollment rate of poor children, especially in the rural areas, but increases that of richer children, particularly those residing in urban areas. Table 5 reports that the estimated elasticity of primary enrollment with respect to the teacher-pupil ratio varies from -0.53 for the poorest expenditure quintile to 0.13 for the richest quintile.

Why would an improvement of the teacher-pupil actually *reduce* the enrollment rate for poor children? One reason might be that improvements in the teacher-pupil ratio might take place at the expense of other schooling inputs, such as bursaries and scholarships, that primarily help poor students attend primary school. Another reason might be that improvements in the teacher-pupil ratio at the community level are often financed out of higher user fees and supplements, which in turn can have an adverse effect on the enrollment rate of poor children (if the price elasticity of demand for schooling is more negative for the poor than for the nonpoor).[8]

The differing effects of school facilities expansion and improvements in the teacher-pupil ratio on enrollments for different economic groups are highlighted in Figure 2, which plots the estimated elasticities of enrollment with respect to these two interventions against per capita household expenditure. The results are striking; they suggest that both the switch from a positive to a negative elasticity of enrollment with respect to school facilities *and* the switch from a negative

[8]In Kenya, although teacher salaries in the public school system are paid by the central government, local communities are free to (and often do) provide salary and other supplements to teachers. Communities unable to provide such supplements often have difficulty retaining teachers. This can easily lead to a situation where the teacher-pupil ratio in a community can be improved by collection of various teacher salary supplements from students.

to a positive elasticity of enrollment with respect to the teacher-pupil ratio occur at an annual per capita expenditure level of Ksh. 2,000 - 3,000. Approximately, 5-10 percent of the households in the sample fall below this level of per capita expenditure.

Household schooling expenditures per pupil. While the enrollment rate can be viewed as the household's demand for the quantity of schooling, household schooling expenditures per pupil can be treated as the household's demand for schooling quality. The parameters of the schooling expenditure equation are reported in Table 6, while the corresponding elasticities are calculated and shown in Table 7.

The first observation to make is that far fewer parameters of the schooling expenditure equation depend significantly on log per capita expenditure (only 5 of 20 estimated parameters). Interestingly, the interaction effect of age and being male on schooling expenditures is negative, suggesting that households spend more on the primary schooling of older girls (relative to older boys), but this effect attenuates with per capita expenditure, so that at high levels of per capita expenditure households spend more on a boy's schooling than on a girl's schooling.

The age of the household head's spouse is positively associated with schooling expenditures, as are the schooling of both the household head and his/her spouse. In general, the spouse's schooling, particularly at the primary level, has much larger effects on child schooling expenditures than the head's schooling. The effect of a spouse's post-primary education on child schooling expenditure increases with per capita expenditure, such that a spouse with post-primary schooling is associated with 71 percent higher schooling expenditures per child in the richest per capita expenditure quintile. (This compares to a mere 6 percent increase in child schooling expenditures with a post primary-educated household head.)

The effect of total expenditure per capita on schooling expenditures per child is negative, but increases with the level of per capita expenditure. However, when all of the interactions with log per capita expenditure in the equation are taken into account, the net effect of per capita expenditure on schooling expenditures per child is negative at virtually all levels of expenditure per capita. The expenditure elasticity of schooling expenditures per child is as large as -2.6 for the poorest quintile and as low as -0.32 for the richest quintile (Table 7). These results are puzzling and counter-intuitive.

While both of the community schooling variables have significant effects on schooling expenditure per pupil, neither of the two effects are dependent on log expenditure per capita. The effect of school facilities expansion on household schooling expenditures per child is estimated to be negative, while the effect of the teacher-pupil ratio is estimated to be positive. These results can be understood if it is recognized that schooling expenditure per pupil reflects not only the quality of schooling purchased by households but also the "price" of schooling. As such, effects on schooling expenditure confound effects on the price and quality of schooling. It is likely that an expansion of schooling facilities in a community serves to reduce the price of schooling services and the total amount spent by households on their child's schooling (assuming the demand for schooling quality has less-than-unitary own-price elasticity). Likewise, if improvements in the teacher-pupil ratio are financed by higher prices for schooling services, an increase in the teacher-pupil ratio would be associated with increased school spending per child by households.

Urban households are observed to spend less on the schooling of each child than rural households, although this effect strengthens with per capita expenditure. Table 7 shows that urban households in the poorest quintile spend nearly 168 percent less on the schooling of each child than rural households; however, in the richest quintile, urban households spend 76 percent more. Again, these results reflect the confounding effect of urban residence on both the price of schooling as well as on schooling quality purchased. Because of economies of scale and greater density of schools in urban areas, the price of schooling services is generally lower in urban than in rural areas. However, at higher levels of income and expenditure, urban households "purchase" quality to a much greater extent than rural households. This would explain the negative effect of urban residence alone -- but a strong positive effect of urban residence interacted with log per capita expenditure -- on household schooling expenditures per pupil.

VI. Concluding Remarks

In this paper, I have estimated reduced-form equations for primary school enrollments and household schooling expenditures per pupil, using household survey data and district-level data on schooling infrastructure from Kenya. I find that there are significant differences in the responsiveness of enrollments to household and community characteristics across per capita expenditure

groups. Hence, analysis of the determinants of school enrollment that is not disaggregated by per capita expenditure is likely to provide misleading results.

There are two important findings that emerge from the analysis undertaken here. First, while there is a very large literature by now on the positive effects of female education on child schooling in developing countries, I find that the beneficial impact of female education (in this case, education of the spouse of a household head) is much stronger for the poorer expenditure quintiles than for the top quintiles. Indeed, among the top quintiles, the effect of female education on child schooling is not significantly different from that of male education. However, in the poorest quintile, the effect of female education on primary enrollment is two to three times as large as that of male education. This means that female education can be a powerful means of reducing inequities in child schooling outcomes across income groups.

Second, the results obtained here throw light on the frequent dilemma facing policy makers in developing countries on the choice between expanding school facilities (quantity) and the teacher-pupil ratio (quality). The empirical results presented here suggest that the two interventions have diametrically opposite effects on poor and nonpoor children. An expansion of school facilities increases the enrollment of children in the poorest quintiles but has no impact on the enrollment of children in the top quintiles. On the other hand, an improvement in the teacher-pupil ratio increases the enrollment rate of children in the top quintiles, and actually *reduces* the enrollment of children in the poor quintiles. One reason for the decline in enrollment of poor children might be that improvements in the teacher-pupil ratio often take place at the expense of other schooling inputs, such as bursaries and scholarships, that primarily help poor students attend primary school. Another reason may be that improvements in the teacher-pupil ratio are often financed out of higher user fees and supplements, which in turn can have an adverse effect on the enrollment rate of poor children.

These findings would appear to suggest that in situations where there is less than universal primary enrollment (UPE) and the government has set a time-bound goal of UPE, such as in Kenya, policies that serve to expand the number of school facilities may make more sense than interventions that increase the teacher-pupil ratio. This does not mean that the expansion of school facilities should take place entirely in the public sector; indeed, given the precarious budgetary situations of most African countries, it is unlikely that the public sector can take on the task of establishing new

schools. A more feasible policy would be to enlist the private sector in expanding primary school coverage. There are many formal and informal restrictions on the private sector's participation in the primary education sector in Kenya and in other developing countries; rationalization or removal of these barriers is likely to have high returns in the form of expanded enrollments, especially for children from poor backgrounds.

Table 4: Logit Estimates of the Probability of a Child Aged 7-14 years being enrolled in primary school, Kenya, 1994								
	Using teacher/*child* ratio				Using teacher/*pupil* ratio			
Independent Variable	Coeff.	t ratio	Coeff.	t ratio	Coeff.	t ratio	Coeff.	t ratio
Age	-0.678	-0.43	-0.757	-0.47	-0.696	-0.45	-0.661	-0.42
Age x log per cap hh exp (LPCEXP)	0.331	1.91	0.338	1.94	0.327	1.93	0.322	1.87
Age squared	0.102	1.35	0.099	1.29	0.103	1.39	0.098	1.31
... x LPCEXP	-0.022	-2.67	-0.022	-2.59	-0.022	-2.71	-0.021	-2.60
Age x Male	-0.251	-0.75	0.056	1.90	-0.219	-0.67	0.050	1.75
Age x Male x LPCEXP	0.033	0.90			0.030	0.83		
Whether male?	4.319	1.32	-0.383	-1.32	4.490	1.41	-0.308	-1.09
... x LPCEXP	-0.508	-1.42			-0.523	-1.51		
# of younger male siblings in hh	-0.860	-2.10	-0.723	-2.01	-0.855	-2.15	-0.732	-2.06
... x LPCEXP	0.102	2.23	0.087	2.16	0.101	2.27	0.088	2.21
# of younger female siblings in hh	-0.894	-2.00	-1.103	-2.68	-0.762	-1.70	-1.185	-2.94
... x LPCEXP	0.105	2.13	0.128	2.81	0.091	1.84	0.137	3.07
# of older male siblings in hh	-0.212	-0.52	0.018	0.47	-0.357	-0.90	-0.014	-0.36
... x LPCEXP	0.025	0.55			0.038	0.85		
# of older female siblings in hh	0.887	2.22	0.580	1.59	0.867	2.27	0.646	1.86
... x LPCEXP	-0.093	-2.15	-0.060	-1.51	-0.095	-2.27	-0.071	-1.87
Age of hh head	-0.017	-0.41	0.002	0.57	-0.011	-0.26	0.001	0.16
... x LPCEXP	0.002	0.47			0.001	0.27		
Age of spouse of head	0.125	2.00	0.114	2.25	0.103	1.68	0.026	4.75
... x LPCEXP	-0.012	-1.74	-0.011	-1.95	-0.008	-1.24		
Whether hh head female?	4.349	1.08	0.677	1.15	4.198	0.98	0.760	1.33
... x LPCEXP	-0.432	-0.89			-0.398	-0.77		
Whether head has primary schooling?	-0.831	-0.85	0.457	5.24	-1.596	-1.70	-1.300	-1.53
... x LPCEXP	0.143	1.32			0.243	2.35	0.211	2.25
Whether head has post-primary schooling?	0.718	0.45	0.730	5.84	-0.280	-0.18	0.967	7.92
... x LPCEXP	0.006	0.03			0.135	0.77		
Whether head's spouse has primary?	4.048	3.69	3.579	3.67	3.933	3.73	3.247	3.31
... x LPCEXP	-0.368	-3.05	-0.315	-2.94	-0.330	-2.85	-0.254	-2.35
Whether head's spouse has post-primary?	4.210	2.44	4.757	3.44	4.476	2.68	3.661	2.70
... x LPCEXP	-0.356	-1.92	-0.414	-2.82	-0.353	-1.96	-0.263	-1.83

Log of per capita hh expenditure	0.484	0.43	0.300	0.27	0.112	0.10	-0.511	-0.47
... x LPCEXP	-0.056	-2.15	-0.055	-2.00	-0.060	-2.50	-0.050	-1.95
Distance (minutes) to water source	-0.015	-2.31	-0.016	-2.53	-0.016	-2.59	-0.018	-2.93
... x LPCEXP	0.001	2.00	0.002	2.22	0.001	1.95	0.002	2.30
# of primary schools per child aged 7-14 in district	459.615	1.22	507.115	1.38	1,181.036	3.80	1,192.821	3.87
... x LPCEXP	-72.976	-1.76	-78.995	-1.96	-103.513	-3.03	-104.856	-3.10
... x Whether urban	-93.654	-0.72			-445.643	-3.71	-444.208	-3.68
# of primary teachers per child/student in district	-28.224	-0.58	-42.042	-0.89	-202.175	-3.99	-206.987	-4.26
... x LPCEXP	10.322	1.91	11.917	2.28	19.493	3.46	20.060	3.71
... x Whether urban	-28.566	-1.81	-36.997	-3.94	51.446	2.58	54.101	2.71
Whether urban?	2.323	1.68	1.203	3.23	0.380	0.26	-0.924	-1.68
... x LPCEXP	-0.120	-0.87			-0.127	-0.94		
Intercept	-14.588	-1.60	-12.893	-1.41	-8.991	-0.97	-4.141	-0.47
Log Likelihood Ratio	-4,725		-4,730		-4,831		-4,838	
Wald test for no significant interaction effects	95.47		87.2		105.23		98.49	
Notes: Number of observations is 11,452 children aged 7-14 years. Huber-corrected standard errors reported.								

Table 6: Regression of Educational Expenditures per Child Aged 7-14 years enrolled in primary school, Kenya, 1994

Independent Variable	Using teacher/*child* ratio				Using teacher/*pupil* ratio			
	Coeff.	t ratio	Coeff.	t ratio	Coeff.	t ratio	Coeff.	t ratio
Age	-1196.37	-0.17	-176.91	-0.69	-1171.65	-0.16	-183.89	-0.72
Age x log per cap hh exp (LPCEXP)	107.91	0.14			104.66	0.13		
Age squared	49.21	0.14	11.14	0.91	48.27	0.14	11.46	0.94
... x LPCEXP	-4.00	-0.11			-3.87	-0.10		
Age x Male	-1505.88	-1.87	-798.74	-2.05	-1537.83	-1.91	-802.14	-2.06
Age x Male x LPCEXP	166.32	1.87	89.37	2.11	169.97	1.91	89.95	2.11
Whether male?	7694.61	0.66	101.01	0.23	8047.12	0.70	77.82	0.18
... x LPCEXP	-823.99	-0.65			-864.15	-0.68		
# of younger male siblings in hh	2859.69	2.15	2856.40	1.91	2875.14	2.16	2881.32	1.92
... x LPCEXP	-318.49	-2.13	-318.82	-1.90	-320.41	-2.14	-321.77	-1.91
# of younger female siblings in hh	75.33	0.10	32.10	0.93	105.75	0.14	28.88	0.84
... x LPCEXP	-4.19	-0.05			-7.74	-0.09		
# of older male siblings in hh	1371.98	0.82	-54.99	-1.11	1369.39	0.82	-54.74	-1.09

... x LPCEXP	-158.35	-0.85			-158.07	-0.85		
# of older female siblings in hh	567.68	0.44	46.96	0.66	552.58	0.43	45.13	0.63
... x LPCEXP	-56.72	-0.42			-55.23	-0.40		
Age of hh head	12.75	0.22	-3.76	-1.13	13.53	0.23	-3.89	-1.17
... x LPCEXP	-1.78	-0.27			-1.88	-0.29		
Age of spouse of head	-38.04	-0.21	24.66	2.58	-36.64	-0.21	24.98	2.66
... x LPCEXP	6.83	0.34			6.73	0.35		
Whether hh head female?	-2316.36	-0.83	-80.95	-0.23	-1824.51	-0.71	-115.64	-0.33
... x LPCEXP	256.23	0.75			198.58	0.63		
Whether head has primary schooling?	-661.06	-0.78	52.13	1.16	-536.69	-0.62	57.91	1.29
... x LPCEXP	77.45	0.82			64.59	0.68		
Whether head has post-primary?	936.41	0.81	152.42	1.61	1122.45	1.05	161.91	1.75
... x LPCEXP	-81.38	-0.65			-100.69	-0.87		
Whether head's spouse has primary?	1369.23	0.97	197.25	3.97	1336.16	1.00	210.93	4.26
... x LPCEXP	-129.01	-0.84			-123.61	-0.84		
Whether spouse has post-primary?	-9281.62	-1.74	-9230.15	-1.96	-9488.95	-1.82	-9468.48	-2.00
... x LPCEXP	1070.15	1.93	1068.67	2.20	1095.15	2.02	1096.56	2.24
Log of per capita hh expenditure	-5242.57	-0.99	-4528.88	-3.21	-5264.52	-1.00	-4528.79	-3.19
... x LPCEXP	250.02	3.01	242.48	3.30	250.73	3.02	242.05	3.28
Distance (minutes) to water source	-1.04	-0.17	0.54	1.41	-1.13	-0.19	0.49	1.33
... x LPCEXP	0.16	0.25			0.17	0.26		
# of primary schools per child 7-14	-238.28	-0.83	-70.10	-4.09	-107.64	-0.31	-85.10	-6.12
... x LPCEXP	18.04	0.56			2.54	0.07		
... x Whether urban	-590.26	-2.23	-603.72	-2.28	-357.86	-1.73	-311.50	-1.67
# of primary teachers per child/student	39.79	0.54	0.82	0.27	20.91	0.32	4.99	1.82
... x LPCEXP	-4.21	-0.53			-1.79	-0.25		
... x Whether urban	49.62	2.39	49.59	2.54	12.98	0.47		
Whether urban?	-12325.-77	-1.91	-12489.-12	-1.72	-11515.-60	-1.68	-11296.-56	-1.57
... x LPCEXP	1380.92	2.28	1401.58	1.98	1363.83	2.21	1375.57	1.95
Intercept	27319.67	0.63	21263.14	3.52	27375.82	0.64	21209.80	3.49
R-square	0.236		0.232		0.236		0.231	
F-test for no significant interaction effects	3.01		2.9		3.05		3.36	

Notes: Number of observations is 9,068 children aged 7-14 years. Huber-corrected standard errors reported.

Table 5: Marginal effects and elasticities of net primary enrollment, by per capita expenditure quintile, Kenya, 1994

With respect to:	Total Sample	Per Capita Expenditure Quintiles				
		Bottom	Second	Third	Fourth	Top
Age	0.052 (0.681)	0.088 (1.279)	0.059 (0.762)	0.045 (0.574)	0.038 (0.501)	0.024 (0.296)
Whether male?	0.035 (0.045)	0.043 (0.06)	0.034 (0.043)	0.033 (0.041)	0.034 (0.043)	0.029 (0.036)
# of younger male siblings	0.013 (0.011)	-0.006 (-0.006)	0.008 (0.007)	0.013 (0.01)	0.02 (0.015)	0.027 (0.018)
# of younger female siblings	0.012 (0.01)	-0.018 (-0.018)	0.004 (0.004)	0.013 (0.011)	0.024 (0.018)	0.036 (0.025)
# of older male siblings	-0.002 (-0.002)	-0.003 (-0.003)	-0.002 (-0.002)	-0.002 (-0.001)	-0.002 (-0.001)	-0.002 (-0.001)
# of older female siblings	0.000 (0.000)	0.016 (0.015)	0.003 (0.002)	-0.001 (-0.001)	-0.007 (-0.004)	-0.014 (-0.008)
Age of head	0.000 (0.007)	0.000 (0.009)	0.000 (0.007)	0.000 (0.006)	0.000 (0.006)	0.000 (0.005)
Age of spouse	0.004 (0.212)	0.005 (0.287)	0.004 (0.208)	0.004 (0.189)	0.004 (0.198)	0.004 (0.161)
Whether hh head female?	0.13 (0.167)	0.156 (0.219)	0.127 (0.162)	0.12 (0.149)	0.126 (0.159)	0.11 (0.134)
Whether head has primary schooling?	0.108 (0.139)	0.08 (0.112)	0.094 (0.12)	0.103 (0.128)	0.123 (0.155)	0.131 (0.159)
Whether head has post-primary schooling?	0.166 (0.213)	0.199 (0.279)	0.162 (0.206)	0.153 (0.19)	0.16 (0.202)	0.14 (0.17)
Whether spouse has primary school-ing?	0.158 (0.202)	0.249 (0.35)	0.168 (0.213)	0.141 (0.176)	0.13 (0.164)	0.085 (0.104)
Whether spouse has post-primary schooling?	0.215 (0.275)	0.319 (0.449)	0.224 (0.284)	0.193 (0.241)	0.184 (0.232)	0.132 (0.16)
Log of per capita expenditure	0.086 (0.11)	0.127 (0.178)	0.094 (0.119)	0.078 (0.097)	0.071 (0.09)	0.052 (0.063)
Distance to water source	-0.001 (-0.033)	-0.001 (-0.068)	-0.001 (-0.039)	-0.001 (-0.03)	-0.001 (-0.024)	0 (-0.01)
# of primary schools per 1,000 chil-dren aged 7-14 yrs	0.031 (0.144)	0.07 0(.373)	0.041 (0.197)	0.029 (0.135)	0.016 (0.075)	-0.006 (-0.021)
# of primary teachers per 1,000 pupils	-0.003 (-0.149)	-0.009 (-0.532)	-0.005 (-0.234)	-0.003 (-0.132)	-0.001 (-0.026)	0.003 (0.128)
Whether urban?	-0.062	-0.077	-0.066	-0.062	-0.061	-0.034

	(-0.079)	(-0.109)	(-0.083)	(-0.078)	(-0.077)	(-0.041)

Notes: All marginal effects are evaluated at the sample mean values for each quintile. Figures in parentheses are elasticities evaluated at quintile-specific mean values. Elasticities for indicator (dummy) variables are partial elasticities.

Table 7: Marginal effects and elasticities of educational expenditures per pupil, by per capita expenditure quintile, Kenya, 1994

With respect to:	Total Sample	Per Capita Expenditure Quintiles				
		Bottom	Second	Third	Fourth	Top
Age	62.86 (0.664)	11.21 (0.134)	46.62 (0.571)	67.53 (0.611)	86.93 (0.542)	120.8 (0.433)
Whether male?	307.77 (0.317)	-760.79 (-0.881)	14.98 (0.018)	398.46 (0.35)	797.43 (0.484)	1497.9 (0.527)
# of younger male siblings	2669.62 (1.808)	2640.17 (2.291)	2645.03 (2.335)	2682.01 (1.461)	2687.24 (0.983)	2707.25 (0.515)
# of younger female siblings	28.88 (0.019)	28.88 (0.024)	28.88 (0.022)	28.88 (0.017)	28.88 (0.01)	28.88 (0.006)
# of older male siblings	-54.74 (-0.032)	-54.74 (-0.042)	-54.74 (-0.039)	-54.74 (-0.025)	-54.74 (-0.017)	-54.74 (-0.009)
# of older female siblings	45.13 (0.025)	45.13 (0.034)	45.13 (0.025)	45.13 (0.022)	45.13 (0.015)	45.13 (0.008)
Age of head	-3.89 -(0.184)	-3.89 -(0.216)	-3.89 (-0.22)	-3.89 -(0.157)	-3.89 -(0.106)	-3.89 -(0.059)
Age of spouse	24.98 (0.952)	24.98 (1.105)	24.98 (1.129)	24.98 (0.815)	24.98 (0.552)	24.98 (0.31)
Whether hh head female?	-115.64 (-0.119)	-115.64 (-0.134)	-115.64 (-0.139)	-115.64 (-0.102)	-115.64 (-0.07)	-115.64 (-0.041)
Whether head has primary schooling?	57.91 (0.06)	57.91 (0.067)	57.91 (0.07)	57.91 (0.051)	57.91 (0.035)	57.91 (0.02)
Whether head has post-primary schooling?	161.91 (0.167)	161.91 (0.187)	161.91 (0.195)	161.91 (0.142)	161.91 (0.098)	161.91 (0.057)
Whether spouse has primary schooling?	210.93 (0.217)	210.93 (0.244)	210.93 (0.254)	210.93 (0.186)	210.93 (0.128)	210.93 (0.074)
Whether spouse has post-primary schooling?	582.84 (0.6)	-680.82 (-0.788)	234.58 (0.282)	689.44 (0.606)	1162.19 (0.705)	2007.98 (0.706)
Log of per capita expenditure	-1727.67 (-1.778)	-2256.03 (-2.612)	-1961.5 (-2.358)	-1768.13 (-1.555)	-1463.92 (-0.888)	-920.19 (-0.324)
Distance to water source	0.49 (0.018)	0.49 (0.023)	0.49 (0.023)	0.49 (0.016)	0.49 (0.01)	0.49 (0.005)
# of primary schools per 1,000 children aged 7-14 yrs	-121.03 (-0.451)	-94.36 (-0.415)	-100.15 (-0.457)	-110.97 (-0.364)	-138.8 (-0.302)	-179.64 (-0.191)
# of primary teachers per 1,000	4.99	4.99	4.99	4.99	4.99	4.99

pupils	(0.206)	(0.239)	(0.246)	(0.177)	(0.12)	(0.066)
Whether urban?	183.57 (0.189)	-1457.43 (-1.687)	-307.24 (-0.369)	283.56 (0.249)	920.65 (0.558)	2158.46 (0.759)

Notes: All marginal effects are evaluated at the sample mean values for each quintile. Figures in parentheses are elasticities evaluated at quintile-specific mean values. Elasticities for indicator (dummy) variables are partial elasticities.

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