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Investment in Human Capital

Schooling Supply Constraints in Rural Ghana

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Investment in Human Capital

Schooling Supply Constraints in Rural Ghana

The Living Standards Measurement Study

The Living Standards Measurement Study (LSMS) was established by the World Bank in 1980 to explore ways of improving the type and quality of household data collected by statistical offices in developing countries. Its goal is to foster increased use of household data as a basis for policy decisionmaking. Specifically, the LSMS is working to develop new methods to monitor progress in raising levels of living, to identify the consequences for households of past and proposed government policies, and to improve communications between survey statisticians, analysts, and policymakers.

The LSMS Working Paper series was started to disseminate intermediate products from the LSMS. Publications in the series include critical surveys covering different aspects of the LSMS data collection program and reports on improved methodologies for using Living Standards Survey (LSS) data. More recent publications recommend specific survey, questionnaire, and data processing designs, and demonstrate the breadth of policy analysis that can be carried out using LSS data.

LSMS Working Paper
Number 93

Investment in Human Capital

Schooling Supply Constraints in Rural Ghana

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The World Bank
Washington, D.C.

First printing December 1992

ISSN: 0253-4517

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Library of Congress Cataloging-in-Publication Data

Lavy, Victor.
Investment in human capital : schooling supply constraints in rural Ghana / Victor Lavy.
p. cm. — (LSMS working paper, ISSN 0253-4517 ; no. 93)
Includes bibliographical references (p.).
ISBN 0-8213-2321-0
1. Education, Rural—Ghana—Costs. 2. Education, Rural—Economic aspects—Ghana. 3. School attendance—Ghana. 4. High school attendance—Ghana. 5. Human capital—Ghana. I. Title.
II. Series.
LB2826.6.G4L38 1992
371.2'06'09667—dc20 92-41656
CIP

ABSTRACT

Human capital investment is usually modeled in an intertemporal optimization framework in which households or individuals maximize the present value of life-time utility. The main cost emphasized in these models is forgone earnings while in school. Direct costs such as user fees and travel costs are given much less attention. In many developing countries, however, direct costs such as travel expenses can be an important component in household educational decisions. If the direct cost of enrollment in middle or secondary schools is much higher than for primary schools, the households reduce investment in primary education.

The paper introduces into the Ben-Porath/Heckman model a convex cost function of schooling, and analyzes the implications for school attendance and attainment. The empirical work confirms the prediction of the theoretical model: The cost of advanced levels of education influences primary schooling decisions. This finding is relevant for current policy debates concerning the financing of educational systems in developing countries.

ACKNOWLEDGEMENTS

I have benefitted from comments on an earlier draft from Paul Gertler, Paul Glewwe, Barbara Herz, John Newman, Mark Pitt, Duncan Thomas, Jacques van der Gaag, D. Sidon, Peter Pedroni, participants in seminars at The World Bank and Brown University, and the European Economic Association meetings in Cambridge, England.

FOREWORD

How important is access to secondary education as a determinant of primary school enrollment? What will be the impact on primary level schooling attainment of raising primary and/or secondary school user's fees? What is the effect of supply constraints on child schooling decisions? This study answers these questions, using simultaneously information on the demand and the supply of schooling.

This paper is part of a broader research program in the Population and Human Resources (PHR) Department on the effect of availability and quality of social services on outcomes of investment in human capital. This research program is located in the Poverty Analysis and Policy Division. The data used are from the Ghana Living Standards Survey, one of the Living Standards Measurement Study (LSMS) household surveys the World Bank has implemented in many developing countries.

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I. Introduction

The theoretical analysis of investment in human capital is generally modeled in an optimizing intertemporal framework where households or individuals maximize the present value of lifetime utility (for example, Ben-Porath 1967, Heckman 1976, Blinder and Weiss 1976, and many others reviewed in Weiss 1986). However, previous empirical studies on the demand for education are embedded in a static framework; only the contemporaneous cost of attending school is incorporated in an analysis of school attendance or attainment. The most recent studies in developing countries are by King and Lillard (1983), Gertler and Glewwe (1990), and Glewwe and Jacoby (1991). Future expected costs, however, were not taken into account in explaining households' human capital or schooling decisions. Ben-Porath (1967) emphasized that, "A phase of increasing direct costs in the early period when no earnings are realized is certainly not inconsistent with the real world." However, most of the theoretical papers that followed assume in the comparative static analyses that the direct costs of schooling are constant or zero and therefore do not feature in marginal/optimal conditions and decisions. The modeling and measurement of the effects of direct costs on schooling become important when these vary significantly over the schooling cycle, reflecting, to a large extent, supply constraints. For example, if the direct enrollment costs in middle or secondary schooling are much higher than those of primary schooling, this cost differential will affect household decisions to invest in primary school education. More explicitly, the vector of prices for all schooling levels affects the decision to attend any one schooling level.

In the developed world, the omission of future costs, or the assumption of costs being constant throughout the education cycle, characterizes fairly a reality in which pre-university education is free and almost accessible to all. The reality in many developing countries, however, is very different. Although user fees may be nil, supply constraints like difficult access to schools (long distance to the nearest school, high travel cost, boarding fees) are very real for many rural households in Africa, especially for post-primary schooling. In

Ghana, for example, a 1987 national sample of rural communities and households revealed 85 percent had a primary school in the community within less than half a mile. On the other hand, only 46 percent had a middle school in the community, while the rest had to travel at least 5 miles to reach such a school. The scarcity of and the difficult access to secondary education is even more dramatic: only 8 percent had a secondary school in the community while the distance to the nearest school for the majority was 15 miles. These scarcities are aggravated by a lack of roads (in a third of the communities), by roads being impassable during many months of the year (in more than two thirds of the communities) and by a lack of public transportation (in 40 percent of the communities).

These scarcities and their actual or shadow costs represent supply constraints on the level of schooling attained. Can these supply constraints on middle and secondary education explain why so many children in developing countries never go to school or drop out of primary school? The purpose of this paper is to test these hypotheses, focusing on enrollment and schooling attainment of children of primary-school age. The paper suggests that the link between the schooling supply, the demand for education, and the enrollment rates should be embodied in a dynamic optimization framework: households take account of all the relevant costs over the full schooling cycle and the effect of such costs on the optimal years of schooling. The paper concentrates specifically on the empirical implications of school attendance and attainment by introducing explicitly into the Ben-Porath/Heckman model a convex cost function of schooling, while maintaining the other basic features of that model. (Wallace and Ihnen 1975, Weiss 1986, and Jacoby 1990 present variations on the basic Ben-Porath/Heckman model that allow for credit constraints.)

Rural household and community data from the Ghana 1987-1988 Living Standards Measurement Survey (LSMS) suggest that the cost of advanced levels of education influences schooling decisions at the primary-school level. The relative magnitude of the cross-price elasticities (the elasticities of demand for primary schooling for primary and post-primary cost of schooling) suggests that the cross-price effects should not be neglected when designing new structures of educational user fees. This is an important insight which is directly relevant to current policy debates concerning the structure and financing of educational systems in developing countries. In particular it relates to two major policy changes recommended recently for the education sector in developing countries. The first is the widely accepted recommendation to allocate more resources to primary education. The second is to increase user fees for post-primary schooling to provide more resources for primary education (World Bank 1986). The suggested reallocation of resources within the education sector is based on the presumption that the supply of primary schooling is the effective constraint, which, once relaxed, will allow the economy to reap the benefits of education. This prediction hinges on well-documented empirical evidence that the return to primary education is higher than the return to any other schooling level. The recommendation to increase user fees for post-primary schooling is probably based on the implicit assumption that the higher fees will have no impact on the demand for primary education. This assumption also could be based on the further assumption that improved access to and quality of primary schools will more than offset the effect on primary enrollment of the higher cost of post-primary education. The practical question in the background of these policy changes is whether the public sector should concentrate on improving access to and quality of primary schools in rural communities, or if the effort should be made to achieve a balance where resources are also allocated to improve access to and quality of post-primary schooling. I reflect on these policy issues after the presentation of my empirical results.

In the next section, I highlight in a simple human capital investment model (Ben-Porath 1967, Heckman 1976, and Weiss 1986) features that reflect the variability, over the schooling cycle, of access to and the cost of education (supply constraints). Implications for the best path of schooling and the awareness of households to future supply constraints are then discussed. The empirical strategy and the data are discussed in Section III, which lead to the empirical results and the policy implications discussed in Section IV.

II. Human Capital and the Increasing Cost of Schooling

In this section, I present a modified specification of the Ben-Porath/Heckman model, dealing more explicitly with the direct costs of schooling. Individuals increase their stock of human capital by devoting a fraction of their time, h, to learning. Years of schooling, E, used here as a measure of human capital, are assumed to be produced by a costly school enrollment process. The technology of changes in E, therefore, involves two inputs: the individual's time, h, and a schooling input, S. The analysis assumes the same schooling technology presented in the Harrod-neutral model of Ben-Porath (1967) and Heckman (1976). The schooling input, S, is directly related to h and can, therefore, be standardized to take values, ranging from full-time school enrollment (1) to no enrollment at all (0). The schooling technology can be further simplified by assuming that the two inputs are used in a fixed proportion, that is, the amount of time invested by the student is matched by an equal input of schooling (S=h). This specification overlooks the time invested in learning at home, but it may not be too restrictive. In this study, as in most similar empirical studies, the underlying technology is that of producing "years of schooling." The schooling accumulation process is governed by a strictly concave production function F:

$$(1) \quad E = F\ (bhE, S) \qquad 0<h<1\ ,\ 0<S<1,\ S<=h$$

where b is a productivity parameter (which could be interpreted as reflecting student ability and/or school quality) which is set at unity without affecting the generality of the analysis. Human capital depreciation and other inputs in the production process are ignored here for simplicity. Time can be allocated to the accumulation of financial assets (through market activities) and/or human capital accumulation. The child can rent his or her stock of human capital at a rental rate w for 1-h of the year. The child works at wage rate wE, contributing wE(1-h) to current family income. Assuming a constant w implies that all units of human capital are homogeneous, earning the same rental rate. However the results reported in Glewwe (1990) suggest that the rates of return to human capital in Ghana are increasing (see Appendix Table A4). These profiles of increasing returns to education combined with the increasing direct schooling costs discussed in the previous section, suggest that the rental rate increases with the stock of human capital. I therefore allow for the rental rate to be an increasing function of E, w(E).

The enrollment in school involves a cost, expressed as a user fee, P, per year of schooling. As discussed above, the empirical evidence suggests that this direct cost of education (mainly in transportation costs) increases with years of schooling, perhaps following a step function, as the student moves from primary to middle to secondary schooling. Allowing for such a path of increasing cost of schooling is important because it could explain why many households decide not to enroll their children in school at all although the direct and indirect costs of schooling in the first few years may be close to zero. The cost function of the enrollment process is assumed to be continuous and convex in years of schooling, P=P(E), with positive first and second derivatives, $P_E>0$ and $P_{EE}>0$. The family consumes c and optimizes its allocations under a budget constraint. A perfect credit market is assumed, with prevailing interest rate, r, and a condition that the terminal value of financial assets be non-negative. Bequests are ignored and a child's economic life is taken to begin at the normal age of primary school entry with a time horizon equal to T.

Other family members contribute to family income, v(t), however for analytical convenience, I have set v(t)=v, a constant. The household maximizes family utility over each child's time horizon, subject to the constraints of family income, family size and composition, by choosing between accumulation of financial and other assets and investment in schooling of the child.

Optimizing over C(t) and h(t) (recall that S(t) is assumed to equal h(t)), the household maximizes the time-preference-discounted total utility over horizon T as follows:

$$(2) \quad \int_0^T U(c)\, e^{-\delta t} dt$$

subject to

$$\dot{E} = F(hE, S) \text{ and } \dot{A} = rA + v + w(E)(1-h) - hP(E) - c$$

$$E(0) = 0,\ A(0) = 0,\ A(T) = 0,\ h \leq 1$$

where A is total wealth, δ is the rate of time preference. The utility function is assumed to be strictly concave with $U_c>0$ and $U_{cc}<0$. Setting the Hamiltonian for this problem

$$(3)\qquad H = \int_0^T U(c)\, e^{-\delta t} + \mu F(\ ) + \lambda\ [\dot{A}]$$

where λ is the multiplier function associated with the human capital production constraint and μ is the shadow price of current assets in utility terms. Assuming an interior solution to the optimization problem, the first-order conditions for maximization of the Hamiltonian imply,

$$(4)\qquad \frac{\partial H}{\partial c} = U_c\, e^{-\delta t} - \lambda = 0$$

$$(5)\qquad \frac{\partial H}{\partial h} = \mu F_h E - \lambda\ [w(E) + P(E)]$$

$$(6)\qquad -\frac{\partial H}{\partial A} = \dot{\lambda} = -r\lambda$$

$$(7)\qquad -\frac{\partial H}{\partial E} = \dot{\mu} = -\lambda w_E - h[\mu F_E - \lambda(w_E + P_E)],\quad \mu(T) = 0$$

The boundary condition on μ, the shadow price of human capital, derives from the fact that human capital has no value at the end of the lifetime. In fact, since $\lim_{t \to T} A_t = 0$ then $\lambda_t \to 0$ as $t \to T$. As, for example, in Heckman (1976), it is useful to write $g(t) = \mu(t)/\lambda(t)$ and interpret g as the shadow price of human capital relative to non-human capital. The following can be derived using the above first-order conditions:

(8) $$\dot{g} = -w_E + h(w_E + P_E - gF_E) + gr$$

If we use the condition $\mu(T)=0$, equation (8) may be integrated to solve for g(t). If h is set to unity from t_0 to t_1 and falls to zero thereafter, the solutions to (8) are as follows:

(9) $$g = \frac{w_E}{r} [1 - e^{r(T-t)}] \qquad \text{for } h = 0$$

(10) $$g = \frac{w_E - P_E}{F_E} e^{(F_E - r)(t_1 - t)} \qquad \text{for } h = 1$$

the switching point, t_1, is determined by the fact that $g(t_1) = (w_E + P_E)/F_E$. Thus the student begins full-time schooling at time zero and continues until t^*, expressed as follows:

(11) $$t* = T + \frac{1}{r} \ln \left[1 - \frac{r}{F_E} (1 + \frac{P_E}{w_E}) \right]$$

where t_1 falls with the market interest rate and rises with the efficiency of schooling production (F_E). The schooling period, however, is inversely related to the direct marginal cost of enrolling in school (P_E) and is positively related to the marginal market rental rate (w_E). Therefore the whole path of school fees and other direct costs have a direct effect on the decision to attend any one schooling level and thus affects the length of the schooling period. As noted earlier, the schooling cost in Ghana can best be described by a step function, in which the price jumps as the student moves from primary to middle to secondary school. This step function can be approximated by a quadratic cost function, $P=P_0+P_1E+P_2E^2$. For this cost function, $P_E=P_1+2P_2E$ and therefore t^* will be affected by all the price elements of the cost function. Since t^* directly has to do with completed schooling years, all the price elements in the marginal direct cost of schooling have also an inverse relationship with optimal E.

Another result that becomes more plausible in this specification of the model is the possibility of $t^*=0$. If the user fee is set to be constant or zero, then $t^*=0$ if $T=1/F_E$ (assuming that r/F_E is very small). If T equals 50 or 60 years, then $t^*=0$ is achieved only if F_E is very low (1/50 to 1/60). However, if the schooling cost function is convex, then the possibility that $t^*=0$ is more plausible as both P_E and W_E affect t^*, pushing it towards $t^*=0$.

The model described above can be solved to yield an expression for the optimal years of schooling. A solution describing the evolvement of E over time and the optimal level of E can be derived if the utility and cost functions are explicitly specified (as in the Ben-Porath model). For our analysis, however, it is sufficient to describe how the expression for the optimal schooling years changes when the cost of schooling is non-constant. The main difference is that the whole path of the direct schooling cost is now included in the list of observable variables that affect the optimal years of schooling. Similarly, the opportunity cost of a child's time also is included in these determinants. The effect of these cost variables -- the direct schooling cost and the time cost -- is to lower the optimal years of schooling.

III. Empirical Application: Rural Ghana

Estimation Framework

The analysis in Section II suggests two relationships that capture the effect of the whole time horizon of schooling cost on current investment in human capital. The first is an equation that explains school attendance; the second is an equation that describes the optimal schooling level or highest grade completed. As shown in Table 1, many children never attended school ($t^*=0$) while only 13 percent (140 out of 1,100) who start school drop out before completing primary school. The two decisions, to never attend school and to drop out, could be affected differently by cost and other determining factors. I therefore estimate two logit functions of schooling status: if a child has ever attended school and if he or she currently attends school. The theoretical discussion suggests the current cost of primary schooling and the expected future cost of middle and secondary schooling should have a negative effect on the contemporaneous decision to enroll a child in school.

The majority of students in Ghana (over 95 percent in primary and middle schools) are enrolled in free public schools. The main direct costs involved are the time and the financial travel cost. As indicated above, the distance and travel costs to primary schools are very low but rise dramatically for middle and secondary schools. I experiment with two measures of these costs: (1) the minimum distance to the nearest schools (primary, middle, and secondary) and (2) the mean travel time to the nearest schools (primary, middle, and secondary). As the distance costs depend on the availability of roads and public transportation, I append the distance measures with variables that account for the availability of usable roads and public transportation in the community.[1]

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[1]Using the distances as prices may lead to a problem of endogeneity if the spatial distribution of schools is not random. The placement of schools in the various communities may be correlated with other determinants of the demand for schooling, leading to a bias in the price coefficients. For example, communities may influence, through interaction with central and local authorities, the timing of placement and the location of new school facilities. Alternatively, placement of new schools, as planned by the Ministry of Education, may be governed by an objective to equalize social service differentials or disparities in average enrollment rates across regions or communities. In the context of rural Ghana, it can be safely assumed that the location of primary and secondary schools is exogenous to all households. The placement policy is to have one primary school in every rural community, and indeed, as shown above, almost all children had access to a nearby school. Secondary schools however are placed most often in large towns or rural centers. The possibility of "attracting" a secondary school to a community is very remote. The endogeneity problem can arise, therefore, only with respect to middle schools. We discuss this issue further in footnote 2.

Table 1: Schooling Attainment by Age and Schooling Status

	Age										
Years of Schooling	5	6	7	8	9	10	11	12	Total	Currently in School	Percent in School
0	245	235	143	133	74	70	27	72	999	237	23.7
1	21	39	49	77	40	37	15	26	304	259	85.2
2	0	12	31	42	55	41	16	15	212	182	85.8
3	0	0	4	19	28	37	31	18	137	120	87.6
4	0	0	0	3	16	26	30	37	113	103	91.1
5	0	0	0	0	7	4	38	49	99	89	89.9
6	0	0	0	0	0	0	8	29	38	34	89.5
Total	266	286	227	274	220	215	165	246	1902		
Currently in School	73	122	136	160	150	125	122	136		1024	
Percent in School	27.4	42.7	59.1	58.4	68.2	58.1	73.9	55.3			100.0

Enrollment fees, another direct cost, are negligible in Ghana. For example, the results of a 1988 survey of schools from all regions in the country suggests that the annual average enrollment fee for primary schools is 125 cedis (US $0.40), and for middle schools is approximately 300 cedis (US $1.0). I nevertheless include these variables (travel costs and enrollment fees) as determinants in the schooling equation with the distance variables.

The responsiveness of households to variation in prices is conditioned by the perceived quality of the schools. Quality control may be important in identifying the price effects as the quality of primary education in a given community may correlate with distance to the nearest post-primary school. I therefore include in the enrollment equation a vector of quality characteristics for primary as well as post-primary schooling.

The model implies that the decision to enroll in school is a positive function of the marginal effect of schooling years on market wages or the shadow opportunity value of a child's time. As discussed above for prices, the whole-time profile of such returns to human capital should take account of schooling decisions. Although some wage earners are observed in the rural sample, the majority are self-employed farmers, making it difficult to estimate community- or region-specific rates of return to education. However, the return to human capital in rural areas is a function of a vector of observable agricultural inputs that complement or substitute for human capital, like machinery (for example, tractors or ricehusks), chemical inputs (fertilizers, pesticides, and so on), and extension services. Variations across communities in the prevalence and use of these inputs can account for regional variations in the return to human capital. I therefore include this set of village level variables in the reduced-form schooling equation, which, with the variations in community agricultural laborer wages, should capture systematic regional differences in the returns to schooling. The observed market child wage rate (community level) is also added to the equation to measure the effect of the shadow cost of time in school.

I include in the logit school enrollment equations other variables to control for household income and demographic structure. The variables used are gender, number of siblings, age distribution of siblings, father's education, mother's education, per-capita household expenditure, household's ownership of land, and regional indicators. All are entered as dummy variables, with the exception of the number of siblings and household per-capita expenditure (used as a measure of permanent income). The latter is an endogenous variable and is instrumented, therefore, before being used as a determinant in the enrollment and the completed schooling years equations.

The second equation estimates a relationship between optimal schooling years and determinants. The sample includes all primary school age children and therefore contains some who have completed their optimal schooling years and already are in the phase beyond t^*. The sample however mostly comprises students still in school (whose optimal years of schooling are still not realized), as well as students who never started school ($t^*=0$). Therefore, years of schooling as a measure of current schooling attainment results in a variable that is right-censored. I use two techniques to account for this censoring problem: (1) an ordered probit (suggested in King and Lillard 1983), and (2) a simple duration model in which the number of schooling years is the measurement of the length of "survival." I estimated a simple hazard model assuming various distributions for the duration variable, but the results did not vary qualitatively as a function of the distribution used. The following results are obtained from the Weibull distribution. The covariates in the ordered probit and in the duration equation are the determinants discussed for the enrollment equation.

The Data

The Ghana Living Standards Survey (GLSS) was carried out by the Government of Ghana in collaboration with The World Bank to collect detailed information on a nationwide random sample of 3,200 households. Demographic data on each individual in the household include age, sex, education and schooling status. This study will focus on 1,850 rural households in 1987, the first year of the survey. The sample was augmented by a community questionnaire, that provided detailed data on education, other social services and infrastructure available in or near the communities surveyed. Although most schools in Ghana are public and free, households in rural communities very often have no school nearby and must choose whether or not to travel great distances to the nearest school. Distance and daily travel result in very high costs for transportation and value of lost time. The community data provide the distance to the nearest primary, middle, and secondary schools, as well as the size (number of classes) and age of each school.

The Ghanaian education system includes three levels: primary school (grades 1-6), middle school (grades 7-10), and secondary school. Secondary school consists of 5 to 7 years (enrollment in the last 2 years depends on successful completion of an examination). The data for quality characteristics of primary- and middle-level schooling were collected in a follow-up survey (1988) that used the same sampling framework. (See Glewwe and Jacoby 1991 for a detailed description of the survey instruments). The cluster-level school characteristics, which were aggregated into 33 regions, include: average years for teacher experience, schooling and training; proportion of schools with blackboards; number of books per classroom; presence of library; number of desks; proportion of classrooms of simple construction, completely unusable, or cannot be used when it rains; number of schools without running water or electricity; and a number of schools with a selective admission policy.

The sample includes 1,902 primary school age children who were currently enrolled, had dropped out or had never attended school. Table 1 presents the sample distribution by schooling status, grade attainment, and age. More than half of the children (1,024) were currently attending school. Most of the non-attending children had never attended school; only a few could be considered dropouts. This sample includes the 5- and 6-year-old children who were not yet enrolled in school but may have done so at a later date. Yet, even after netting out these young children from the sample, the proportion who never attended school is still higher than that of the dropouts. This evidence underscores the importance of trying to explain the decision to invest in the human capital of a child.

Estimation Results

Table 2 presents the means and standard deviations of the variables used in the above regressions. Thirty-two percent of the children had a father with primary-level education, while 7 percent of the fathers had higher-level education. "No education" is the left out category. In most of the households the mother was illiterate, 15 percent had primary education and only one percent had more than primary schooling. For most households farming was the main source of income, and only 19 percent did not own land. Seventy-eight percent of households were located in communities with a usable road but in most areas the road was impassable during many months of the year. Fewer communities (60 percent) had public transportation. Other infrastructure was much less developed, for example, half of the families had access to a secure and safe source of water during the rainy season, and fewer during the dry season. Electricity or generators were available in 15 percent of the communities but only a few households are connected to the network. In most communities (71 percent) the farmers used fertilizers and pesticides but only 17 percent of the communities had an agricultural extension station. Mechanization was not widespread; farmers used tractors in only 37 percent of the communities.

Tables 3 and 4 present the logit regressions for those who ever attended school and the current enrollment. The schooling attainment equations are presented in Table 5 (duration model) and Table 6 (ordered probit model).

I first discuss the results about the central hypothesis of this paper: that the post-primary cost of schooling is an important determinant of investment in primary education. The coefficients of the distance variables from all the equations are summarized in Table 7. Three sets of regressions, corresponding to the inclusion and exclusion of the primary and middle school quality variables, are reported in Table 7. The logit and attainment equations produce consistent results that suggest access to middle and secondary schools has a substantial and negative effect on primary school enrollment and on educational attainment. The distance to middle school is the most important element (having t ratios over 4 in all equations for the whole sample). The distance to the

Table 2: Variables, Means and Standard Deviations

	Mean	Standard Deviation
Sample size	1,733	
Student		
Female	0.47	0.50
Age	8.30	2.30
Siblings, Ages 6-11	2.00	1.20
Siblings, Ages 12-17	1.20	1.20
Household		
No Land	0.19	0.40
Log Per Capita Income	10.63	0.60
Father's School Attainment:		
Primary	0.32	0.47
Post-primary	0.07	0.26
Mother's School Attainment:		
Primary	0.15	0.36
Post-primary	0.01	0.10
Distance to Primary School	0.37	1.06
Distance to Middle School	2.07	0.26
Distance to Secondary School	14.73	13.44
Community		
Male Wage, Community Average	5.06	3.22
Road in Community	0.78	0.41
Public Transportation in Community	0.60	0.49
Chemical Inputs in Agricultural Production	0.71	0.45
Extension Station in Community	0.17	0.37
Visiting Agent	0.54	0.49
Cooperative in Village	0.34	0.47
Tractors	0.37	1.30
Ricehusks	0.11	0.31
School		
Enrollment Fee:		
Primary	137.5	85.60
Middle	303.3	405.8
Selective Admissions Policy	0.25	0.24
Personnel:		
Average Years of Teacher Experience	9.26	2.79
Average Years of Teacher Education	11.51	1.38
Average Years of Teacher Training	2.53	0.91
Physical Plant:		
"Shed" Classrooms	0.19	0.18
Leaking Classrooms	0.29	0.13
Unusable Classrooms	0.08	0.11
No Water in School	0.91	0.13
No Electricity in School	0.93	0.13
Blackboards per Room	0.90	0.08
Books per Room	49.05	24.30
Desks per Room	0.26	0.29

nearest secondary school is also significant (with t ratios over 3 in the enrollment and attainment regressions). Moreover, in both sets of regressions, the distance to the nearest primary school is of marginal importance, although it also has a negative effect in the ever-attending regressions and on optimal schooling years. The large standard errors of the distance to primary school variable in both equations is mainly due to the small variance compared to the distance to post-primary schools.[2]

In Table 7 the data suggest that the inclusion of the school quality variables leads to some changes in the results. If the quality of primary education in a given community is correlated with the distance to the nearest post-primary school, possibly the distance variables capture some of this effect. The pattern in Table 7 suggests that the coefficient of the distance to the nearest primary school is affected by the quality variables, specially for the middle school. For example, a comparison of rows 4 to 7 in the school attainment duration model reveals that the primary school distance coefficient is larger and more precisely estimated when the middle school quality characteristics are added to the regression. It is also interesting to note that the distance to the nearest primary school does not have any effect on school continuation decisions but has a strong effect on the initial decision to attend school. The important result, however, for the hypothesis here is that the effect of the access

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[2]Rosenzweig and Wolpin (1986) have examined the problem of endogeneity of program placement in the Philippines. Their findings suggest that inattention to this problem can lead to severe biases in estimates of program impact. The estimation of fixed effects models, using panel data, can be useful in controlling for the non-random program placement. Very often, however, the panel data are closely spaced so that program change is unlikely to be large enough to allow estimation of precise program effects. An alternative approach, which we have explored here, is to estimate the access to schools using as instruments area-specific characteristics that affect placement of schools but are not correlated with the demand for schooling. We have used the distance to a public telephone and post office to help identify the distance to a middle school in a given community. An implicit assumption in the above equation is that there are no other community-specific attributes that affect both the demand for schooling and its supply to the community.

The variables included in the instrumenting equation explain approximately 45 percent of the variance in the distance to middle schools and the F value is 108.9. The distance to the nearest post office and public telephone seems an appropriate instrument; its t value equals 11. Also, when distance to the nearest post office replaced the middle school distance in the schooling or school attainment equations, it did not contribute any explanatory power.

Replacing the distance to the nearest middle school with its instrumented values did not qualitatively change the results (available on request from the author). However, the coefficient of the distance to the nearest middle school is almost doubled. The standard errors, as expected, are larger, but these point estimates are still significantly higher than zero. Instrumenting the distance to the nearest middle school leaves the other coefficients basically unchanged. This is more important for the other two cost variables: distance to the nearest primary school and secondary school, which are significant determinants in the instrumenting equation for the distance to the nearest middle school.

Table 3: Logistic Regressions of Ever Attended School

	Sample			
	Age 5 - 12		Age 7 - 12	
	Coefficient	t-stat	Coefficient	t-stat
Sample size	1,733		1,226	
Student				
Constant	12.654	4.3	9.876	2.6
Female	-0.446	3.7	-0.679	4.1
Age	0.414	13.7	0.181	3.7
Siblings, Ages 6-11	0.103	2.0	0.041	0.6
Siblings, Ages 12-17	0.024	0.4	0.129	1.6
Household				
No Land	-0.173	0.9	0.257	1.0
Log Per Capita Income	0.252	2.3	0.213	1.5
Father's School Attainment:				
Primary	0.666	4.4	1.300	5.7
Post-primary	0.564	2.1	0.625	1.5
Mother's School Attainment:				
Primary	0.979	4.7	1.292	3.4
Post-primary	1.871	1.7	0.776	0.7
Distance to Primary School	**-0.117**	**1.8**	**-0.102**	**1.3**
Distance to Middle School	**-0.098**	**4.5**	**-0.093**	**3.6**
Distance to Secondary School	**-0.019**	**3.1**	**-0.006**	**2.9**
Community				
Male Wage, Community Average	0.276	2.2	0.272	1.7
Road in Community	0.477	2.2	0.436	1.5
Public Transportation in Community	0.169	0.9	-0.040	0.1
Chemical Inputs in Agricultural Production	0.713	3.6	1.076	4.1
Extension Station in Community	-0.045	0.2	-0.100	0.3
Visiting Agent	-0.359	2.1	-0.446	1.9
Cooperative in Village	0.236	1.2	0.173	0.7
Tractors	0.122	1.4	-0.049	0.5
Ricehusks	0.050	0.1	0.001	0.0
School				
Enrollment Fee:				
Primary	0.003	2.0	0.003	1.1
Middle	0.000	0.1	0.000	0.5
Selective Admissions Policy	0.569	1.4	-0.093	1.9
Personnel:				
Average Years of Teacher Experience	0.063	1.2	0.107	1.6
Average Years of Teacher Education	0.077	1.1	0.032	0.3
Average Years of Teacher Training	-0.094	0.4	-0.201	1.0
Physical Plant:				
"Shed" Classrooms	1.418	2.1	2.532	3.0
Leaking Classrooms	-1.308	1.0	-3.677	2.3
Unusable Classrooms	-0.354	0.1	-2.380	1.8
No Water in School	0.273	0.3	1.614	1.4
No Electricity in School	-0.362	0.4	-0.758	
Blackboards per Room	4.230	2.8	3.380	1.8
Books per Room	0.002	0.3	0.007	0.1
Desks per Room	0.792	1.8	0.790	1.1
-2 Log Likelihood	1,653.6		1,005.2	

Table 4: Logistic Regressions of School Enrollment

	Sample			
	Age 5 - 12		Age 9 - 12	
	Coefficient	t-stat	Coefficient	t-stat
Sample size	1,106		598	
Student				
Constant	11.427	1.4	15.241	1.8
Female	-0.352	1.4		
Age	-0.259	4.0	-0.380	2.5
Siblings, Ages 6-11	0.013	0.1	-0.025	0.1
Siblings, Ages 12-17	0.023	0.2	0.174	1.1
Household				
No Land	0.115	0.4	0.212	0.4
Log Per Capita Income	0.153	0.6	-0.115	0.3
Father's School Attainment:				
Primary	-0.086	0.3	0.167	0.5
Post-primary	-0.205	0.4	0.045	0.1
Mother's School Attainment:				
Primary	0.305	0.8	-0.405	0.8
Post-primary	1.002	1.0	0.561	0.3
Distance to Primary School	**0.175**	**1.2**	**0.112**	**0.8**
Distance to Middle School	**-0.293**	**5.1**	**-0.306**	**4.2**
Distance to Secondary School	**-0.084**	**4.4**	**-0.072**	**3.1**
Community				
Male Wage, Community Average	1.004	3.3	0.989	0.4
Road in Community	0.136	0.3	-0.293	0.4
Public Transportation in Community	0.979	2.1	1.206	2.4
Chemical inputs in Agricultural Production	0.484	1.1	0.395	0.8
Extension Station in Community	0.009	0.1	0.048	0.8
Visiting Agent	0.623	1.9	0.596	0.7
Cooperative in Village	2.042	4.0	2.058	3.4
Tractors	-0.244	2.4	-0.289	2.0
Ricehusks	1.034	2.3	1.284	2.4
School				
Enrollment Fee:				
Primary	-0.012	3.2	-0.009	2.3
Middle	-0.004	3.5	-0.004	2.8
Selective Admissions Policy	1.531	1.5	-1.054	0.6
Personnel:				
Average Years of Teacher Experience	-0.072	0.7	-0.152	1.2
Average Years of Teacher Education	0.276	1.8	0.204	1.0
Average Years of Teacher Training	0.280	0.9	0.389	1.0
Physical Plant:				
"Shed" Classrooms	-2.835	1.7	-2.710	0.7
Leaking Classrooms	14.825	4.0	14.968	3.0
Unusable Classrooms	11.588	3.4	9.381	2.1
No Water in School	-1.652	0.7	-3.050	1.2
No Electricity in School	-14.304	4.5	-12.298	3.3
Blackboards per Room	-9.621	2.1	-7.347	1.4
Books per Room	-0.008	0.3	-0.011	0.4
Desks per Room	-0.003	0.0	-0.040	0.0
-2 Log Likelihood	486.7		325.8	

Table 5: A Duration Model of School Attainment

	Sample			
	Age 5 - 12		Age 9 - 12	
	Coefficient	t-stat	Coefficient	t-stat
Sample size	1,733		768	
Student				
Constant	5.737	2.2	4.259	0.9
Female	-0.317	2.9	-0.782	2.9
Age	0.682	34.0	0.326	2.5
Siblings, Ages 6-11	0.091	2.1	-0.33	0.3
Siblings, Ages 12-17	0.062	1.3	0.185	1.3
Household				
No Land	-0.227	1.5	-0.225	0.5
Log Per Capita Income	0.136	1.4	0.114	0.5
Father's School Attainment:				
Primary	0.509	3.6	1.720	4.3
Post-primary	0.136	0.6	0.897	1.5
Mother's School Attainment:				
Primary	0.895	4.5	1.338	2.3
Post-primary	1.589	2.2	2.564	1.2
Distance to Primary School	**-0.053**	**1.2**	**0.017**	**0.1**
Distance to Middle School	**-0.089**	**5.9**	**-0.211**	**5.3**
Distance to Secondary School	**-0.039**	**7.8**	**-0.055**	**4.2**
Community				
Road in Community	-0.052	0.1	-0.172	0.4
Public Transportation in Community	0.332	2.1	0.601	1.3
Male Wage, Community Average	0.395	3.7	0.966	3.7
Chemical Inputs in Agricultural Production	0.417	2.3	0.974	2.2
Extension Station in Community	-0.403	2.0	-0.231	0.8
Visiting Agent	0.013	0.0	0.272	0.8
Cooperative in Village	0.469	2.8	0.347	0.7
Tractors	-0.029	0.2	-0.165	0.6
Ricehusks	-0.406	1.9	-0.473	0.9
School				
Enrollment Fee:				
Primary	0.001	0.1	0.001	0.8
Middle	-0.001	0.1	-0.000	0.6
Selective Admissions Policy	0.267	0.7	-1.352	1.6
Personnel:				
Average Years of Teacher Experience	0.056	1.3	0.064	0.6
Average Years of Teacher Education	0.025	0.4	-0.102	0.6
Average Years of Teacher Training	0.029	0.1	0.266	0.7
Physical Plant:				
"Shed" Classrooms	0.665	1.2	1.077	0.7
Leaking Classrooms	-0.608	0.6	-2.590	0.9
Unusable Classrooms	0.526	0.7	0.126	0.1
No Water in School	-1.236	1.5	0.577	0.3
No Electricity in School	-2.031	2.3	-7.314	3.0
Blackboards per Room	1.963	1.8	2.071	0.6
Books per Room	-0.014	2.3	-0.038	2.0
Desks per Room	1.257	2.8	1.084	0.8
-2 Log Likelihood	1,028.0		834.8	

Table 6: An Ordered Probit Model of School Attainment

	Sample			
	Age 5 - 12		Age 9 - 12	
	Coefficient	t-stat	Coefficient	t-stat
Sample size	1733		768	
Student				
Constant	6.478	3.9	2.564	0.9
Female	-0.283	3.8	-0.354	3.1
Age	0.322	18.0	0.081	1.5
Siblings, Ages 6-11	0.078	2.5	-0.003	0.1
Siblings, Ages 12-17	0.032	0.9	0.122	2.3
Household				
No Land	-0.131	1.2	-0.106	0.5
Log Per Capita Income	0.118	1.8	0.129	1.5
Father's School Attainment:				
Primary	0.363	3.6	0.749	4.3
Post-primary	0.028	0.2	0.223	0.9
Mother's School Attainment:				
Primary	0.472	3.8	0.413	1.8
Post-primary	0.855	1.5	0.677	0.8
Distance to Primary School	**-0.049**	**1.3**	**-0.006**	**0.1**
Distance to Middle School	**-0.056**	**4.9**	**-0.086**	**4.5**
Distance to Secondary School	**-0.017**	**4.6**	**-0.013**	**2.3**
Community				
Male Wage, Community Average	0.188	2.4	0.259	2.2
Road in Community	0.043	0.3	0.088	0.5
Public Transportation in Community	0.220	1.8	0.146	0.8
Chemical Inputs in Agricultural Production	0.309	2.7	0.583	3.2
Extension Station in Community	-0.161	1.2	-0.071	0.3
Visiting Agent	-0.110	1.1	-0.022	0.1
Cooperative in Village	0.348	2.9	0.139	0.7
Tractors	-0.009	0.2	-0.032	0.4
Ricehusks	-0.187	1.3	-0.093	0.4
School				
Enrollment Fee:				
Primary	0.001	1.4	0.001	0.8
Middle	-0.001	0.7	-0.001	0.6
Personnel:				
Average Years of Teacher Experience	0.040	1.3	0.041	0.2
Average Years of Teacher Education	0.038	0.9	-0.016	0.2
Average Years of Teacher Training	-0.048	0.5	-0.010	0.1
Selective Admissions Policy	0.097	0.4	-0.601	1.6
Physical Plant:				
"Shed" Classrooms	0.043	0.3	0.675	1.1
Leaking Classrooms	-0.464	0.7	-1.426	1.4
Unusable Classrooms	0.063	0.1	-0.064	0.1
No Water in School	-0.254	0.5		
No Electricity in School	-1.042	1.7		
Blackboards per Room	1.800	2.1	0.818	0.6
Books per Room	-0.003	0.8	-0.006	0.8
Desks per Room	-0.735	2.4	0.745	1.4
-2 Log Likelihood	1,032.7		539.5	

Table 7: Supply Constraints and Schooling: A Summary

	Ever Attending	Current Enrollment	School Attainment, Ordered Probit	School Attainment, Duration Model
Without Quality of Schools				
Distance to Nearest Primary School	-0.148 (2.5)	0.429 (2.9)	-0.063 (1.7)	-0.087 (2.0)
Distance to Nearest Middle School	-0.102 (5.1)	-0.276 (4.8)	-0.058 (5.6)	-0.093 (6.4)
Distance to Nearest Secondary School	-0.019 (3.5)	-0.040 (3.1)	-0.014 (4.5)	-0.035 (7.3)
With Primary School Quality				
Distance to Nearest Primary School	-0.117 (1.8)	0.175 (1.2)	-0.049 (1.3)	-0.053 (1.2)
Distance to Nearest Middle School	-0.098 (4.5)	-0.293 (5.1)	-0.056 (4.9)	-0.089 (5.9)
Distance to Nearest Secondary School	-0.019 (3.1)	-0.084 (4.4)	-0.017 (4.6)	-0.039 (7.8)
With Primary and Middle School Quality				
Distance to Nearest Primary School	-0.172 (2.3)	0.001 (0.0)	-0.084 (2.2)	-0.105 (2.2)
Distance to Nearest Middle School	-0.098 (3.7)	-0.234 (2.9)	-0.058 (4.5)	-0.072 (3.8)
Distance to Nearest Secondary School	-0.012 (1.6)	0.104 (4.0)	-0.018 (4.6)	-0.033 (5.4)

variables is robust for the inclusion of controls for school quality. Therefore, inclusion in the regressions of the school quality variables reinforces the fact that the distance variables reflect net effects of the various direct costs of the whole investment profile.[3]

These distances are likely to be correlated with community-level variables which may affect the demand for schooling. These variables could include the degree to which a village is commercialized, the support of the village leadership for education, and a range of more amorphous factors which Ghanaians summarize with reference to the degree to which a community is "progressive." The large range of quality measures (from school infrastructure to teaching materials) of both the primary and secondary schools of the community, as well as many other community characteristics that I have included in many variants (reported below) of the basic empirical model, should have controlled for much of these unobserved community heterogeneity. I also included in all equations six regional dummies, which were able to capture region-specific variations in enrollment rates and school attainment. First, the effect of access costs to higher levels of education on enrollment in primary school is not sensitive at all to the "within" or "between" estimation method. This result did not change when I experimented with a more detailed list of regional dummies. Second, the results are robust for the inclusion or exclusion of some of the access to school variables, which suggests that a potential colinearity between the distance to primary and middle schools, or between the latter and the distance to secondary schools, does not derive the results. The variables that should measure interregional variations in the return to human capital yield interesting results. Adult agricultural wage rates; the existence of a cooperative in the village; and the intensive use of chemicals in agricultural production are positively correlated with school enrollment and attainments. Conversely, the availability and use of technical extension services and mechanization (tractors, ricehusks) are negatively correlated with farmers' investment in their children's

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[3]The basic results reported above did not change when the distance to nearest school variables were replaced with mean travel time to the same schools.

human capital. The child agricultural wage rate is insignificant in any of the regressions and is not reported.[4]

The main result, that the access cost to post-primary education is the major determinant in the parents' decision to enroll their children in primary school, is even more striking in that the sample is heavily weighted by young children who are enrolled, or could have been enrolled, in the first four grades. However, the exclusion of the very young (age 5-6) from the sample -- does not change the basic result. For example, the third column in Table 3 (results of the ever-attending equation with a sample of the 7-12 age group) indicates that the coefficients of the distance variables have the same sign and are as significant as those in the full sample. The age coefficient becomes much less important, but the qualitative results of all the other variables are unchanged.

If households discount the future costs of post-primary education and weight the effect of supply constraints on the probability of completing optimal schooling, the data should reveal this "discounting" behavior is not static but responds to constraint changes. For example, the distance to the nearest middle school is of more immediate relevance to 5th or 6th grade children. Therefore, if the above hypothesis is correct, the data should reveal, as children approach completion of primary school that their school participation and attainment become more sensitive to the middle school constraint. In Tables 4, 5 and 6 the third column presents the enrollment and attainment equations estimated only with the age 9-12 sample. The basic results in the first column of the same three tables are qualitatively unchanged. However, an important difference in the 9-12 age group is that the coefficient of middle school distance in the restricted sample is much larger than for the sample group as a whole (up from -0.089 to -0.211 in Table 5, and from -0.056 to -0.086 in Table 6). This difference in the coefficients suggests that the middle school constraint has a greater impact on the behavior of parents whose children are approaching the constraint. An alternative to splitting the sample, as described above, is to interact the cost

[4] The inclusion of these variables and their significant effect on schooling and attainment is important to identify the distance effects, as a cost effect, if the distances to school are correlated with determinants of the return to schooling.

variables with the child's age, allowing the price effect to vary continuously with age. Such an interaction variable, when included, was negative, confirming the results obtained with the samples stratified by age.

Footnotes 1 and 2 discussed the possibility that an endogenous placement of social services may also cause the distance variables to be endogenous. An issue in evaluating the effect of supply constraints is the possibility that households may migrate in search of better educational services and lower access costs. Migration therefore could be explored as an endogenous choice in responding to educational services. However, more information on the migratory history of households and a mapping of the entire population to appraise how migrants make the choice is needed. Such an undertaking is not feasible with the existing data but some related evidence enables us to draw conclusions on the size of this issue.

All household heads in the sample are farmers and most of them (82 percent) own their land. Because the market for land is very limited in rural Ghana and land is mostly inherited, relocation as suggested above will also probably be limited. More, although indirect, evidence may be derived by estimating the enrollment and attainment equations using a sample of children who do not have older siblings of post-primary education age. The notion is that households with post-primary age children already may have relocated, while, for the remaining households, the access to school may indeed be exogenous. Table A2 (see Appendix) presents the regressions with such a sample. The coefficients on the distance variables are similar to those in Table 5. However, the above selection rule leads to a non-random sample with a smaller average family size compared to the overall sample. If households trade quantity for quality of children, the selection bias may be important. A different form of relocation is to send children to board with other households, although the primary school age children include very few who attend school away from home or who board with households in the sample.

The distance constraints may be relaxed directly by changes in the supply, for example by the construction of new schools. Households may respond to such "price" changes by adjusting their optimal enrollment and attainment decisions. To examine this dynamic behavior, I created a dummy variable for all communities where a middle school was constructed in the past two years (1), and for those where no such construction occurred (0). I expect that, in these communities, the effect of distance to the nearest middle school will be more negative than in other communities as households take time to adjust and to discount this new information. The interaction of the above dummy variable with the distance to the nearest middle school has a negative and statistically significant effect (Table A3). The supply constraints are more powerful in the communities where schools have been constructed recently. However, this interpretation may not be valid if the timing of the construction is not random across communities but correlated with unobserved community attributes correlated with the demand for schooling.

The shadow cost of distance supply constraints should be sensitive to the variation in travel costs across communities. I have interacted the middle school distance with two variables that reflect such local transportation costs: the existence of a road suitable for transport and the availability of public transportation. The road variable in Table 3 and the public transportation variable in Tables 4-6 are positive and statistically different from zero, suggesting that school supply constraints have a smaller effect on households that have reliable and low-cost transportation.

Grade repetition is very rare in primary schooling in Ghana and children graduate to middle school without meeting any specific requirements. This is consistent with the evidence presented in Table A1 that provides mean scores for simple (eight questions each) mathematics and reading tests and for more difficult tests (29 questions for reading and 36 questions for mathematics). The mean scores on the simple reading test suggest that not much is learned in primary school in Ghana. Even after 6 years of schooling, the mean score was 2 out of 8, exactly what one would expect if the students had guessed randomly on the test. At the middle-school level, scores are still low which implies that learning in Ghana really starts in middle school and that completion of primary school is only a threshold required to start accumulating human capital. This may explain the importance of access to post-primary schooling in a household's decision regarding enrollment and attainment at the primary-school level.

One of the other variables included in the regressions is educational level attained by parents. If the parents completed primary school, this is a significant determinant of children's school enrollment. The education of the mother is more important for children's enrollment than the father's education: the mother's coefficients are larger and more precisely estimated. This result is remarkable, in that very few mothers in the sample had completed post-primary or even primary education. The gender and age variables were typical of developing countries, that is, enrollment increased with age and was lower for girls. The inclusion of interactions of parental education and the gender dummy suggests that the effect of mother's education on enrollment is greater on girls than on boys.

Gender Differences

The gender sensitivity of the middle and secondary school coefficients provides more indirect evidence to support the interpretation of the distance coefficients as price effects. I have estimated the enrollment and educational attainment for (different) samples of boys and girls. The results are presented in Table 8. The main hypothesis is whether supply constraints have differential effects by gender. Overall, the effect of the constraints is more evident for girls than for boys: the coefficients of distance for all three schooling levels are larger and more precisely estimated for girls than for boys, suggesting higher price elasticities for girls than for boys.

Table 8 illustrates that parental education affects boys and girls in a similar way but the magnitude of the effects and their standard errors are larger for girls. The effect of both parents' schooling level is much larger on girls than on boys. For example, the coefficient of father's education in the girls' regression is one and one half times that in the boys' regression. These results are different from those reported by Thomas (1990), who used the urban sample of the same Ghana data to study the effect of parental education on the health (anthropometric) of children. The effect of father's education on boys was estimated to be larger than the effect on girls; the opposite was true for mother's education.

Table 8: Schooling of Boys and Girls

	Boys		Girls	
	Ordered Probit	Duration	Ordered Probit	Duration
Father's Education: Primary	0.236	0.354	0.538	0.644
	(1.5)	(1.9)	(3.6)	(3.3)
Father's Education: Post-primary	-0.155	0.029	0.237	0.453
	(0.6)	(0.1)	(0.8)	(1.2)
Mother's Education: Primary	0.275	0.486	0.699	1.193
	(1.5)	(1.9)	(3.6)	(4.0)
Mother's Education: Post-primary	0.895	1.473	1.088	1.983
	(1.2)	(1.8)	(1.0)	(1.4)
Distance to Primary School	0.009	0.050	-0.111	-0.136
	(0.2)	(0.7)	(2.0)	(2.4)
Distance to Middle School	-0.057	-0.098	-0.056	-0.092
	(3.5)	(4.7)	(3.0)	(4.2)
Distance to Secondary School	-0.017	-0.040	-0.020	-0.035
	(3.1)	(5.7)	(3.2)	(4.5)
Primary School Enrollment Fee	0.002	0.001	0.001	0.001
	(1.0)	(1.0)	(1.0)	(0.1)
Middle School Enrollment Fee	0.000	0.001	-0.001	-0.001
	(0.1)	(1.2)	(1.3)	(1.2)
-2 Log Likelihood	524.7	506.5	472.9	496.2
Sample Size	920	920	813	813

IV. Reflections on Policy Implications

In this section, I reexamine the policy of shifting the priority for primary education in West Africa in the light of the above facts and empirical evidence. The debate regarding the resource allocation to the social sectors, with the budget constraints faced by most developing countries, has led to a closer examination of the distribution of expenditures within each sector. In health, for example, the discussion has centered around the allocation of public funds to finance preventive versus curative public health services. In the education sector, examination of the intra-sectoral resource allocation has led to a widely accepted recommendation to change the distribution--increasing the resources allocated to primary education at the expense of secondary and higher levels of schooling. Many World Bank reports, for example, recommend that more money should be allocated to primary education, either through direct redistribution or cost-recovery measures, including user fees and subsidies, at the post-primary level (Schwartz and Stevenson 1990). All of these measures, if adopted, will increase the direct and indirect costs of post-primary education to expand and improve the quality of primary education.

The analysis of internal inefficiencies in resource allocation to education was reinforced by the large differentials in economic returns to different levels of schooling. The evidence summarized in Psacharopoulos (1985) suggests that the return to primary education is the highest and that the return declines with subsequent years of schooling.

The above reasoning for intra-sectoral allocations runs into several difficulties, specially when examining the evidence from West Africa. First, there is scattered empirical evidence that in many countries, specially in rural areas, primary schools are underused. Also, and related to the above, the correlation between expansion of primary school facilities and primary school enrollment rates is weak. A second difficulty stems from new estimates of the return to schooling in West Africa that reflect a pattern contradictory to the one presented in Psacharopoulos (1985). Van der Gaag and Vijverberg (1989) and Glewwe (1990) show the lowest rates of return to schooling in rural Côte d'Ivoire and Ghana to be at the primary-school level (Table A4). In Côte d'Ivoire this rate increases monotonically from 7 to 11 percent at the primary-school level to 22 percent at the post-secondary level. In Ghana, returns to primary schooling are almost nil; they are highest for post-primary schooling levels. The low return to primary schooling can be explained by the low achievement scores presented in Table A1. Completion of several years of schooling or even a primary school diploma does not lead to the accumulation of any significant amount of human capital; the market consequently treats this level of schooling as no schooling. Because these estimates were derived from a sample of mostly urban wage earners, their relevance in determining the return to education in the farming sector is questionable.

The main empirical result of this paper suggests that the supply constraints on middle and secondary education are at least as important as the supply of primary schools to hold down enrollment rates and to fuel early dropout of students from the education system. The policy prescription drawn from these results is that, in rural Ghana, it is as important to expand and improve access to and quality of middle and secondary schools as to improve the quality of primary education. The effect of expansion of the former on enrollment and schooling attainment at the primary-school level should feature prominently in the discussion for changing the intra-sectoral allocation in the education sector and in the design of school user fees.

This conclusion is enhanced by the estimated ratios of price elasticities presented in Table 9. The first entry in column one presents the elasticity of the probability of ever attending school for the primary school distance as a ratio of the elasticity of the same probability for the middle school distance. The same ratio for the elasticity of the optimal schooling years is given in the second entry of column one. In the second row the secondary school distance replaces the middle school distance in the cross-price elasticities. The ratio size of the own and cross-price elasticities suggests that increasing the cost of post-primary education can offset any positive effects on enrollments by reduced costs of primary education and optimal schooling years.

Table 9: Ratios of Own and Cross-price (Distance) Elasticities

	Probability of Ever Attending Primary School	Optimal Years of Schooling
Elasticity w/r to Primary School Distance / Elasticity w/r to Middle School Distance	1.63	1.35
Elasticity w/r to Primary School Distance / Elasticity w/r to Secondary School Distance	2.66	0.59

Elasticities are computed at mean probabilities, using the coefficients from columns one and three, respectively, from the lower panel in Table 7.

Appendix

Table A1: Mean Test Scores - All Ghana

	Simple Math	Simple Reading	Long Math	Long Reading
GRADE				
Primary				
3	2.57 (162)	0.16 (162)	0.87 (162)	0.18 (162)
4	3.61 (160)	1.02 (160)	1.73 (155)	1.00 (158)
5	4.12 (121)	1.12 (121)	2.18 (118)	1.07 (121)
6	4.61 (109)	2.00 (109)	4.06 (105)	2.72 (108)
Middle				
7	4.80 (109)	3.09 (109)	3.89 (104)	3.98 (105)
8	4.84 (114)	3.56 (114)	4.39 (110)	4.21 (112)
9	5.61 (83)	4.65 (83)	6.55 (80)	6.54 (82)
10	5.95 (152)	5.66 (152)	8.29 (144)	9.86 (146)
Secondary				
1	6.52 (23)	6.17 (23)	9.71 (21)	12.19 (21)
2	6.95 (19)	7.32 (19)	12.53 (17)	17.31 (16)
3	6.67 (15)	7.40 (15)	12.07 (15)	19.27 (15)
4	6.85 (13)	7.46 (13)	13.58 (12)	20.00 (12)
5	7.20 (30)	7.53 (30)	15.96 (23)	21.48 (23)
A-Level				
1	7.75 (4)	7.50 (4)	22.25 (4)	24.50 (4)
2	7.56 (9)	7.89 (9)	20.63 (8)	23.38 (8)

Source: Glewwe and Jacoby (1991), Table 1.

Note: Sample sizes are in parentheses.

Table A2: School Attainment: Sample Includes Children Without Older Siblings

(Duration model)

	Coefficient	t-stat
Distance to Nearest Primary School	-0.146	2.1
Distance to Nearest Middle School	-0.062	2.2
Distance to Nearest Secondary School	-0.031	3.6
N	780	

Table A3: School Attainment: The Effect of Timing of Construction of Middle Schools

(Duration model)

	Coefficient	t-stat
Distance to Nearest Primary School	-0.128	2.6
Distance to Nearest Middle School	-0.064	3.2
Distance to Nearest Secondary School	-0.037	5.6
Distance to Nearest Middle School Constructed in Past Two Years	-0.053	1.8

Table A4: Returns to education in West Africa

Ghana [a]

Age	15		25		40		55	
	pr	pu	pr	pu	pr	pu	pr	pu
Primary	0.7	0.7	1.1	0.9	1.9	1.1	2.6	1.3
Middle	9.1	2.8	9.5	2.9	10.3	3.1	11.0	3.4
Secondary	--	--	5.0	2.0	5.7	2.2	6.5	2.5
Post-secondary	--	--	1.1	1.4	1.3	1.7	1.5	1.9

Côte d'Ivoire [b]

	Private	Public
Primary	7.4	7.4
Middle	20.9	20.8
Secondary	20.8	20.8
Post-secondary	22.7	22.7

Notes: a. The Ghana results are taken from Glewwe (1990).
b. The Côte d'Ivoire results are taken from Van der Gaag and Vijverberg (1989).
c. A dummy variable for literacy and numeracy included in the equation.

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