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School Attainment, Parental Education and Gender in Côte d'Ivoire and Ghana

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CENTER DISCUSSION PAPER NO. 692

SCHOOL ATTAINMENT, PARENTAL EDUCATION AND
GENDER IN CÔTE D'IVOIRE AND GHANA

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March 1993

Note: Center Discussion Papers are preliminary materials circulated to stimulate discussions and critical comments. Professor Tansel was a Postdoctoral Fellow in the Economic Growth Center at Yale University from December 1990 through November 1992 and is an Associate Professor at the Middle East Technical University, Ankara, Turkey. Earlier versions of this paper were presented at the 1992 meetings of the European Society for Population Economics in Gmunden, Austria, at the 1992 Northeast Universities Development Consortium Conference at Boston University and at the 1993 Econometric Society Meetings in Anaheim.

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by

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ABSTRACT

This study investigates the factors that influence a household's decision to send their children to school in Côte d'Ivoire and Ghana. The questions that are addressed are as follows: What is the relative impact of parental education on the schooling attainment of their children and do these factors affect schooling of male and female children differently? How do the costs of schooling represented by the distances to the nearest schools affect the demand for schooling? And do these effects differ by the gender of the children? These relationships are explored at the three levels of schooling, namely the primary, middle and the post middle (high school or tertiary education) levels attained by the children. The set of socioeconomic individual, household and community characteristics that are used to explain schooling attainment include parents' education, household income, costs of schooling, rural or urban locations of residence. Models are estimated for male and female children separately to allow for the possibility that the determinants of schooling differ for them since substantial differences are observed in the educational achievement of men and women. The data used come from the Living Standard Measurement Study (LSMS) surveys implemented in Côte d'Ivoire and Ghana. Three years of survey from Côte d'Ivoire (1985, 1986 and 1987) and two years of survey from Ghana (1987-1988 and 1988-1989) are analyzed.

I. INTRODUCTION

The recent literature on development documents that education increases productivity of the labor force, improves the health, enhances the quality of life, betters the income distribution and advances the development potentials of the economy. Accordingly, increasing the levels of education of its population has been a major goal of the governments of many developing countries. In achieving higher levels of education for the population both the supply considerations -- such as the provision of school facilities, and the demand considerations are important. This paper examines the determinants of the demand for education in Côte d'Ivoire and Ghana. The aim is to assess the importance of parents' education in schooling attainment of their children, and to study the differences by gender. The effect of the distances to the nearest schools are also examined. A Probit model of primary schooling attendance and Tobit Models of years completed of middle and post middle schooling (high school and tertiary education) are estimated for male and female children separately. In both Côte d'Ivoire and Ghana women attain much lower levels of schooling than men.

Although both countries were considered to be in a successful economic growth track in the 1960's there were differences in the macro economic environments of Côte d'Ivoire and Ghana. The growth rate of real GDP was 7.84 percent in Côte d'Ivoire and 3.75 percent in Ghana during the period of 1960-1974. The growth rate slowed down to 4.71 percent in Côte d'Ivoire during the period of 1976-1982 and the Eighties were marked with declines in real GDP. The economic difficulties started much earlier in Ghana. Late Sixties and Seventies were characterized by stagnation and declines in real incomes: the real GDP declined by about 13 percent in 1975 and the serious economic problems continued throughout the late Seventies and the Eighties. Both countries introduced stabilization programs in the Eighties to combat economic difficulties.¹

While social investments including education were emphasized in Ghana even before independence [Gold Coast (1951)], Côte d'Ivoire was deemed to lag behind in this regard [den Tuinder (1978)]. Over time, costs of schooling declined and their availability has improved in both countries. The gap between the two countries narrowed in the late Seventies as Côte d'Ivoire caught up. Both countries experienced declines in social services in the Eighties. The declining school quality in Ghana in particular after the 1980's is discussed in Keith (1985) and Glewwe (1991). Enrollments

which increased at very high rates in the 1960's slowed down in the 1970's and the 1980's partly due to economic problems and partly due to approaching upper limits in primary enrollments. Thus, it is of interest to see the effects of different economic and social environments and policies on the demand for education in the two countries.

The main findings are that parents' education has a significant influence on the educational achievement of children of both genders. The effect of father's education was found to be more important than that of mother's in both countries in both the male and female samples. The impact of parent's education on the schooling attainment of female children was larger than on the attainment of male children in Ghana while the reverse was true in Côte d'Ivoire. In the Côte d'Ivoire estimates the cost effects of distances to the nearest primary schools were larger and more significant than the cost effects of distances to the nearest secondary schools for both male and female children. In Ghana, primary school distances were insignificant while the significant effect of the middle school distances were larger than the effects of secondary school distances in both the male and female samples.

Organization of this paper is as follows. The structure of education in Côte d'Ivoire and Ghana is discussed in Section II. The demand for education model and its empirical specification are presented in Section III. Section IV presents the various aspects of the data used including the level and distribution of schooling attainment. Estimation results appear in Section V. Section VI gives the concluding remarks.

II. STRUCTURE OF EDUCATION

In Côte d'Ivoire and Ghana average educational attainments are rather high in comparison to other sub Saharan countries, but low when compared to other countries with similar levels of per capita GNP and development.^{2,3} Although current primary level enrollment ratios are about the same in both countries (see Appendix Tables 1-2) the secondary level enrollment ratios are substantially lower in Côte d'Ivoire than in Ghana. Tertiary level enrollment ratios are higher in Côte d'Ivoire than in Ghana for both males and females. In both countries the male enrollment ratios are substantially higher than the female enrollment ratios at all levels of education. Enrollment ratios

declined in particular, at the primary and secondary levels in both countries in the 1980's due to the prolonged economic difficulties experienced and the ensuing measures of the structural adjustment programs.

Primary schools provide six years of education and middle schools take four years in both countries. In Côte d'Ivoire students have to pass a competitive entrance examination to continue at the middle school while in Ghana students continue to middle school without an impediment of an examination. Post middle schooling consists of three years of high school and tertiary levels of education in Côte d'Ivoire while in Ghana post middle schooling takes five years of high school, two years of sixth form and tertiary levels of education.⁴ The three levels of schooling examined in this study are primary, middle and post middle levels in both countries.

III. THE MODEL

The human capital theory which originated in the works of Schultz (1960, 1963), Mincer (1958, 1974) and Becker (1975) regards education as an investment. Accordingly, the individuals compare the direct and opportunity costs of education with its future benefits. The investment continues up to the level where marginal benefits make the further investment worthwhile. The nonpecuniary benefits of education which are ignored in the human capital theory are emphasized for instance by Michael (1973).

The theoretical framework employed in this paper is a household production model introduced by Becker (1965). Consistent with the quality-quantity trade off models of Becker and Lewis (1973), Becker and Tomes (1976, 1979), and Becker (1991) parents maximize a one period utility in the arguments of number of children, quality of children, leisure of household members and a composite consumption good subject to income and time constraints for the household members and the production functions. The time inputs of the household members and the goods purchased in the market are the arguments of the production functions. Time children spend in school (T_E) and household expenditures on education (X_E) are the arguments of child quality production function since education improves child quality. Optimization leads to a set of reduced form household demand equations for the number of children, child quality, leisure, consumption good and the

derived demand equations for the labor force participation and goods purchased in the market. For instance the demand for schooling will be represented by:

$$T_E = \gamma(W, P, V, C)$$

where W is a vector of wages of household members, P is a vector of prices of inputs purchased in the market, and V is unearned household income and C is a set of child or household specific characteristics.⁵ In order to examine the relationship between parent's and children's education, altruistic parents who care about the welfare of their children are hypothesized [Becker and Tomes (1976, 1984), Becker (1991) and Barros and Lam (1992)]. In a world of perfect capital markets where parents can borrow or lend at a given rate of interest assume that education is purely a capital good with no nonpecuniary benefits. Assume further that costs and benefits of education are universal in the sense that it is not more rewarding or less costly for the children of lawyers to become lawyers. Then, there will be an optimum level of investment into human capital where the marginal rate of return will equal the rate of interest. Moreover, this optimum level will be independent of the level of parent's education, their degree of altruism, their wealth and number of children. However, if any one of these assumptions is relaxed then there will be a causal relationship between the education of parents and the schooling attainment of their children. The following is a summary of the instances of causal relationship between parent's and children's education considered by Barros and Lam (1992).

Assume that the capital markets are not perfect so that parents are credit constrained, then investment into schooling of children will be less than the optimum amount but will increase with household income to the point of optimality in the case of one child in the household. The case of more than one child when the parents are credit constrained is analyzed by Behrman, Pollak and Taubman (1992). It is conceivable that better educated parents are less likely to be credit constrained. Then, less educated parents will underinvest in their children's schooling implying a causal relationship between parent's and their children's education.

Second, we now relax the assumption of universal costs and benefits of children's schooling so that better educated parents are, for example, able to reduce the cost of their children's schooling.

This will give a comparative advantage to the better educated parents in acquiring child schooling implying a causal relationship between parent's and their children's education.

Third, we relax the assumption that education is a capital good and assume that there are nonpecuniary benefits of education to the acquiring children but not to the parents. In this case, the level of investment into schooling of children will depend on their parent's degree of altruism. If better educated parents are more altruistic they will invest more into their children's schooling. However, if better educated parents are less altruistic then they may not be willing to forgo their own consumption for their children's.

Fourth, we relax the assumption that education is a capital good and we now assume that there are nonpecuniary benefits of children's education to their parents. If we further assume that better educated parents enjoy better educated children more than the less educated parents, then the better educated parents will invest more than the less educated parents into their children's schooling to increase their own consumption of child schooling for own benefit.

Mother's education and children's schooling are found to be positively associated in most empirical studies. Mother's education may be representing a number of factors: taste for schooling, efficient household production, opportunity cost of mother's time in the labor market, permanent income, parental role modeling, genetic endowments of abilities and motivation. Mothers may have a comparative advantage in helping their children to learn their school lessons. Leibowitz (1974) suggests that father's education may represent genetic factors while mother's education may reflect both genetic factors and the home investments, since mothers spend more time in care of children than do the fathers.

There are direct and indirect costs to schooling which are components of the exogenous price of schooling. The indirect cost of sending children to school is foregoing children's inputs to household production and to the labor market. In particular, in the rural areas time spent at school may be at the expense of homework, or other learning activities such as working at the family farm or business. Local child wages prevailing in the area would measure the indirect costs if the alternative to schooling is market work. Indirect costs may differ from the local child wages if the alternative is to work at the family farm or business. Other things equal, households who live in areas where local

child wages are higher will demand less schooling assuming youth wages with schooling are not even higher in high child wage areas. Direct costs of schooling are monetary expenses on books, uniforms, transportation and tuition, less any subsidies received. Other components of the price of schooling are distance to schools and the quality of education provided by the schools. The quality adjusted price of schooling increases with distance to the schools, because of the time and transportation costs.

To introduce gender to the household model parents are assumed to have different preferences for their son's and daughter's education or quality. This differential preference may be due to prevailing social norms, household resource constraints, or a response to labor market conditions in terms of the actual or perceived differences in returns to daughters and sons. The quality of sons and daughters included in the utility function as separate arguments leads to gender specific reduced form demand functions for schooling.

The model suggests behavioral adjustments to changes in social norms, prices and income. For instance, if the society or parents do not see female children as future providers then parents may not invest in their education. Or the labor market returns to men's education may be higher than to women's education as was assumed by Rosenzweig and Schultz (1982). Then daughters may receive less education than sons. However, a decrease in costs of education, other things held constant, will increase parent's investment in both their daughter's and son's education. The size and the speed of response to such market changes will depend on price and income elasticities of schooling demand.

EMPIRICAL SPECIFICATION

The quantity of education demanded is measured by the years of schooling completed by children.⁶ A Probit model is specified for primary school completion. Those who enter primary school mostly complete it suggesting a binary outcome rather than years of schooling completed at the primary level. Tobit models are specified for the middle and post middle schooling achievements. The years of schooling completed is truncated at a lower limit of zero. The upper limits are the number of years of schooling required for the completion of the middle (10 years) and post middle (no limit) levels of education. The percent of individuals with zero years of schooling are 41 and 64 (male and female samples, respectively) in Côte d'Ivoire and 32 and 50 (male and

female samples, respectively) in Ghana. Further, there are multiple modes in the years of education completed at the completion levels of the primary school (6 years) and middle school (10 years) and less pronounced modes at higher levels in both countries as it is observed in Figures 1 and 2 in the Appendix. Clearly, the linearity assumption would be violated and the ordinary least squares which hypothesizes a linear expected value locus is inappropriate.⁷ The form of my data on education suggests a possible specification of a two-limit Tobit model as follows:

$$y_i^* = \beta_i'X_i + u_i$$

where

$$\begin{aligned} y_i &= 0 && \text{if } y_i^* \leq 0 \\ &= y_i^* && \text{if } 0 < y_i^* < c_i \\ &= c_i && \text{if } y_i^* \geq c_i \end{aligned}$$

y_i^* is the latent variable. i denotes the achievements of middle and post middle levels of education. c_i is the upper censoring point and takes on the values of 10 and "none" respectively. y_i is the observed years of schooling completed. X represents a vector of individual, parental, household and community characteristics. u is the random error term distributed normally with zero mean and constant variance. β is the vector of coefficients to be estimated. Maximum likelihood estimates of this model provide consistent and efficient parameter estimates.

The Probit and Tobit models are estimated on the subsamples of individuals aged 16 and over, 19 and over and 25 and over respectively, for the primary, middle and post middle schooling levels. The reasoning for this runs as follows: A pupil starting primary school around the age of 5 will be at least 11 years old at completion if he/she does not repeat or take time off. Therefore, in studying the determinants of primary school completion, the sample is restricted to individuals aged 16 years and over. Similarly, a pupil completing four additional years of middle school will be at least 19 years of age, and the sample is restricted to individuals aged 19 years and over for studying the determinants of middle school attendance. Finally, for examining the determinants of post middle schooling, the sample is restricted to individuals aged 25 years and over. The samples are further restricted to individuals 36 and less years of age to concentrate on children who were of school age

at independence and who grew up during the period of improved schooling supply conditions after independence.

The set of explanatory variables used are as follows. Parent's education is represented by the years of schooling completed by the father and the mother. Dummy variables for various age groups are included to observe the cohort effects. Total household expenditure per adult over 15 (in its logarithmic function) is used as a proxy for household permanent income since it is easier to measure than household income and it is a better proxy for permanent household income.⁸ The price of schooling variables are the distances of the communities to the nearest primary, middle (in the case of Ghana) and secondary schools.⁹ Community child wages are a measure of the opportunity cost of children's time. Community male and female wages approximate the opportunity cost of parent's time.¹⁰ A dummy variable indicates whether the household is located in a rural area.

IV. DATA

The data used comes from the Living Standards Measurement Study (LSMS) surveys implemented in Côte d'Ivoire and Ghana. The designs of these parallel surveys are explained in Ainsworth and Munoz (1986) and Scott and Amenuveqbe (1989). Three years of survey from Côte d'Ivoire, 1985, 1986 and 1987 and two years of survey from Ghana 1987-88 and 1988-89 are analyzed. In the case of Côte d'Ivoire it was possible to consider a total of 8,635 men and 9,920 women for whom all the relevant variables were complete or reported. Numbers of such observations for Ghana were 9,468 and 10,616 respectively, for men and women. For these individuals in both countries their parental, household and community characteristics are matched.¹¹

The mean years of schooling achieved by the children in the sample and by their parents by age group are given in Table 1. The mean schooling attainment is 3.61 years for men and 1.91 years for women in Côte d'Ivoire. While fathers achieve on the average 1.26 years, mothers achieve only .45 years in the same country. The mean years of education achieved in Ghana are markedly higher than in Côte d'Ivoire. The mean years of education is about 5 years for men, 3 years for women, 4 years for their fathers and 2 years for their mothers in Ghana. While these years are about a year larger for men and women in Ghana than in Côte d'Ivoire, they are about four times as large for both of

the parents in Ghana than in Côte d'Ivoire. As it is observed in Table 1 in Côte d'Ivoire, mothers achieve less than a year of schooling except for the 5-11 year old children where they average just about a year of education. This has created difficulty in estimating the effect of mother's schooling on her children's attainment in this country.

Table 1
Mean Years of Education by Gender and Age
and for Parents, Côte d'Ivoire, 1985-1987 and Ghana, 1987-1989

Age Group	Côte d'Ivoire				Ghana			
	Male	Female	Father's	Mother's	Male	Female	Father's	Mother's
5-11	1.28	1.03	2.30	1.02	1.07	.98	6.29	3.59
12-16	4.57	3.31	1.96	.74	4.71	4.01	5.39	2.55
17-19	5.70	3.53	1.55	.47	7.65	5.45	4.88	1.80
20-24	5.57	3.15	.97	.23	8.26	5.75	4.29	1.62
25-29	5.67	2.60	.74	.14	8.43	5.51	3.31	1.08
30-65	2.93	.72	.26	.02	6.39	2.86	1.68	.39
Total	3.61	1.91	1.26	.45	5.11	3.34	4.14	1.87
Sample Size	8,635	9,920	18,555	18,555	9,471	10,616	20,087	20,087

The mean years of schooling achieved increases with age for both sexes and declines mainly after late 20's for men and early 20's for women in both countries. In the 5-11 age category the mean years of education are about the same for both boys and girls. It starts differing in the age group 12-16 and the largest discrepancy in the mean years of schooling achieved between men and women occurs in the 30-65 age group in both countries.

Fathers have twice the education of mothers in the 5-16 age group and more in other age groups in Côte d'Ivoire, while in Ghana the difference between fathers' and mothers' years of education is less pronounced. Children 5-11 years old have the most highly educated parents in both countries. The parental education levels decline continuously as children get older. Thus, not only younger cohorts seem to attain more schooling but also their parents seem to be more educated than the parents of older cohorts. This, of course is in accordance with the generally positive trend in schooling attainment.

V. ESTIMATION RESULTS

This section presents the maximum likelihood (MLE) estimates of the Tobit model for middle and post middle schooling achievements for male and female samples of Côte d'Ivoire and Ghana. Appendix Table 4 shows the means and standard deviations of the variables used in the analysis for the three age groups of the male and female samples for Côte d'Ivoire. The means and standard deviations for the male and female samples of Ghana are shown in Appendix Table 5. The maximum likelihood estimates of the Tobit models of years of schooling for the middle schooling is given in Table 2 for the male and female samples of Côte d'Ivoire and Ghana. Table 3 reports the same estimates for the post middle schooling. The implied marginal effect of each variable on the years of schooling completed evaluated at the mean values of the variables and the corresponding *t*-ratios are given in these tables. Finally, this section also presents estimation results of a probit model of attending primary schooling for both countries in Table 4.

ENDOGENEITY OF TOTAL EXPENDITURE

Log per adult total expenditure may be correlated with the error term which would potentially bias the coefficient estimates. One possible route for the reverse causation from total expenditure to the years of schooling attained may be through the labor supply decisions. Exogeneity testing of log per adult total expenditure is carried out using Smith and Blundell (1986) version of the Hausman (1978) test and presented in the last column of the Tables 2-3. The residuals from an auxiliary regression of total expenditure on exogenous variables including household assets¹² is included among the regressors and tested for significance. The null hypothesis of exogeneity of the total expenditure is rejected at the middle schooling of the female sample in Côte d'Ivoire and middle and post middle schooling of the male samples in Ghana.

Following the suggestion of Rivers and Vuong (1988) a similar exogeneity testing is carried out for the Probit model of primary schooling in the last row of Table 5. In the Probit estimates exogeneity is rejected in the male samples of Côte d'Ivoire and Ghana. Tables 2-3 present the instrumental variable Tobit estimates due to Nelson and Olson (1978) with the predicted log per adult total expenditure. The second stage standard errors are adjusted according to Amemiya (1979). A

similar procedure is followed in obtaining the instrumental variable Probit estimates and their standard errors in Table 5 according to Maddala (1983).

In the Tobit and Probit estimates which are not corrected for the possible endogeneity of the log per adult total expenditure, the coefficients of the log per adult total expenditure in all of the samples were larger than the corrected instrumental variable Tobit and Probit estimates, implying an upward bias due to possible endogeneity of the log per adult total expenditure.

EFFECTS OF PARENT'S EDUCATION

Table 4 summarizes the coefficients on the parent's education in different samples using the estimates in the Tables 2-3.¹³ All of the coefficient estimates are significant at five percent level except those for the mother's years of schooling at the post middle schooling level in Côte d'Ivoire which is probably due to having very few mothers achieving any significant years of education in particular for this cohort of children.

Comparing father's and mother's education coefficients in the male and female children samples and in the middle and post middle levels of schooling we observe that in all cases father's education coefficients are almost twice as large as the mother's education coefficients in both countries, except in Ghana female children samples in the middle and post middle schooling levels. Further, in Ghana the effects of both the father's and the mother's education are larger in the female samples at both the middle and post middle schooling levels than in the male samples. In these two latter cases of female samples in Ghana the effect of mother's years of education (although still smaller than that of father's) is much larger than the effect of the mother's education in the male children sample.

Table 2
 Maximum Likelihood, Instrumental Variables, Tobit Estimates of
 Middle Schooling, Ages 19-36, Côte d'Ivoire, 1985-1987 and Ghana, 1987-1989

Variable	Côte d'Ivoire				Ghana			
	Female		Male		Female		Male	
	Marginal Effect	t-Ratio ^a	Marginal Effect	t-Ratio ^a	Marginal Effect	t-Ratio ^a	Marginal Effect	t-Ratio ^a
Constant	-15.38	3.29	5.837	-.71	-18.8	1.83	-24.1	2.09
Father Years of Schooling	.281	8.55	.349	8.12	.271	13.4	.162	6.85
Mother Years of Schooling	.163	2.19	.233	1.66	.238	6.18	.084	2.41
Age 20-23	--	--	--	--	--	--	--	--
Age 24-27	-.503	3.06	-.314	1.27	-.374	1.20	-.596	1.66
Age 28-31	-.971	5.39	-.378	1.36	-.348	.89	-1.043	1.75
Age 32-36	-1.462	7.89	-.720	1.91	-.635	1.87	-1.232	1.79
Log per Adult Expenditure ^b	1.292	3.01	.756	1.19	1.799	1.91	2.482	2.31
Distance to Primary School	-.121	1.71	-.609	5.39	.055	1.00	.064	1.43
Distance to Middle School	--	--	--	--	-.203	7.14	-.102	4.18
Distance to Secondary School	-.016	3.00	-.016	2.16	-.025	4.09	-.022	4.11
Male Wages ($\times 10^{-2}$)	-.208	3.19	-.296	3.34	1.00	4.12	.717	3.65
Female Wages ($\times 10^{-2}$)	.120	1.79	.249	2.28	-.858	3.29	-.530	2.48
Child Wages ($\times 10^{-2}$)	.209	3.59	.258	3.13	-.204	.83	-.192	.81
Rural	-1.471	3.35	-2.565	3.89	-.507	1.66	-.130	.42
- Log Likelihood	4,063		4,128		5,027		3,439	
Sample Size	2,862		2,205		3,335		2,641	
Exogeneity Testing:								
Residual Expenditure	-.634	1.80	.566	.95	-.893	.87	-1.739	1.66

^aAbsolute value of the asymptotic *t*-ratio.

^bPredicted Log per Adult Expenditure using ownership of assets which included business assets, value of land, unearned income of the household and amount saved (in Ghana) as the identifying instruments.

Table 3

Maximum Likelihood, Instrumental Variables, Tobit Estimates of
Post Middle Schooling, Ages 25-36, Côte d'Ivoire, 1985-1987 and Ghana, 1987-1989

Variable	Côte d'Ivoire				Ghana			
	Female		Male		Female		Male	
	Marginal Effect	t-Ratio ^a	Marginal Effect	t-Ratio ^a	Marginal Effect	t-Ratio ^a	Marginal Effect	t-Ratio ^a
Constant	-14.7	2.83	-17.0	1.21	-9.878	.88	44.6	2.65
Father Years of Schooling	.263	6.47	.324	4.97	.271	9.32	.152	4.00
Mother Years of Schooling	.122	1.27	.062	.28	.183	4.13	.134	2.11
Age 20-23	--	--	--	--	--	--	--	--
Age 24-27	--	--	--	--	--	--	--	--
Age 28-31	-.319	1.87	.126	.33	.337	1.09	-.727	1.69
Age 32-36	-.700	4.00	-.380	.77	.019	.03	-1.287	2.48
Log per Adult Expenditure ^b	1.185	2.91	1.671	1.69	1.018	1.04	4.520	3.14
Distance to Primary School	-.076	1.01	-.641	3.85	.093	1.10	.085	1.00
Distance to Middle School	--	--	--	--	-.221	5.11	-.190	4.83
Distance to Secondary School	-.015	2.43	-.019	1.67	-.037	4.31	-.034	3.19
Male Wages ($\times 10^{-2}$)	.197	2.11	.461	2.50	-.807	2.40	-.850	2.18
Female Wages ($\times 10^{-2}$)	-.253	3.21	-.321	2.21	.985	2.83	1.660	4.23
Child Wages ($\times 10^{-2}$)	.152	2.08	.196	1.40	-.060	.15	-.660	1.52
Rural	-1.165	2.38	-3.501	3.17	-.781	2.03	.129	.27
- Log Likelihood		2,328		2,811		4,666		4,357
Sample Size		1,688		1,172		2,083		1,616
Exogeneity Testing:								
Residual Expenditure	-.525	1.48	.313	.34	.181	.19	-.3055	2.11

^aAbsolute value of the asymptotic *t*-ratio.

^bPredicted Log per Adult Expenditure using ownership of assets which included business assets, value of land, unearned income of the household and amount saved (in Ghana) as the identifying instruments.

In Côte d'Ivoire, while a one standard deviation increase in father's education increases the male children's achievement by .94 years at the middle school level, the same increase is .82 at the post middle school level. The similar effects of mother's education are somewhat smaller: .22 years at the middle level and insignificant at the post middle level of schooling. In the female sample the effect of father's education on the schooling attainment of their daughters is .72 years at the middle schooling level and .53 years at the post middle schooling level, while the effect of mother's education are .18 years and insignificant at the two levels, respectively.

Table 4
The Effects of One Standard Deviation Increase in the Parent's Education
and the Distances to the Nearest Schools on Years of Schooling Achieved
in Côte d'Ivoire and Ghana

	Côte d'Ivoire		Ghana	
	Female	Male	Female	Male
Middle Schooling				
Father's Years of Schooling	.717	.939	1.485	.868
Mother's Years of Schooling	.181	.224	.793	.271
Post Middle Schooling				
Father's Years of Schooling	.526*	.823*	1.385	.736
Mother's Years of Schooling	.095*	.043*	.534	.352
Middle Schooling				
Distance to Primary School	-.143	-.810	.087*	.115*
Distance to Middle School	--	--	-.916	-.490
Distance to Secondary School	-.322	-.298	-.470	-.447
Post Middle Schooling				
Distance to Primary School	-.098*	-.885	.133*	.145*
Distance to Middle School	--	--	-1.023	-.935
Distance to Secondary School	-.312	-.371	-.710	-.677

*Indicates insignificance at five percent level.

Source: Tables 2-3 and the Appendix Tables 4-5.

In Ghana, the effect of a one standard deviation increase in the father's education is to increase grade attainment of his male children by .87 and .74 years at the middle and post middle levels of schooling while effect of mother's education are respectively .27 and .35 years. In the female sample the similar effects of father's education are 1.49 and 1.39 years and of mother's education are

.79 and .53 years at the two schooling levels. In all cases in Ghana, unlike in Côte d'Ivoire the effect of parent's education are larger on the schooling attainment of their female children than of the male children.¹⁴

COST EFFECTS OF DISTANCES TO THE NEAREST SCHOOLS

The distances to the nearest primary, middle and secondary schools are expected to capture the cost of schooling. The cost considerations in the form of long distances to the nearest schools reduce the probability of school attendance and the expected level of schooling attained. In the Côte d'Ivoire sample 92 percent of the observations reported existence of a primary school in their community. For those without a primary school the average distance to the nearest primary school was 3.65 kilometers. The percent of observations reporting existence of a local secondary school was 46, and for those without a secondary school the average distance to the nearest secondary school was 27.0 kilometers.

In the Côte d'Ivoire estimates the distances to the primary and secondary schools have the expected negative signs and are significant except for the primary school distance at the post middle schooling level for the female sample. The distance to the primary school is more important than the distance to the secondary school since at the secondary school level the opportunity cost of school travel time may be more important than other costs.

In the Ghana sample 88 percent of the observations reported having a primary school in their community and for those without a primary school the average distance to a nearest primary school was 3.64 kilometers while 73 percent reported existence of a middle school and the average distance to a nearest middle school was 29 kilometers. The percent of observations in a community with a secondary school was 49 and the average distance to a nearest secondary school was 25.63 kilometers

In the Ghana estimates the distances to primary, middle and high schools are separately included. They have the expected negative signs and significant only for the middle and secondary school distances in both the male and female samples. In all of the samples the coefficients on the middle school distance are about five times larger than the coefficients on the secondary school distance. Moreover, at the middle schooling level the coefficients for the distances to the nearest

middle school are much larger in the female sample than in the male sample implying that distance is a greater deterrent for girls than for boys. Further, in both countries there is evidence that each level of schooling, the distance cost is an important determinant of the schooling achieved at that level. Lavy (1991) hypothesized that the whole path of expected costs of primary, middle and higher schooling should affect the schooling investment decisions. Using the rural households from the 1987 Ghana LSMS survey he too finds that the distance cost of primary school is insignificant while distance cost of post primary education is a significant determinant of enrollments of the primary level.

EFFECTS OF PERMANENT INCOME AND COMMUNITY WAGES

Per adult household expenditure is used as a proxy for household permanent income. Per adult expenditures have significant positive effects on the years of schooling achieved in both male and female samples in the Côte d'Ivoire estimates, except in the male sample in the middle schooling level. In the female sample the effect of an increase in log per adult expenditure on the years of schooling achieved is about the same at the middle and post middle schooling levels. In the Ghana estimates the effect of per adult expenditure is also positive and significant, except in the female sample at the post middle schooling level. This effect increases with the level of education in the male sample from 2.5 years in the middle schooling level to 4.5 years at the post middle schooling level, suggesting that post middle schooling is more responsive to permanent income than middle schooling. The positive coefficient on log per adult total expenditure in all samples indicate that schooling is a normal good and the growth in permanent income will increase years of schooling attained.

Community child wages measure the opportunity cost of schooling. In Côte d'Ivoire the coefficient estimates on the community child wages are positive, contrary to expectations and all are significant except for the male sample at the post middle schooling level. The positive coefficient for the child wages could be signalling better earning opportunities which raises the cost of being in school. Also, in particular, farming families may see education especially important for their children in an urbanizing setting.¹⁵ In the Ghana estimates the community child wages are negative but not significantly different from zero. King and Lillard (1987) found that child wage exerts a

negative effect on schooling levels in Philippines. In the school enrollment function estimated by Rosenzweig and Evenson (1977) in India child wage had a negative coefficient significant for females but was insignificant for males.

Community male and female wages represent the opportunity cost of the time of the father and mother respectively. I expect the coefficient on the male wages to be positive and the coefficient on the female wages to be negative. In Côte d'Ivoire male and female samples, the coefficients on the community male and female wages are all significant however, with the perverse negative and positive signs respectively at the middle and post middle schooling levels making it difficult to provide an explanation. In Ghana, the coefficient estimates on the community male and female wages are all significant and have the expected positive and negative signs respectively. The standard errors of the mean wages differ in the two countries by a factor of about eight. Glewwe and Twum-Baah (1991) report that the distribution of welfare is less unequal in Ghana than in Côte d'Ivoire.

In both countries residence in a rural location is associated with significantly lower schooling attainment, except in the Ghana male sample at the middle and post middle schooling levels where the coefficient estimates are insignificant.^{16,17}

COHORT EFFECTS

To observe the cohort effects dummy variables for the age groups 24-27, 28-31 and 32-36 are included. Age groups 19-23 and 25-27 are the excluded categories in the middle school and post middle school estimates respectively. Estimates of the cohort coefficients are all negative, significant and progressively larger for the older cohorts in the female sample at the middle and post middle schooling levels in Côte d'Ivoire implying that older cohorts received significantly less years of education than the younger cohorts while in the male sample cohort coefficients were not significant except for the 32-36 age group at the middle schooling level. In Ghana, in the female samples the cohort coefficients were insignificant except for the 32-36 age group at the middle schooling level whereas for men the coefficients were significant, negative and progressively larger at both schooling levels, suggesting that younger cohorts are achieving significantly more years of education than the older ones.

A PROBIT MODEL OF PRIMARY SCHOOLING

A Probit model of whether the individual ever achieved any years of schooling or not is estimated and the results are summarized in Table 5. These models are estimated for the individuals 16-36 years old who are over the age of completion of the primary schooling.

The distance variables are all significant except at the primary schooling level in Ghana. They all reduce the probability of children's school attendance. As in the Tobit estimates, in the case of Ghana, the impact of distance to the nearest middle school is larger and more significant than the impact of the distance to the nearest secondary school.

Table 5

Maximum Likelihood, Instrumental Variables, Probit Estimates of Primary Schooling, Ages 16-36, Côte d'Ivoire, 1985-1987 and Ghana, 1987-1989

Variable	Côte d'Ivoire				Ghana			
	Female		Male		Female		Male	
	Marginal Effect	t-Ratio ^a	Marginal Effect	t-Ratio ^a	Marginal Effect	t-Ratio ^a	Marginal Effect	t-Ratio ^a
Constant	-1.046	1.44	.782	1.03	-1.140	1.11	-2.914	2.86
Father Years of Schooling	.074	10.61	.057	8.99	.030	14.3	.013	6.49
Mother Years of Schooling	.039	2.65	.035	1.51	.021	5.15	.016	3.83
Age 20-23	-.095	3.18	-.074	3.22	-.070	2.01	-.055	2.71
Age 24-27	-.122	4.00	-.075	2.76	-.121	2.59	-.144	3.42
Age 28-31	-.206	6.16	-.106	3.39	-.104	1.90	-.208	3.21
Age 32-36	-.305	9.08	-.091	2.40	-.146	3.00	-.227	3.15
Log per Adult Expenditure ^b	.095	1.62	-.038	.63	.112	1.16	.284	2.94
Distance to Primary School	-.015	2.21	-.036	6.70	-.001	.03	.005	1.10
Distance to Middle School	---	---	---	---	-.030	7.40	-.007	2.51
Distance to Secondary School	-.002	3.24	-.002	2.92	-.004	4.38	-.001	2.30
Male Wages ($\times 10^{-2}$)	-.033	4.28	-.029	4.08	.110	4.63	.061	4.70
Female Wages ($\times 10^{-2}$)	.030	3.08	-.021	2.41	-.075	3.14	-.038	2.96
Child Wages ($\times 10^{-2}$)	.328	4.01	.277	4.08	-.014	.61	-.023	1.34
Rural	-.288	4.89	-.200	3.39	-.027	.91	.019	.99
- Log Likelihood	1,927		1,789		2,100		1,556	
Sample Size	3,628		2,983		4,015		3,366	
Exogeneity Testing:								
Residual Expenditure	-.027	.49	.127	2.13	-.039	.41	-.212	2.15

^aAbsolute value of the asymptotic *t*-ratio.

^bPredicted Log per Adult Expenditure using ownership of assets which included business assets, value of land, unearned income of the household and amount saved (in Ghana) as the identifying instruments.

The estimate in Table 5 suggest that the father's years of schooling contribute respectively, 7.4 and 5.7 percent to the probability of his daughter and son completing primary school in Côte d'Ivoire, while the contribution of the mother's years of schooling to the same are 3.9 and 3.5 percent respectively (insignificant in the case of male sample). In Ghana female sample the effect of father's and mother's years of education are 3 and 2 percent respectively while in the male sample 1.3 and 1.6 percent.

VI. CONCLUSION

This paper investigates the determinants of the human capital investments for male and female children in Côte d'Ivoire and Ghana as it relates to their parent's education, household income and proximity to schools. Primary, middle and post middle schooling levels are examined separately. The schooling attainment of the children is measured by the years of schooling completed. The schooling attainment of both male and female children are found to be strongly related to their parent's education in both Côte d'Ivoire and Ghana. The following are the main findings. The effect of father's education was larger than that of the mother's education in both the male and female samples in both countries. In Ghana both parents' education have a larger impact on their female children's schooling than on the male children's schooling, while the reverse was true in Côte d'Ivoire. The close relationship between educational attainment of children and their parent's education could be an obstacle to social mobility.

Distance to schools is used as an indirect measure of the cost of attending school and is found to have negative impact on schooling attainment of male and female children in Côte d'Ivoire at the middle and post middle school levels. In Ghana the effect of the primary school distance was insignificant and significant for the middle and secondary school distances; in all samples the coefficients on the middle school distance were larger than the coefficients on secondary school distance. In both countries the results suggest that at each level of schooling, the distance cost is an important factor at that level of schooling.

The opportunity cost of time spent in schools as measured by community child wages were positive and significant in Côte d'Ivoire but were insignificant in Ghana. The community male and

female wages which are expected to measure opportunity cost of parent's time were all significantly different from zero. In Côte d'Ivoire the effect of the community male wages were negative and community female wages were positive. These signs were not expected. In Ghana the effect of the community male wages were mostly positive and the effects of the community female wages were mostly negative, as expected.

The effect of household income (which is proxied by per adult total expenditure) was positive and significant in most samples in both countries which is consistent with the demand for education as a consumption good in a setting with imperfect capital markets or credit constrained investment behavior by poor households.

NOTES

1. The GDP growth rates in this paragraph are computed by the author using the real GDP figures supplied in World Bank (1976) and (1991).
2. The enrollment ratios in sub-Saharan Africa are 73 percent for males and 58 percent for females in the primary school level and 20 percent for males and 12 percent for females in the secondary school level. The primary enrollment ratios in the low income and lower-middle income countries of which respectively, Ghana and Côte d'Ivoire belong to are about 100 percent for both boys and girls and the secondary school enrollment ratios range between 42-57 percent for males and 27-50 percent for females. These figures are for 1987 (World Bank, 1991). These figures also indicate a large gap between the male and female schooling in sub-Saharan Africa. The gap disappears in high income countries.
3. Holding constant for national income, teacher prices and demographic structure, Schultz (1989) computes that enrollment rates and public education expenditures at the primary and secondary levels in the African countries are significantly above the average of the 80 countries for the period 1960-1980. Further, in this study the low levels of income and high cost of teachers are found to account for the lower female-to-male enrollments in Africa.
4. As part of the Economic Recovery program a major educational reform was introduced in 1989 reducing the 17 years of pre-university education to a total of twelve years, including six years of elementary, three years of middle and three years of high school. World Bank, lent Ghana education sector adjustment credits in 1987 and in 1990.
5. Such a framework is used in studying the determinants of education by Wolfe and Behrman (1974), Rosenzweig and Evenson (1977), Chernichovsky (1985), de Tray (1988) and Psacharopoulos and Arrigada (1989) among others. In contrast Birdsall (1982 and 1985) considers a two-period utility function in the arguments of current consumption and expected future income of their children in the second period. In this treatment, investment into human capital yields a return through higher market earnings capacity. Parental utility is maximized subject to the resource constraints of income, available time, wage rates and flow of services

from physical assets. Children's future income is a function of time spent in school, total household expenditures on schooling and of the child and household characteristics such as innate ability and parental background. The maximization process leads to reduced form demand equations for schooling, leisure, number of children and consumption goods as a function of the exogenous variables. The exogenous variables include the price of schooling, price of children, price of consumption goods, wage rates for each of the household members, unearned income and child and household characteristics.

6. For children who are enrolled in school at the time of the survey, final grade attainment is unknown. It is assumed that they will complete the grade level currently enrolled. Such observations are right censored. Lillard and King (1984) suggests use of an ordered probability model taking censoring into account. The models employed here circumvents this problem since the estimation is carried out on different samples of education levels restricted to individuals above graduation ages.
7. In a Tobit model the conditional expectation of the years of schooling completed is a nonlinear function of the independent variables and the parameters. Therefore, the use of ordinary least squares in estimation will give biased parameter estimates (Amemiya, 1984; Greene, 1981).
8. Total household expenditure per adult over 15 is adjusted for inflation in each of the survey years using a monthly price index in Ghana. In Côte d'Ivoire, the 10 percent annual rate of inflation was uniformly distributed over the survey years.
9. These distances are measured in kilometers in the Côte d'Ivoire sample and converted to kilometers from miles in the Ghana sample. This information is provided in the community questionnaires of the respective countries for the rural areas. Households living in rural areas are assigned the distances of their communities to the nearest primary or secondary schools. For an urban household a distance of zero is assigned assuming existence of a school in the urban area.
10. These wages are measured in CFA Franks in Côte d'Ivoire and in Cedis in Ghana. Data on wages are provided in the community questionnaires of the respective countries. Households living in rural areas are assigned the local wages in their communities. Since no information was

collected for the urban areas, the urban households are assigned the national wages. Further, wages are deflated also to adjust for the inflation during the survey period. A monthly price index was used in Ghana for each of the survey years. In Côte d'Ivoire, the annual rate of inflation -- since it was only about 10 percent -- was uniformly distributed over each of the survey years.

11. The sample sizes of the LSMS surveys from Côte d'Ivoire and Ghana used in this study were as follows:

Sample Restriction	Côte d'Ivoire (1985-1987)	Ghana (1987-1989)
All Persons Age 5-65	32,949	32,389
Missing Education Information on the Individual	0	0
Missing Parental Education Information	8,138	7,511
Missing Parental Occupation Information	2,970	1,082
Missing Information on Other Variables Used in This Study	3,286	3,709
Remaining Number of Observations	18,555	20,987

After eliminating the observations with missing information there were 18,555 observations left in Côte d'Ivoire of which 8,635 were men and 9,920 were women. After the similar elimination process the number of observations left in Ghana were 20,087 of which 9,468 were men and 10,616 were women.

12. Various assets used for this purpose include business assets, value of land and unearned income of the household in Côte d'Ivoire. In Ghana, amount of savings is also used. Assets are adjusted for inflation in the manner explained in Note 10. The identifying instruments performed quite well in predicting the log per adult expenditure. They were jointly significant in all of the samples considered.
13. To examine the sensitivity of the coefficients on the parent education and on the distances to the nearest schools to the variables representing community characteristics such as male, female and child wages in the community, the models are estimated by excluding these community variables. Although coefficients on parents' education variables were somewhat larger when the

community variables are excluded, in general, they were robust to different specifications. At the middle and post middle schooling levels inclusion of community wages reduced the coefficients of school distances somewhat, however these coefficients were also robust to alternative specifications.

14. In an earlier specification parent's education were represented by two dummy variables, one indicating whether the father is literate or not and the other indicating whether the mother is literate or not. In this formulation parent's literacy had a significant influence on the schooling attainment of children of both genders. The effect was larger on the attainment of higher levels of education. The effect of father's literacy was found to be more important than that of mother's in both countries in both the male and female samples. The impact of parent's literacy was larger for the female children at all levels of schooling than for the male children in Ghana while the reverse was true in Côte d'Ivoire.
15. While for the younger individuals the current community child wage correctly indicates the opportunity cost of schooling, for the older individuals in the sample it will only be a proxy for the community wages at their youth when they were in school. This could potentially yield biased estimates of the effect of community child wages. The accuracy of such "window-based" estimates based on single year window observations which serve as proxies for multi-year observations is questioned by An, Haveman and Wolfe (1991).
16. While 64 percent of the sample is rural in Côte d'Ivoire, the 36 percent is urban and distributed as 12 percent in Abidjan and 24 percent in other urban areas. In Ghana 44 percent of the sample is rural. The remaining 56 percent urban is distributed as 12 percent in Accra and 44 percent in other urban areas. Overall urbanization, that is, urbanization outside of the capital cities is twice as much in Ghana as in Côte d'Ivoire. In another version of the model dummy variables were included for each of the four regions in Côte d'Ivoire (Urban other than Abidjan, Forest East Rural, Forest West Rural and Savannah Rural). The regional coefficients measure the differential impact of living in each of the regions as compared to living in Abidjan. The impact of living in each of these regions were negative, significantly different from the impact of living in Abidjan, the largest differential impact is observed in the rural Savannah. Similarly,

dummy variables were included for each of the six regions in Ghana (Urban Coast, Rural Coast, Urban Forest, Rural Forest, Urban Savannah, Rural Savannah). Their coefficients capture the differential impact of living in each region as compared to living in Accra. The impact of living in the Urban Forest areas are not significantly different from living in Accra. Other coefficient estimates were all negative and significant implying the advantage of living in Accra. The largest differential impacts are observed for the Urban and Rural Savannah regions. The regional differences could be due to personal or household characteristics, but they may also indicate unequal regional distribution of educational facilities.

17. In another set of estimates the effects of living with parents when the children are ten years old are examined. These effects are captured with two dummy variables indicating whether the children lived with their father or with their mother when ten years old. Their coefficient estimates if negative may be taken to measure the effect of child fostering especially when the child is going to school which is a rather prevalent social custom in Côte d'Ivoire. Fostering could be motivated to increase the child's opportunity for education or to work and not receive family support for education. In the Côte d'Ivoire sample of children aged 16-36 years old used in this study only 45 percent of them lived with their father or mother when they were ten years old. While in the Ghana sample used in this study 74 percent of the children lived with their father when ten years old and 82 percent of them lived with their mothers when ten. In the Côte d'Ivoire estimates these coefficients are all negative in sign and except at the female sample at the post middle schooling level they are statistically significant, confirming that child fostering extends the child's educational opportunities. Ainsworth (1989), Bledsoe *et al.* (1989) and Goody (1982) explain that it is common to live with relatives or friends while attending school when a local school is not available. In the Ghana estimates these coefficients take on positive or negative values and are insignificant except for the male and female samples both at the post middle schooling levels for the variable indicating living with father when ten years old. Fostering in Ghana is both less common and less closely related to extending a child's education.

REFERENCES

- Ainsworth, M. (1989). "Demand for Children in Côte d'Ivoire: Economic Aspects of Fertility and Child Fostering," Ph.D. Dissertation, Yale University.
- Ainsworth, M. and J. Munoz (1986). *The Côte d'Ivoire Living Standards Survey*, Living Standards Measurement Study, Working Paper 26, Washington, D.C.: The World Bank
- Amemiya, T. (1979). "The Estimation of a Simultaneous Equation Tobit Model," *International Economic Review*, 20(1): 169-181.
- Amemiya, T. (1984). "Tobit Models: A Survey," *Journal of Econometrics*, 24(3): 3-61.
- An, C. B., R. Haveman and B. Wolfe (1991). "The 'Window Problem' in Studies of Children's Attainments: A Methodological Exploration, Unpublished manuscript.
- Barros, P. R. and D. Lam (1992). "Why Do Parents' Education Matter to Children's Education," Processed, Economic Growth Center, Yale University.
- Becker, G. S. (1965). "A Theory of the Allocation of Time," *Economic Journal*, 75, 493-517.
- Becker, G. S. (1975). *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*, Second Edition. New York: National Bureau of Economic Research.
- Becker, G. S. (1991). *A Treatise on the Family*. Cambridge, MA: Harvard University Press.
- Becker, G. S. and H. G. Lewis (1973). "On the Interaction Between the Quantity and Quality of Children," *Journal of Political Economy* 81(2): S279-S288.
- Becker, G. S. and N. Tomes (1976). "Child Endowments and the Quantity and Quality of Children," *Journal of Political Economy*, 84(4/2), S143-S162.
- Becker, G. S. and N. Tomes (1979). "An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility," *Journal of Political Economy*, 87(6), 1153-1189.
- Behrman, J. R., R. A. Pollak and P. Taubman (1992). "The Wealth Model: Efficiency in Education and Distribution in the Family," University of Pennsylvania, Processed.
- Behrman, J. R. and B. L. Wolfe (1987). "Investment in Schooling in Two Generations in Pre-Revolutionary Nicaragua," *Journal of Development Economics*, 27, 395-419.
- Birdsall, N. (1982). "Child Schooling and Measurement of Living Standards," World Bank Living Standards Measurement Study Working Paper No. 14, Washington, D.C., World Bank.
- Birdsall, N. (1985). "Public Inputs and Child Schooling in Brazil," *Journal of Development Economics*, 18, 67-86.
- Bledsoe, C. and U. C. Isiugo-Abanihe (1989). "Strategies of Child Fosterage Among Mende Grannies in Sierra Leone," in R. Lesthaeghe (ed.), *African Reproduction and Social Organization*. Berkeley: University of California Press.
- Chernichovsky, D. (1985). "Socioeconomic and Demographic Aspects of School Enrollment and Attendance in Rural Botswana," *Economic Development and Cultural Change*, 33, 319-332.

- den Tuinder, B. A. (1978). *Ivory Coast, the Challenge of Success*. Baltimore: Johns Hopkins University Press for IBRD.
- de Tray, D. N. (1988). "Government Policy, Household Behavior, and the Distribution of Schooling: A Case Study of Malaysia," in T. P. Schultz (ed.), *Research in Population Economics*, Vol. 6. Greenwich, CT: Jai Press, Inc., pp. 303-336.
- Glewwe, P. (1991) *Schooling, Skills, and the Returns to Government Investment in Education*, Living Standart Measurement Study Woking Paper, 76, Washington D.C., The World Bank.
- Glewwe, P. and K. A. Twum-Baah (1991) *The Distribution of Welfare in Ghane, 1987-1988*, Living Standards Measurement Study, Working Paper, 75, Washington D.C.: The World Bank.
- Greene, W. H. (1981). "On the Asymptotic Bias of the Ordinary Least Squares Estimator of the Tobit Model," *Econometrica*, 49(2): 505-513.
- Gold Coast (1951). *Accelerated Development Plan for Education*. Accra: Government Printing Department.
- Goody, N. E. (1982) *Parenthood and Social Reproduction: Fostering and Occupational Roles in West Africa*, Cambridge: Cambridge University Press.
- Hausman, J. A. (1978). "Specification Tests in Econometrics," *Econometrica*, 46, 931-959.
- Hurd, G. E. (1967). "Education," Chapter VI. In W. Birmingham, I. Neustad and E. N. Omaboe (eds.), *A Study of Contemporary Ghana, Some Aspects of Social Structure*, Volume II. London: George Allen and Unwin, Ltd.
- Keith, S. (1985) *Ghana: Education Sector Review and Proposed Investment Strategy*, Western Africa Regional Office, Washington, D.C.: The World Bank.
- King, E. M. and L. A. Lillard (1987). "Determinants of Schooling Attainment and Enrollment Rates in the Philippines," *Economics of Education Review*, 6, 167-181.
- Lavy, V. (1991). "Supply Constraints and Investment in Human Capital: Schooling in Rural Ghana," Processed, Department of Population and Human Resources, The World Bank, Washington, D.C.
- Leibowitz, A. (1974). "Home Investments in Children," in T. W. Schultz (ed.), *Economics of the Family*. Chicago: University of Chicago Press, pp. 432-452.
- Maddala, G. S. (1983). *Limited Dependent and Qualitative Variables in Econometrics*. Cambridge: Cambridge University Press.
- Michael, R. T. (1973). "Education in Nonmarket Production," *Journal of Political Economy* 80(1): 306-321.
- Mincer, J. (1958). "Investment, Human Capital and Personal Income Distribution," *Journal of Political Economy* 66(1): 281-321.
- Mincer, J. (1974). *Schooling Experience and Earnings*. New York: National Bureau of Economic Research.

- Nelson, F. and L. Olson (1978). "Specification and Estimation of a Simultaneous Equation Model with Limited Dependent Variables," *International Economic Review*, 19(3): 695-709.
- Psacharopoulos, G. and A. M. Arriagada (1989). "Determinants of Early Age Human Capital Formation: Evidence from Brazil," *Economic Development and Cultural Change*, 20, 683-708.
- Republique de Côte d'Ivoire (1986). *Enseignement et Formation et Côte d'Ivoire, Statistiques, Année Scolaire, 1985-1986*, Abidjan.
- Rivers, D. and Q. H. Vuong (1988). "Limited Information Estimators and Exogeneity Tests for Simultaneous Probit Models," *Journal of Econometrics*, 39: 347-366.
- Rosenzweig, M. and R. Evenson (1977). "Fertility, Schooling and Economic Contribution of Children in Rural India: An Economic Analysis," *Econometrica* 45(5): 1065-1080.
- Rosenzweig, M. R. and T. P. Schultz (1982). "Market Opportunities, Genetic Endowments and Intrafamily Resource Distribution: Child Survival in Rural India," *American Economic Review*, 72, 808-815.
- Schultz, T. P. (1989). "Investment in Women, Economic Development, and Improvements in Health in Low-Income Countries," in *Biomedical Science and the Third World: Under the Volcano*, *Annals of the New York Academy of Sciences*, 569, 288-310.
- Schultz, T. W. (1960). "Capital Formation by Education," *Journal of Political Economy* 68(12): 571-583.
- Schultz, T. W. (1963). *The Economic Value of Education*. New York: Columbia University Press.
- Scott, M. and Amenuveqbe (1989) *Sample Designs for the Living Standard Surveys in Ghana and Mauritania*, Living Standards Measurement Study, Working Paper, 49, Washington, D.C.: The World Bank.
- Smith, R. J. and R. W. Blundell (1986). "An Exogeneity Test for a Simultaneous Equation Tobit Model with an Application to Labor Supply," *Econometrica*, 54(3), 679-685.
- Unicef, Accra (1988). "Adjustment Policies and Programmes to Protect Children and Other Vulnerable Groups in Ghana." In G. A. Cornia, R. Jolly and F. Stewart (eds.), *Adjustment with a Human Face*, Volume 2. Oxford: Clarendon Press, pp. 92-125.
- United Nations, Unesco (1992). *Statistical Yearbook*, 1991 and 1978-79, 1985, 1987, 1988.
- Weissman, S. R. (1990). "Structural Adjustment in Africa: Insights from the Experiences of Ghana and Senegal," *World Development* 18(12): 1621-1634.
- World Bank (1976, 1991). *World Tables 1976 and World Tables 1991*. Baltimore: Johns Hopkins University Press.
- World Bank (1987). *Education Policies for Sub Saharan Africa: Adjustment Revitalization and Expansion*, Report No. 6934. Washington, D.C.
- World Bank (1991). *World Development Report 1991*. New York: Oxford University Press.

Appendix

Structure of Education in Côte d'Ivoire and Ghana

CÔTE D'IVOIRE

Côte d'Ivoire became independent in 1960 and a university was established in Abidjan in the same year. The formal education consists of six years of primary school, four years of middle school and three years of high school none of which is compulsory. Students enter primary school around 6-7 years of age and at the end of six years after an examination receive Certificate de L'Enseignement Primaire Elementaire (CEPE). At the end of four years of middle school the students are granted a Brevet de L'Enseignement du Premier Cycle (BEPC). A high school diploma requires an additional three years of schooling and the successful completion of the baccalaureate examinations. Qualified middle school, high school and university students are provided with scholarships. Enrollments except at primary level are restricted via competitive entrance examinations. Excess demand encouraged the establishment of private middle and high schools. There are large numbers of repeaters at all levels including the university level. den Tuinder (1978, p. 285) estimated that in 1972-73 the cost of repeating was 30 percent of the total education costs.

As seen in Appendix Table 1, only 46 percent of the primary school age children were enrolled in 1960. After increasing to 82 percent in 1982, it declined to 75 percent in 1985. Female primary school enrollment ratio was slower to increase: it went up from 24 percent in 1960 to 57 percent in 1982 and declined to 62 percent in 1985. The secondary school enrollment ratio was only 2 percent (1 percent for females) in 1960. It increased steadily over the years reaching 19 percent (12 percent for females) in 1980.

In 1960 there were 239 thousand students enrolled in primary schools. Primary school enrollments grew by an average annual rate of 11.1 percent during 1960-70 and by about 4 percent during 1980-85. The secondary school enrollments increased at a spectacular rate of 50 percent per annum during 1960-70 and at a rate of about 5 percent during 1980-86 (United Nations, 1992).

After its establishment in 1960, the enrollments at the University of Abidjan increased rapidly. The number of students doubled between 1976 and 1986 increasing from six thousand to about

twelve thousand. The percentage of the 20-24 age group enrolled in tertiary education increased from .11 in 1960 to 2.70 in 1980. It was essentially constant during the period of economic difficulties in 1980-85 and increased to 3 percent in 1986 (Republique de Côte d'Ivoire, 1986).

Appendix Table 3 shows that the share of educational expenditures in the current government budget increased from about 15 percent in 1960 to 34 percent in 1973 and 36 percent in 1980, making Côte d'Ivoire the largest allocator in the world of its current budget on education. Educational expenditures were 6.3 percent of GNP in 1985 and in general have been a larger share of GNP in Côte d'Ivoire than in Ghana.

GHANA

Ghana is the first of the West African colonies to become independent in 1957 and it became a republic in 1960. Education was given a high priority after the election of a popular government for domestic affairs in 1951 (Gold Coast, 1951; Hurd, 1967).

Primary schools provide six years of education for students about 6-12 years old. Middle schools take four years at the end of which students are granted Middle School Leaving Certificate (MSLC) after an examination. Primary and middle school educations are both free. After graduation from primary school or during the first two years of the middle school the students may go to the "secondary school" which is the equivalent of the high school stage in Côte d'Ivoire. The students are selected by entrance examination and have to pay tuition. The normal age of starting this high school is between 12-17 years. The high school lasts five years and graduating students take the General Certificate of Education (GCE) examination. Those who pass the GCE at O-level enter the sixth-form. Sixth-form lasts two years at the end of which students take the GCE examination again. Those who pass the GCE at A-level qualify for entry at one of the three universities. Qualified university students are provided with scholarships. There are also commercial and vocational schools of 3-4 years which could be attended after primary school. The Teacher training-B schools (four years) could be attended after middle school to teach at primary schools. The Teacher training-A schools (three years) could be attended after secondary school to teach at middle schools.

In 1960 there were 503 thousand students enrolled in primary schools which increased to 1.7 million in 1988. The primary school enrollments grew at about 9 percent during the 1960's and at about 1.9 percent during the early 1980's. The secondary school enrollments increased from about 200 thousand in 1960 to about 900 thousand in 1987. The 19 percent rate of growth of the 1960's declined substantially in the 1970's and 1980's (United Nations, 1992).

Appendix Table 2 shows that in 1960, 38 percent of the primary education age group was enrolled. This ratio increased to 80 percent in 1980. After a period of fluctuation, it declined to 71 percent in 1987 partly due to introduction of school fees as part of the Economic Recovery Program in 1983 (Weissman, 1990). Female primary school enrollment ratio followed the similar trend increased from 25 percent in 1960 to over 60 percent in the 1980's. The secondary school enrollment ratio went up from 5 percent (2 percent for females) in 1960 to about 50 percent (30 percent for females) in the 1980's.⁶

Appendix Table 3 gives the trend in educational expenditures in Ghana. The share of education in the current government budget increased from about 13 percent in 1960 to 24 percent in 1970. Since then this share has been fairly constant. However, the budget itself fell from about 18 percent of GNP in 1972 to 10 percent of GNP in 1982 while the GNP per capita declined by about 30 percent during that period. Educational expenditures as a percent of GNP were 4.6 in 1975 and declined to a low of 1.4 in 1984 which was the worst year of the recession, food shortages, inflation and severe drought. The per capita educational expenditures fell over 70 percent from 1975 to 1982 and the proportion of trained teachers in primary schools dropped from 71 percent in 1976/77 to 54 percent in 1980/81, as trained teachers left for better paying jobs in Ghana or abroad (Unicef-Accra, 1988). During the 1980's the school system had problems with shortages of textbooks, papers and pencils, loss of teaching personnel, and a decline in infrastructure.

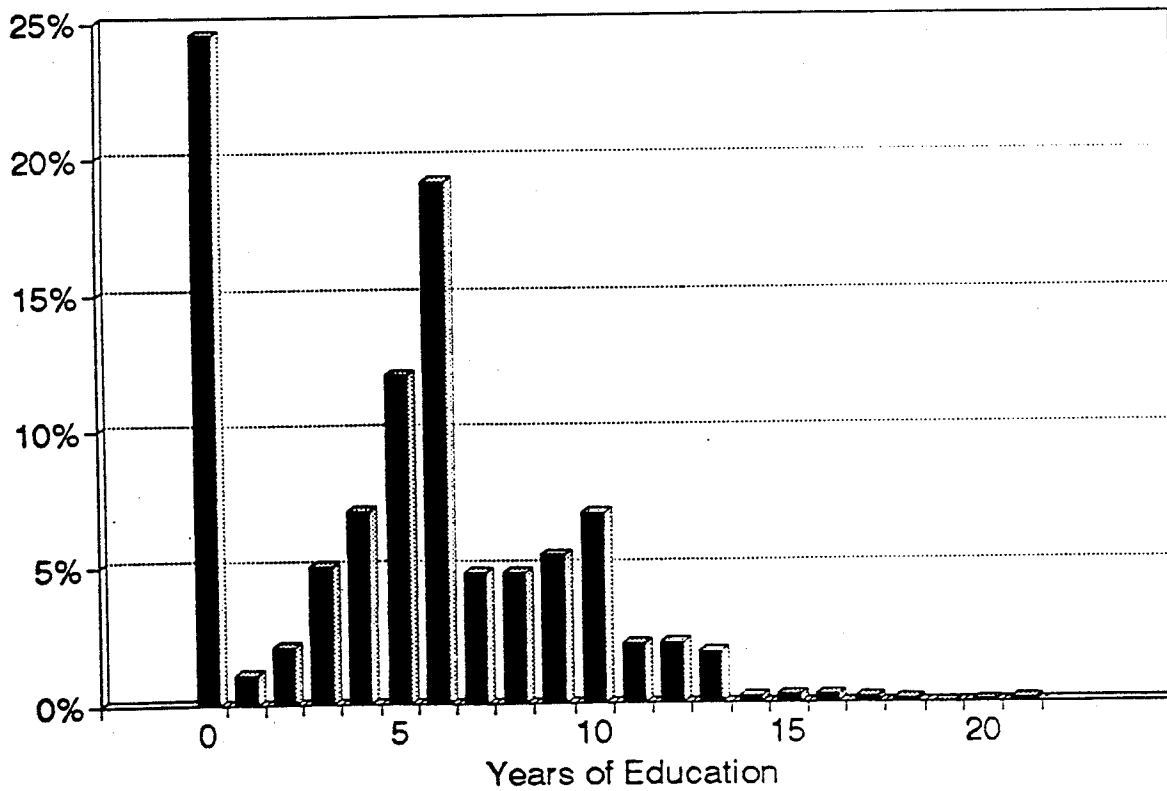
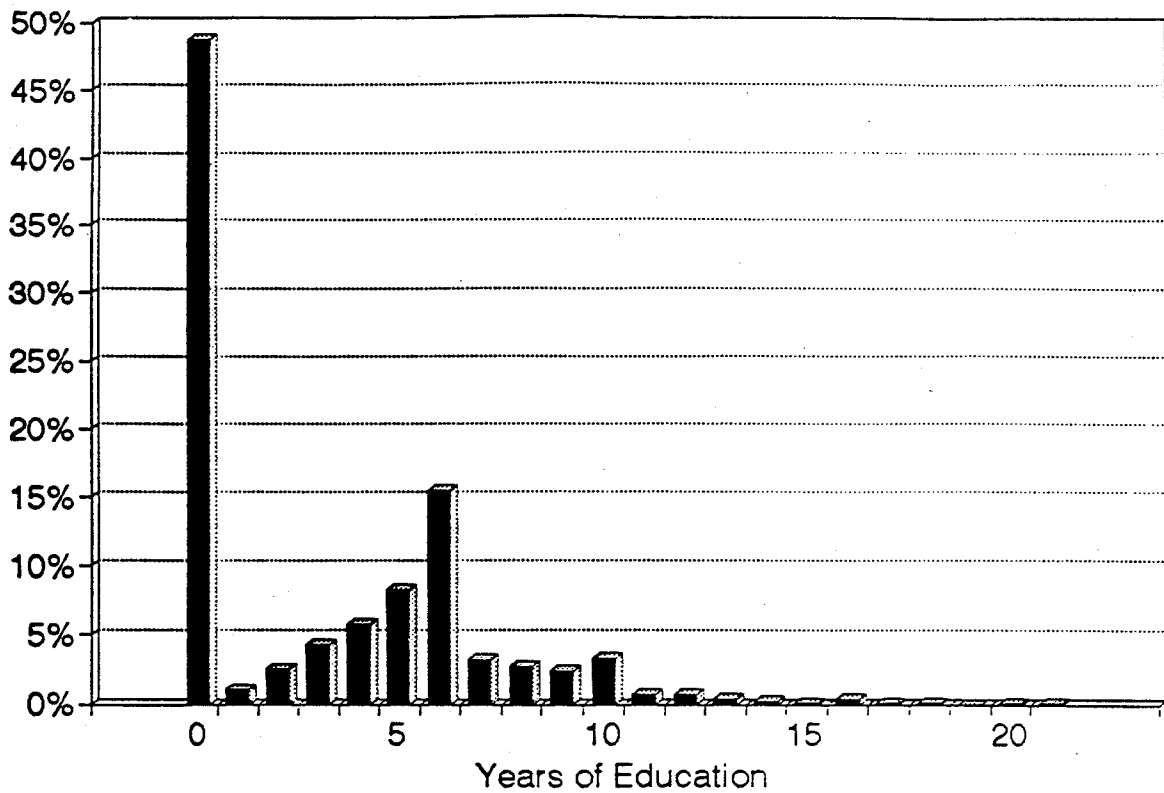


FIGURE 1
Distribution of Observations by Years of Schooling Completed,
Ages 11-36, in the Female (Upper) and Male (Lower) Samples in Côte d'Ivoire

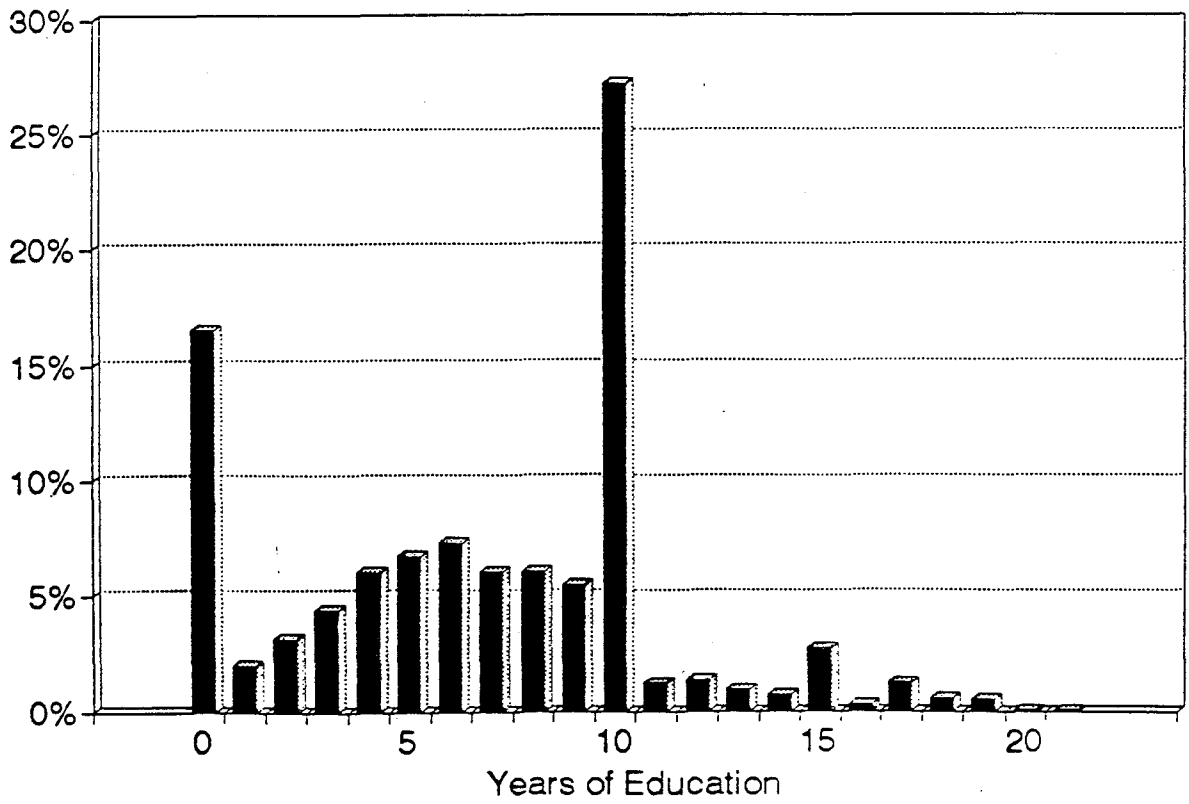
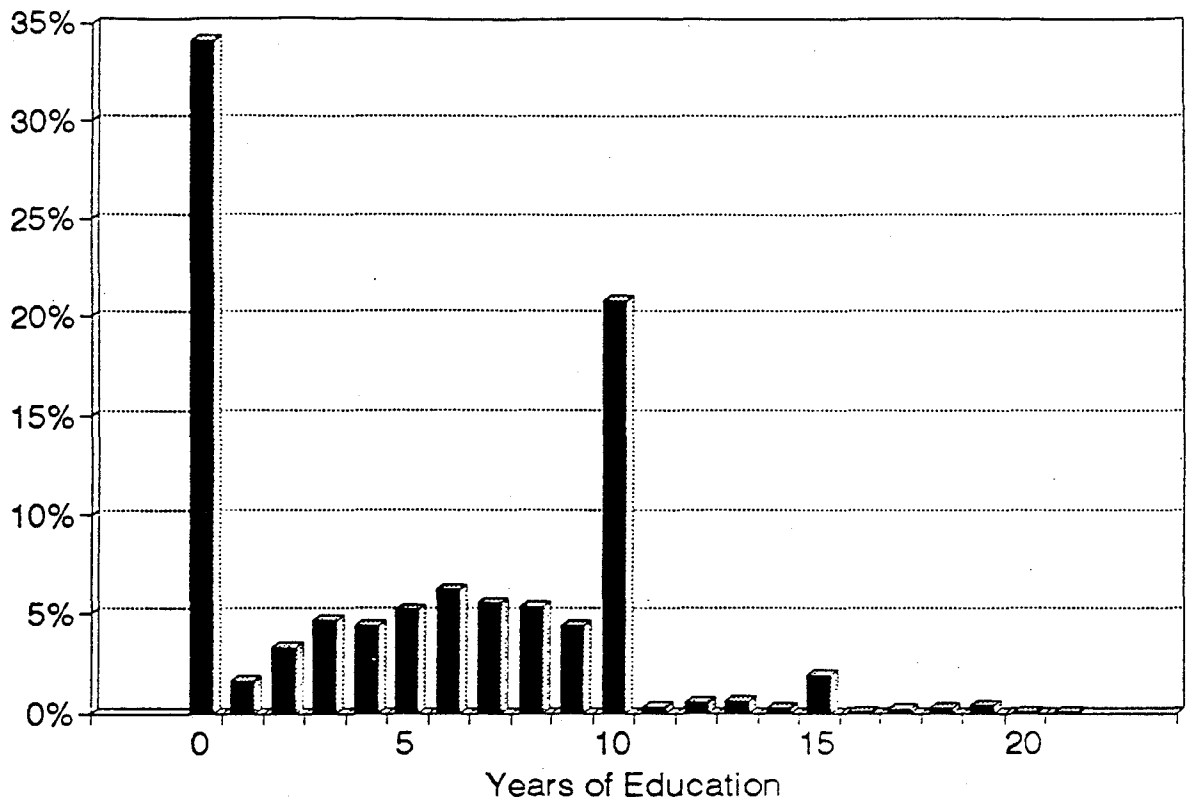


FIGURE 2
Distribution of Observations by Years of Schooling Completed, Ages 11-36, in the Female (Upper) and Male (Lower) Samples in Ghana

APPENDIX TABLE 1

Estimated Gross Enrollment Ratios by Level of Education and Gender,
1960–1987, Côte d'Ivoire

Year	Primary			Secondary			Tertiary		
	(Age 7–12)			(Age 13–19)			(Age 20–24)		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
1960	46	68	24	2	4	1	.11	.19	.02
1965	60	80	41	6	10	2	.47	.76	.15
1970	58	71	45	9	13	4	.90	1.40	.30
1975	64	80	48	13	18	7	1.30	2.0	.4
1980	79	95	63	19	27	12	2.7	4.7	1.0
1982	82	95	67	19	27	11	2.7	--	--
1983	81	95	66	19	27	11	2.5	4.0	.9
1984	76	89	63	20	28	12	2.6	4.0	1.1
1985	75	88	62	20	28	12	3.0*	--	--
1986	--	--	--	19	27	12	3.0*	--	--
1987	--	--	--	20	27	12	--	--	--

-- not available.

*World Bank, World Development Report, 1991.

For the years 1960–1970 the age groups covered were 6–11, 12–18, and 20–24, respectively for the three levels of education. For all other years the ages covered are given in parentheses under the level of education.

Source: United Nations, *Unesco, Statistical Year Book*, 1978–79, 1985, 1987, 1988, 1991.

APPENDIX TABLE 2

Estimated Gross Enrollment Ratios by Level of Education and Gender,
1960–1989, Ghana

Year	Primary			Secondary			Tertiary		
	(Age 6–11)			(Age 12–18)			(Age 20–24)		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
1960	38	52	25	5	9	2	.24	.42	.05
1965	69	82	57	13	19	7	.73	1.29	.15
1970	64	73	54	14	21	8	.8	1.3	.2
1975	72	81	63	36	44	27	1.1	1.8	.3
1980	80	89	71	41	51	31	1.6	2.6	.7
1982	77	86	67	38	47	28	--	--	--
1983	78	87	68	38	47	28	--	--	--
1984	76	85	66	41	51	31	1.5	2.4	.6
1985	76	--	--	40	--	--	1.5	2.4	.6
1986	72	82	63	39	46	31	1.5	2.4	.6
1987	71	78	63	40	49	32	--	--	--
1988	73	81	66	39	47	30	1.5	2.3	.6
1989	75	82	67	--	--	--	--	--	--

-- not available.

For the years 1960–1970 the age groups covered were 6–15, 16–19, and 20–24, respectively for the three levels of education. For all other years the ages covered are given in parentheses under the level of education.

Source: United Nations, *Unesco, Statistical Year Book*, 1978–79, 1985, 1987, 1988, 1991.

APPENDIX TABLE 3

Trends in Current Educational Expenditure in National Currencies,
1960-1989, Côte d'Ivoire and Ghana

Year	Côte d'Ivoire (CFA Frank)		Ghana (Cedi)	
	As Percent of GNP	As Percent of Current Government Expenditure	As Percent of GNP	As Percent of Current Government Expenditure
1960	4.2	15.1	3.4	13.4
1965	5.0	19.8	4.5	17.7
1970	4.6	30.7	3.8	24.1
1975	5.6	33.7	4.6	24.1
1980	5.9	36.4	--	--
1982	7.0	--	--	--
1983	7.5	--	--	--
1984	6.7	--	1.4	--
1985	6.3	--	--	--
1986	--	--	3.3	--
1987	--	--	3.2	28.1
1988	--	--	3.0	26.6
1989	--	--	3.2	--

-- not available.

For Ghana for the 1985-1988 period expenditure data refer to the expenditures of the ministry of education only.

Source: United Nations, *Unesco Statistical Year Book*, 1972, 1978-79, 1991.

APPENDIX TABLE 4

Mean and Standard Deviation for the Female and Male Subsamples,
Côte d'Ivoire, 1987-1989

	Female			Male		
	16-36	19-36	25-36	16-36	19-36	25-36
DEPENDENT VARIABLE						
Years of Schooling Attained	2.914 (1.07)	2.656 (3.86)	2.178 (3.71)	5.638 (4.48)	5.597 (4.78)	5.487 (5.06)
INDEPENDENT VARIABLES						
Father Years of Schooling	1.067 (2.95)	.791 (2.55)	.528 (2.00)	1.286 (3.11)	1.020 (2.69)	.828 (2.54)
Mother Years of Schooling	.300 (1.48)	.179 (1.11)	.095 (.78)	.257 (1.36)	.142 (.96)	.082 (.69)
Age 16-19	.272 (.44)	.077 (.27)	--	.320 (.47)	.093 (.29)	--
Age 20-23	.223 (.42)	.282 (.45)	--	.234 (.42)	.316 (.47)	--
Age 24-27	.183 (.39)	.232 (.42)	.307 (.46)	.170 (.38)	.229 (.42)	.321 (.47)
Age 28-31	.166 (.37)	.210 (.41)	.357 (.48)	.128 (.33)	.173 (.38)	.325 (.48)
Age 32-36	.157 (.36)	.199 (.40)	.337 (.47)	.139 (.35)	.188 (.39)	.354 (.48)
Log per Adult Expenditure	12.41 (.29)	12.42 (.81)	12.46 (.83)	12.42 (.79)	12.45 (.80)	12.57 (.83)
Log Predicted Expenditure	12.41 (.39)	12.42 (.38)	12.45 (.38)	12.42 (.41)	12.45 (.41)	12.57 (.40)
Distance to Primary School	.299 (1.17)	.301 (1.18)	.336 (1.29)	.324 (1.32)	.330 (1.33)	.361 (1.38)
Distance to Secondary School	15.25 (19.7)	15.84 (20.1)	16.57 (20.8)	13.69 (19.1)	13.31 (18.6)	13.80 (19.5)
Male Wages ($\times 10^{-2}$)	3.546 (3.65)	3.617 (3.65)	3.747 (3.64)	3.084 (3.51)	3.067 (3.51)	3.025 (3.49)
Female Wages ($\times 10^{-2}$)	3.035 (3.19)	3.087 (3.18)	3.208 (3.17)	2.671 (3.13)	2.659 (3.13)	2.637 (3.12)
Child Wages ($\times 10^{-2}$)	2.581 (2.94)	2.620 (2.92)	2.715 (2.92)	2.279 (2.86)	2.294 (2.89)	2.273 (2.85)
Urban	.444 (.49)	.431 (.48)	.406 (.49)	.506 (.50)	.509 (.50)	.514 (.50)
Rural	.556 (.50)	.569 (.50)	.594 (.49)	.494 (.50)	.491 (.50)	.486 (.50)
Sample Size	3,628	2,862	1,688	2,983	2,205	1,172

APPENDIX TABLE 5

Mean and Standard Deviation for the Female and Male Subsamples,
Ghana, 1987-1989

	Female			Male		
	16-36	19-36	25-36	16-36	19-36	25-36
DEPENDENT VARIABLE						
Years of Schooling Attained	5.473 (4.87)	5.454 (5.00)	5.164 (5.07)	7.870 (4.64)	8.104 (4.88)	7.990 (5.17)
INDEPENDENT VARIABLES						
Father Years of Schooling	3.751 (5.53)	3.537 (5.48)	2.943 (5.11)	3.820 (5.56)	3.422 (5.36)	2.600 (4.84)
Mother Years of Schooling	1.335 (3.46)	1.202 (3.33)	.855 (2.92)	1.397 (3.42)	1.186 (3.22)	.785 (2.63)
Age 16-19	.216 (.41)	.056 (.23)	--	.265 (.44)	.064 (.24)	--
Age 20-23	.216 (.41)	.260 (.44)	--	.207 (.41)	.264 (.44)	--
Age 24-27	.214 (.41)	.258 (.44)	.319 (.47)	.182 (.39)	.232 (.42)	.281 (.45)
Age 28-31	.180 (.39)	.217 (.41)	.348 (.48)	.169 (.75)	.215 (.41)	.352 (.48)
Age 32-36	.173 (.38)	.208 (.41)	.334 (.47)	.177 (.38)	.225 (.42)	.368 (.46)
Log per Adult Expenditure	11.24 (.71)	11.31 (.70)	11.39 (.71)	11.16 (.72)	11.26 (.71)	11.42 (.69)
Log Predicted Expenditure	11.24 (.29)	11.31 (.25)	11.39 (.26)	11.16 (.36)	11.26 (.33)	11.42 (.27)
Distance to Primary School	.404 (1.55)	.407 (1.58)	.372 (1.43)	.470 (1.79)	.455 (1.79)	.436 (1.71)
Distance to Middle School	1.908 (4.44)	1.939 (4.51)	1.990 (4.63)	2.180 (4.73)	2.204 (4.80)	2.367 (4.92)
Distance to Secondary School	12.63 (19.0)	12.59 (18.8)	12.79 (19.2)	13.67 (19.8)	13.62 (20.3)	13.516 (19.9)
Male Wages ($\times 10^{-2}$)	2.436 (.74)	2.437 (.74)	2.446 (.75)	2.440 (.77)	2.448 (.78)	2.433 (.77)
Female Wages ($\times 10^{-2}$)	2.300 (.72)	2.296 (.73)	2.309 (.71)	2.307 (.73)	2.312 (.73)	2.302 (.72)
Child Wages ($\times 10^{-2}$)	2.102 (.73)	2.099 (.73)	2.104 (.78)	2.116 (.75)	2.120 (.75)	2.102 (.75)
Urban	.605 (.50)	.607 (.50)	.607 (.50)	.561 (.50)	.567 (.50)	.566 (.50)
Rural	.395 (.49)	.393 (.49)	.393 (.49)	.439 (.50)	.433 (.50)	.434 (.50)
Sample Size	4,015	3,335	2,083	3,366	2,641	1,616