The Decline in Primary School Enrolment in Kenya

Arjun S. Bedi[a]
Paul K. Kimalu[b]
Damiano Kulundu Manda[c]
Nancy Nafula[d]

Abstract

Since independence in 1963, Kenya has invested substantial resources in the education sector. For almost twenty five years, these investments and other government policies led to impressive gains in educational access at all levels. However, since the mid to late eighties there has been an erosion in educational participation and a reversal of the gains achieved in previous decades. Motivated by this trend, and the importance attributed to educational acquisition as a means of tackling poverty, this paper uses temporal, cross-section, and pseudo-panel data to assess the plausibility of various factors that may be responsible for the decline in primary school educational enrolment. We consider the role of cost-sharing policies, school input and curriculum reforms, school availability, the expected benefits of education and the spread of HIV/AIDS. The empirical evidence that we assemble shows that reforms in the school curriculum and the policy of cost-sharing are the two main factors responsible for the decline in educational enrolment. An increase in the skill-level of teachers is positively associated with educational enrolment. To ease the fiscal strain and increase enrollment, a policy mix of retaining cost-sharing, hiring skilled teachers, phasing out unskilled teachers and allowing the student-teacher ratio to increase is suggested. Such a policy mix is expected to have a positive impact that is four times larger for the poorest forty percent of households as compared to the richest twenty percent of households.

Keywords: Primary school, Kenya, cost-sharing, school inputs
JEL Codes: D1, I2

---

[a] Institute of Social Studies, The Hague, The Netherlands, em: bedi@iss.nl; [b] Kenya Institute for Public Policy Research and Analysis (KIPPRA), Nairobi, Kenya, em: kimalu@kippra.or.ke; [c]KIPPRA and University of Nairobi, Kenya, em: manda@kippra.or.ke; [d] KIPPRA, em: nafula@kippra.or.ke. Our names as authors are listed alphabetically. We thank Alemayehu Geda, Gabriela Guerrero, Jan van Heemst, Niek de Jong, Diana Kimani, Germano Mwabu, Robert Nyaga and Rob Vos for helpful comments.

I. Introduction

Investments in education are widely recognized as a key component of a country's development strategy. Increases in the quantity and quality of educational provision have been associated with a wide range of benefits including enhanced productivity, reduced poverty and income inequality, improved health and economic growth. Spurred by such evidence, governments in developing countries continue to devote a substantial fraction of their total expenditure to the education sector.

Kenya is no exception. Since independence, the government of Kenya has devoted a substantial fraction of its resources to the education sector. Between 1991-2000, public expenditure on education accounted for 28.2 percent of total government expenditure.[1] These investments have led to the establishment of a comprehensive network of schools and resulted in an impressive expansion of coverage and access to education at all levels. Adult literacy rates have more than trebled from 20 percent in 1963 to 76 percent in 1997 and the average educational attainment of the working-age population (age 15-64) is now around 6 years (see Kimalu et al., 2001).

Despite these impressive gains, a variety of problems continue to hamper the Kenyan education system. In terms of achievement, mean scores in English and Mathematics as measured by the Kenya Certificate of Primary Education (KCPE) are about 50 percent. With regard to efficiency, about 5-6 percent of Kenyan primary school students desert annually and 15-16 percent repeat grades, consequently school completion rates are below 50 percent.

While high drop-out and repetition rates are causes of concern, a more troublesome trend appears to be the decline in school enrolment rates. These declines have overturned the gains in educational participation achieved in previous years. In particular, the gross primary

[1] This figure corresponds to around 5-7 percent of GDP spent on education during the period 1991 and 2000. In terms of international comparisons this educational expenditure ratio is amongst the highest in the world (see UNESCO, 1999).

school enrolment rate (GER) peaked at 115.2 percent in 1980 and by 1999 had fallen to 86.9 percent. Similarly the gross secondary school enrolment rate has declined from 29.4 to 21.5 percent. In its poverty eradication plans the government of Kenya lays out its goal of achieving universal primary education by 2015 and achieving a 15 percent increase in primary school enrolment between 1999-2005. Notwithstanding these targets, the declining pattern of primary school enrolment suggests that it may be difficult for the government to achieve its aims.

Motivated by the decline in enrolment rates and the importance attached to education as a means of alleviating poverty, our focus in this paper is on school enrolment. Specifically, our aim in this paper is to assess the plausibility of various factors that may be responsible for the decline in primary school enrolment. To tackle this issue in a comprehensive manner we draw on temporal information at the macro-level and on detailed household survey data sets. We analyze mean enrolment patterns and enrolment rates across five expenditure quintiles. Furthermore, we also try to identify the most cost-effective policy interventions that may be used to influence enrolment.

The next section of the paper lays out an analytical framework that we use to motivate our empirical investigation. Section III briefly discusses Kenya's education system and examines the recent trends in enrolment rates. In this section we use descriptive statistics to assess the plausibility of various explanations that may drive enrolment patterns. Section IV describes the data set on which we base our econometric work. Section V presents our estimates and section VI concludes the paper.

II. Primary School Enrolment-An Analytical Framework

To formalize the school enrolment decision and to motivate our empirical work this section presents a framework tailored to our needs.[2] Consider the discrete school enrolment

[2] The framework used here is similar to those in Gertler and Van Der Gaag (1988), Gertler and Glewwe (1990) and Bedi and Marshall (2002).

choice faced by parents. Parents have to determine whether it is worthwhile to enrol their children in school. While attending school yields benefits it comes at a cost. Direct and opportunity costs associated with school attendance lower resources available for household consumption. This household choice may be cast in terms of utility functions. Assume that each household has a utility function defined over *b* and *c,* where *b* denotes the benefits associated with attending school and *c* is household consumption. Accordingly, household utility conditional on school attendance (denoted by subscript 1) is given as,

$$U_1 = U(b, c_1). \tag{1}$$

The associated budget constraint is,

$$y = c_1 + p, \tag{2}$$

where *y* is household income, and *p* represents the total cost associated with school attendance.

In a similar fashion the utility associated with not attending school may be defined by,

$$U_0 = U(c_0). \tag{3}$$

The budget constraint is $y = c_0$. Given the utility associated with both options, households choose the option that yields the highest utility. The solution to the unconditional utility maximizing problem is

$$U^* = \max(U_1, U_o), \tag{4}$$

where U^* is the maximum utility. Alternatively, school attendance may be defined in terms of a dichotomous variable, *a,* where $a = 1$ if a child attends school and 0 otherwise. A child attends school i.e., $a = 1$ if $U_1 > U_0$.

Empirical Specification

Since our purpose is to determine the factors that influence enrolment we proceed by specifying linear forms of the conditional utility function.[3] For the schooling option,

$$U_1 = \beta_1 b + \beta_2 c + \varepsilon_1, \tag{5}$$

where the β's are coefficients to be estimated and ε_1 is assumed to be a mean zero, normally distributed error term with positive variance. Since $c_1 = y - p$, we may rewrite (5) to obtain,

$$U_1 = \beta_1 b + \beta_2 (y - p) + \varepsilon_1 \tag{6}$$

The utility function for the non-schooling option is,

$$U_o = \beta_2 y + \varepsilon_0 \tag{7}$$

Thus, an individual attends school, i.e. $a = 1 \;\; if \;\; \beta_1 b - \beta_2 p + \varepsilon_1 - \varepsilon_0 > 0$. Hence, the probability of attending school may be written as:

$$\Pr[a = 1] = \Pr[\beta_1 b - \beta_2 p + \varepsilon_a > 0]. \tag{8}$$

Assuming that the composite error term ε_a is normally distributed gives rise to an estimable probit enrolment model.

Costs of attending school

The total cost of sending a child to school includes direct (monetary) and opportunity costs. The available household survey data allows us to construct a measure of the direct costs of schooling. Detailed costs of sending a child to school are available for those children who

[3] While a linear utility specification has the advantage of simplicity, it also suffers from several disadvantages. Due to linearity, as is evident from equation (8), income/consumption is differenced out of the decision rule and does not directly affect the school enrolment decision. In our empirical work we tried alternative utility function specifications but were unable to empirically distinguish between linear, log-linear and quadratic in consumption utility specifications. An additional justification for not including consumption is that it is potentially endogenous. To counter these problems we control for household resources via inclusion of variables such as home ownership, land per capita and number of rooms in a house. Additionally, we assess the role of household expenditure on enrolment by examining the enrolment decision across different expenditure quintiles.

are attending school. These data are used to compute a district-wide average of the cost of attending school and is used as our measure of the direct cost of schooling.

Turning to opportunity costs, attending school reduces a child's availability for work in and outside the home. If a child makes substantial contributions to family income, or plays an important role in supporting other working members, then the opportunity cost of attending school is likely to be high and this may curtail the attractiveness of the schooling option.[4] These opportunity costs and the value of a child's time will depend on the personal characteristics of the child (age, sex) and the value that parents place on a child's time. Since we do not directly observe opportunity costs we allow such costs to depend on a vector of child and family characteristics.

Benefits of attending school

Parents have to ascertain the total benefits associated with school attendance. The main benefit associated with attending school is likely to be the expected addition to a child's human capital. To capture this effect we need a measure of the human capital gains associated with school attendance. Expected test scores are often used to indicate the benefits derived from education. Since such scores are not available for the individuals in our data set, we use district-wide average test scores from the KCPE examination as a measure of the expected benefits of attending school. These test scores are directly observable by parents and it is likely that they provide a signal that may be used by parents to judge the value of schooling. Bedi and Marshall

[4] For example, Patrinos and Psacharopoulos (1995) show that child earnings account for 27.8 percent of total income in urban households in Paraguay, while Patrinos and Psacharopoulos (1997) show that child labor contributes 17.7 percent of household income in rural Peru.

(1999, 2002) provide empirical evidence on the role played by expected test scores in determining educational choices.[5]

In addition to test scores it is likely that the quality of school inputs/curriculum play a role in determining the expected pay off from education. School inputs may influence the enrolment decision indirectly by influencing test scores (increasing the payoff associated with education) but may also have a direct impact on enrolment. In our empirical work we consider both these possibilities.

In accordance with the discussion above, equation (8) may be adjusted and rewritten as,

$$\Pr[a = 1] = F[\gamma_{SF} SF + \gamma_x X + \gamma_H H + \gamma_{SI} SI], \qquad (9)$$

where, F represents the standard normal cumulative distribution function, SF represents school fees, X is a vector of child and family characteristics that influence the opportunity cost of enrolment, H is a measure of expected human capital gains, SI is a vector of school inputs and the γ's are coefficients to be estimated.

II.1 Estimation Approach

Three Welfare Monitoring Surveys (WMS) conducted in 1992, 1994 and 1997 contain adequate information and enable estimation of equation (9). Following a well-established literature we use a probit model to estimate equation (9) for each of the years that we have data. These cross-sectional estimates rely on spatial variation to identify the effect of the independent

[5] It may be argued that expected earnings or expected employment prospects are better indicators of the expected benefits of education and should be used instead of test scores. We don't have district level information on employment rates by education level and so this measure is ruled out. While it is possible to create a measure of expected earnings, at least for one of the years for which we have data, it is not clear how this measure can be directly influenced by educational policies. On the other hand, school test scores may be influenced by altering the quality of school inputs and may be influenced to a greater extent by educational policies. A further justification for using this measure lies in the relationship between test scores and earnings. Based on their analysis of Kenyan data, Boissiere, Knight and Sabot (1985) report that cognitive skills, as measured by test scores on literacy and numeracy tests, are highly rewarded in the labor market.

variables on enrolment. While such cross-section results provide clues on the temporal effects of changes in school costs and school inputs on enrolment they are not very convincing.

A far more convincing analysis of temporal changes in enrolment rates requires the use of panel data. Since panel data are not available, an alternative is to follow Deaton (1985) and use repeated cross-section data sets to construct a pseudo-panel data set. Essentially this approach consists of pooling information from the three surveys and constructing a panel data of district means.[6] We use the sample information in each of the three surveys to construct district-level means for the independent and dependent variables of interest. These district-level means for each year are stacked together to create a panel data set at the district level. The relationship of interest where the individual observations have been replaced by district means may be represented by a linear equation,

$$E_t = X_t\beta + \varepsilon_t \qquad (10)$$

where E_t is the district sample mean of primary school enrolment, X_t is a vector of explanatory variables that are also measured as district sample means, ε_t is an error term and t is a single index that ranges from 1 to T (114) and is the product of the number of districts (38) and the number of surveys (3). Instead of levels, given that our aim is to establish whether changes in enrolment over time are correlated with changes in the dependent variable, a model in differences is more appropriate. Accordingly, our equation of interest is,

$$\Delta E_t = \Delta X_t\beta + \varepsilon_t . \qquad (11)$$

In words, this equation relates changes in district primary school enrollment means between 1992 and 1997 to changes in the district-level means of the independent variables between 1992 and 1997.

[6] A number of the school input variables that we use are district means and in the context of the current paper creating a pseudo-panel data set at the district level is a natural choice.

The district-level means underlying equations (10) and (11) are based on the sample of people living in a district and not on the entire population living in a district. Accordingly, the sample-based district means may be error-ridden estimators of the population-based district means. Deaton (1985, 1997) shows that provided techniques that account for measurement errors in the variables are used, the sample district means can be used as panel data for estimating relationships of interest.

The key advantage of supplementing the standard estimation of probit models for each year with estimates based on the differenced pseudo-panel data set is that we can control for unobservable fixed effects. Differencing the data sweeps out time-invariant fixed effects and allows temporal changes in the independent variables to identify the parameters of interest. While the removal of fixed effects is a crucial advantage and should lead to more convincing estimates of price and input elasticities, it comes at a cost. Since we are dealing with district-means and not with individual observations, we are unable to control for individual characteristics. Second, the fall in the number of observations when one moves from the individual to the district as the unit of observation supports the estimation of very parsimonious specifications.

Overall, in order to tackle the issues of interest in the most comprehensive manner, we present estimates based on the cross-section data as well as estimates based on the pseudo-panel data set.

III. The Kenyan education system and trends in enrolment

Since independence the Kenyan education system has witnessed several changes in structure and in curriculum. In the prevailing system (8-4-4), primary education is supposed to start at the age of 6 and consists of 8 years. This is followed by 4 years of secondary education.

Secondary education paves the way for higher education, which is imparted through a variety of technical institutes, polytechnics and universities. University education consists of a 4-year cycle.

Based on data collected in 1997, the educational pyramid reveals that 44 percent of the working age population has not completed primary school while 21 percent of the working age population has attained at least 8 years of schooling and completed primary school. About 17 percent has reached but not completed lower secondary education while 13.7 percent has completed lower secondary education. The remaining 5 percent has enrolled beyond lower secondary education and have at least 10 years of education (see Kimalu et al., 2001).

Although the focus of our work is on primary school enrolment in the nineties, it is quite illuminating to begin our discussions by examining enrolment patterns over a longer time period. In 1970 the gross enrolment ratio (GER) in Kenya was 62 percent and there was a gap of 20 percentage points between males and females (see Table 1a). Due to a rapid expansion of educational availability and the introduction of free education for grades I to IV in 1974, enrolment grew rapidly. By 1980 the GER had reached a peak of 115 percent and the gender enrolment gap had narrowed to 10 percentage points. While there is some disagreement on whether enrolments did indeed peak in 1980 all sources clearly show that a first enrolment shock occurred between 1984 and 1985.[7] Enrolment rates fell from 107 to 99 percent. For the next five years they remained stable. In 1989, there was a second shock and the GER declined from 98 to 92 percent. Thereafter, there was a gentler decline till the GER reached around 88

[7] The World Bank's Africa database (see Table 1a) indicates that school enrolments peaked in 1980, while information from the Republic of Kenya's Economic Surveys show that enrolments peaked in 1983. There is also disagreement on the level of the GER. According to the World Bank's Africa database enrolments fell from 107.1 in 1984 to 99 in 1985. The Economic Surveys report corresponding figures of 103 and 96.

percent in 1993.[8] Since then the rates have stabilized between 86-88 percent. Despite variations in the overall GER, the gender gap has narrowed considerably and since 1989 has ranged between 3-4 percentage points. There are substantial regional differences in enrolment rates. In 1990, the Central and Western regions of the country had the highest enrolment rates of around 104 percent. The North Eastern province had the lowest enrolment rate of around 24 percent, followed, somewhat surprisingly, by Nairobi at around 66 percent. Over the decade of the nineties there has been a fall in enrolment rates in nearly all the provinces. The sharpest declines seem to have been experienced in Nairobi and the Central province (see Table 1b).[9]

III. 1 Explaining the trends

As outlined in the previous section, household choices concerning school enrolment are influenced by the costs and benefits associated with education. In particular, increases in the expected returns from attending school (directly or through provision of better school inputs) are likely to increase the probability of school enrolment. On the other hand increases in school fees and increases in the opportunity cost of attending school are likely to reduce the probability of enrolment. In this section we consider various changes that may have altered the cost-benefit calculus and exerted an influence on enrolment patterns.

---

[8] Our discussion of enrolment declines is based on gross enrolment rates. It is possible for this rate to fall due to a reduction in the number of children repeating grades. However, numbers from the Ministry of Education (personal correspondence) show that repetition rates have been increasing over time. In 1979 the repetition rate was 8.92 percent while in 1993 it is estimated to be around 15.4 percent.

[9] The enrolment figures that we present pertain to enrolment in public schools. If there has been a shift in enrolment from public to private schools then part of the decline in the gross enrolment rate may be related to this shift. In recent years there has been an increase in the level of private participation. For instance, between 1994 and 1997, the number of private schools as a percent of all primary schools has increased from 0.67 to 2.2 percent (MOE, 1999). It is estimated that in 1997 around 2-3 percent of total enrolment is in private schools. Given the low private participation and the growth of these schools in a time period when enrolments have been more or less stable (i.e., 1994-1998), suggests that the shift from public to private schools is not particularly important in explaining enrolment patterns.

School Fees

The most apparent reason for the decline in enrolment in the nineties lies in the introduction of a formal cost-sharing system in 1988. According to the cost-sharing system the government's contribution is confined to payment of teachers salaries while parents are required to pay for school uniforms, stationery, text-books, instructional materials and other school equipment. Parents are also expected to contribute to school construction and maintenance costs through *harambees* (fund-raising efforts). Although cost sharing as a formal policy was introduced in 1988, informal cost sharing already existed. Parents were already paying for school uniforms, textbooks and school maintenance. The real change was the re-introduction of school levies (to meet the cost of school materials, instructional equipment) that had been abolished in previous years.

The timing of this sudden and added increase in financial responsibilities is consistent with sharp decline in enrolment rates between 1989 and 1990. It is also consistent with the provincial (urban/rural) trends in enrolment rates. As displayed in Table 1b, Nairobi and the Central province witnessed the largest declines in enrolment rates and at the same time are provinces with the highest school fees as a ratio of per capita expenditure.

School curriculum

The 8-4-4-education system currently prevailing in Kenya was introduced in January 1985. This new system placed considerably more emphasis on acquiring vocational education in the last two years of primary schooling and throughout secondary school. The aim of this new system was to produce self-reliant school leavers with sound technical education. The introduction of this new system placed a substantial financial burden on parents. Physical facilities for teaching, including workshops and home-science classrooms had to be constructed to cater to the new vocational training curriculum. The financial responsibility for constructing these facilities was placed on parents, school committees and the local community served by the

school. The additional subjects to be taught (an increase from 6 to 11 subjects) under this new curriculum also increased the financial requirements for textbooks. Furthermore, completion of the extended curriculum required children to spend considerably more time in school and increased the opportunity costs of schooling. The doubling of subjects, the additional time required and the financial requirements for constructing new facilities suggests that between 1984 and 1985 the total costs of attending primary school may have increased by more than 100 percent. This curriculum-induced price shock appears to be main factor behind the first enrolment shock.

Apart from costs, the new curriculum also increased the burden on teachers and students. Abagi (1997) notes that trying to cover an extended curriculum in the same time period increases pressure on students and staff and reduces student performance (lower test scores).[10] The reduction in learning, i.e., a reduction in the expected benefits from attending school may manifest itself in a reduction in school participation. The reduction in learning due to the increased pressure of the new curriculum could certainly have played a role in depressing enrolments in subsequent years. However, *prima facie* there were no reductions in indicators such as school completion rates or KCPE scores. As displayed in Table 2, school completion

[10] Abagi (1997) writes that students in primary school are placed under great pressure. "They are taught 13 subjects, nine of which are examined at the end of Standard 8, stay in school from 7 a.m. to 5 or 6 p.m., and have short holidays." He goes on to argue that such a burden reduces the motivation for learning and leads to a deterioration in performance.

rates and KCPE scores on English and Mathematics remained virtually unchanged during the nineties.[11]

School inputs

Concentrating only on educational performance does not provide a complete picture. In terms of educational inputs there appear to have been some sharp changes during this period. The ratio of trained to untrained (without formal teaching qualifications) teachers increased sharply from 70 percent in 1990 to 96.6 percent in 1998. Correspondingly, while the student-teacher ratio remained between 31-32, the student to trained-teacher ratio fell from 44.4 to 33.6 (see Table 2). The increase in the proportion of skilled teachers may be expected to lead to an increase in educational performance and increased educational participation.

Our information on other school inputs is limited. Deolalikar (1998) points out that inadequacies in school equipment are one of the most important factors adversely affecting the quality of primary education in Kenya. However, we were unable to gather information on school inputs such as textbooks and school equipment. Since the introduction of the cost-sharing system, parents have been responsible for the supply of text-books and it is possible that the pupil-text book ratio has fallen from the 17:1 reported in 1990 (see Republic of Kenya/UNICEF report, 1994).

In any case, the unchanged educational performance of students despite improvements in the observed quality of teachers increases the possibility that the lack of other inputs or

[11] It is possible that changes (declines) in the KCPE scores and the mean school completion rates are masked. Our conversations with KCPE authorities revealed that raw test scores are standardized to a mean of about 350. This standardization would explain the stability of the test scores over time and would also influence the school completion rates. We spent considerable time trying to obtain details on the standardization procedure. However, apart from indicating that raw test scores were standardized, no additional details were forthcoming. Since it is unlikely that examination authorities would scale test scores in the downward direction and consequently reduce school completion rates, we adopt the view that there were probably no marked improvements in the KCPE scores and school completion rates during the nineties.

factors such as an overloaded curriculum may have reduced the expected benefits of attending school and reduced educational participation.

Capacity of the system

Another possible explanation for the decline in enrolment may lie in the capacity of the primary school system to absorb students. An increase in the primary school-going population coupled with small or no increases in the capacity of the education system would manifest itself in a decline in gross enrolment rates. Between 1990 and 1999 the primary school age population increased by 15.4 percent from 5.85 million to 6.75 million. Over the same duration the number of primary schools grew by 18.5 percent and the number of primary school classes grew by 17 percent. These numbers suggest that the capacity of the school system does not appear to be a factor that inhibits enrolment growth. In fact, over this period, the comparatively lower rate of growth in the number of enrolled students (an increase of 8.9 percent between 1990 and 1999) led to a decline in average class size from 33 to 31.

Labor Market Conditions

One of the main benefits of acquiring education is the expected role played by education in enhancing employment and wage prospects. While Kenya enjoyed an annual average GDP growth rate of around 4.5 percent between 1963-1989, the average annual growth rate between 1990 and 1999 has been substantially lower at around 2.5 percent. This decline in growth rates has been accompanied by a rapid increase in unemployment rates. Between 1989 and 1997 the unemployment rate rose from 6.5 percent to 18 percent (see Table 3). Except for individuals with university education (8 percent unemployment in 1997) unemployment amongst individuals with other levels of education was not substantially different from uneducated individuals (see Table 3). The composition of employment has also undergone some changes in recent years. Small-scale farming (including pastoral activities) provides the largest share of employment in Kenya. While this sector retains its share, the share of the formal sector appears

to have declined. Due to the decline in growth rates and on-going public sector reforms there has been a shift in employment from the formal to the informal or *jua kali* sector. In 1999, excluding small-scale farming, the informal sector accounted for around 68 percent of total employment.

The limited employment prospects are matched by a decline in wage prospects. On the basis of their analysis of wages, Bigsten et al. (1999) show that average real wages fell sharply between the period 1978 to 1995. Furthermore, earnings ratios between individuals who have completed at most primary school and uneducated individuals fell from 1.7 in 1978 to 1.4 in 1995. Private returns to education, especially for secondary education, have also recorded a sharp fall during this period. Overall, the reduced employment prospects, the reduction in formal sector employment, and the reduction in wage returns for educated individuals may have played a role in reducing the economic incentive to acquire education.

HIV/AIDS

The decline in educational participation during the decade of the nineties appears to coincide with the increase in the spread of HIV and AIDS in Kenya. AIDS was first reported in Kenya in 1984 and between 1990 and 1999 the HIV prevalence rate increased from 4.8 percent to 13.5 percent (see Table 4a). The prevalence of AIDS is considerably higher in urban areas (this is consistent with the greater decline in educational enrolment in urban areas) and adults, i.e. individuals between 15-49, account for around 94 percent of the total number of HIV positive individuals. Most deaths associated with AIDS occur in the age range 29 to 39.

There are several ways in which the spread of HIV/AIDS may have an impact on the education sector (see Stover and Bollinger, 1999). First, increased expenditure on health care or a reduction in household income due to the death of a parent may reduce a household's ability to pay school fees and force children to drop out of school. The death of a parent may also increase the opportunity cost of a child's time and result in a reduction in enrolment. Second,

children may drop out of school if they contract the disease themselves. Third, the disease may also reduce the supply of experienced teachers. In the Kenyan case, the effect of HIV/AIDS via a reduction in household income and the attendant increase in opportunity cost is probably the most likely channel through which HIV/AIDS affects educational participation. Given that the disease mainly affects individuals older than 15 years it is unlikely that the incidence of the disease amongst primary school children is a major reason for the decline in educational participation.[12] As discussed above, between 1990-1998 there was an increase in the supply of skilled teachers suggesting that the prevalence of HIV does not appear to affect the availability of skilled teachers.[13]

While it seems most likely that HIV/AIDS will have an impact through its effect on reducing household expenditure, empirical evidence on the effect of HIV/AIDS on educational participation is rather limited. On the basis of cross country evidence from six African countries, Ainsworth et al. (2000) report that countries with higher HIV prevalence appear to have higher enrolment rates suggesting that differences in educational policies probably play a far greater role in determining outcomes than the incidence of disease. From a within country perspective, Ainsworth et al. (2000) use data from a Demographic and Health Survey conducted between 1991-1994 in the Kagera region of Tanzania to examine the effect of adult mortality on primary school enrolment.[14] Their evidence does not suggest that the decline in primary school enrolment rates in Tanzania is strongly associated with adult mortality. They show that, regardless of wealth, households cope with adult deaths by delaying the enrolment of young children (7-10) while maintaining the enrolment of older children (11-14).

---

[12] According to the Kenya Human Development Report (1999), 76,744 full-blown cases of AIDS have been reported. Of these around 1 percent or 736 cases are in the age group 5-14.

[13] After 1998 there does appear to be a decline in the number of skilled teachers. Recent statements by the Government of Kenya also indicate that in the last few years there may have been a decline in the availability of skilled teachers.

We now turn to the Kenyan context. In order to gather information on the prevalence of HIV/AIDS, Kenya has implemented a sentinel surveillance system. Pregnant women who visit antenatal clinics in sentinel sites located across the country are tested for the presence of the HIV virus. Each sentinel site represents a number of districts and a certain percentage of the adult population. Information on HIV prevalence among pregnant women and the percentage of the adult population represented by a particular site are used to make projections for the prevalence of HIV in the country's adult population. Table 4b presents information on HIV prevalence rates across 16 sentinel sites. Except for two sites, the information presented in Table 4b pertains to clinics in urban areas.

Our investigation of the link between enrolment rates and HIV prevalence is restricted by data availability and is limited to correlations between HIV prevalence rates (lagged HIV prevalence rates) and enrolment rates. These correlations do not suggest any relationship. In fact for some years the relationship between the two rates is positive (see Table 4b). Temporal patterns also suggest that there is no relationship between changes in HIV prevalence rates and changes in enrolment rates. There are of course several problems with simply estimating correlations. We have not controlled for the urban nature of the HIV data, nor for any other individual, family or regional characteristics. [15] Overall, given these data, we cannot detect any link between HIV/AIDS and enrolment.

Summary

Between 1984 and 1985 and between 1989 and 1993 primary school enrolment rates in public schools declined in Kenya. Thereafter, that is between 1993 and 1999 they have remained

[14] The Kagera region is located close to Lake Victoria. HIV prevalence rates in this region are around 33 percent higher than the country average.

[15] For instance, if HIV/AIDS rates are higher amongst those with higher incomes, then without controls for income we may conclude that there is a positive link between HIV/AIDS and enrolment.

quite stable at about 86-88 percent. In the preceding section we discussed several factors that may have had a bearing on the decline in enrolment rates in the mid-eighties and the early nineties. These factors may be operating simultaneously and it is difficult to isolate the relative effects of each of the possible factors using only descriptive statistics. However, on the basis of the preceding discussion it does seem that the first enrolment shock between 1984-85 may be attributed to the additional educational costs induced by the new educational structure and curriculum. Similarly, the second enrolment shock between 1989-90 also appears to be cost-driven and may be attributed to the re-introduction of school levies. Thereafter, the more gradual decline till 1993 may be driven by the reduction in expected gains (stagnant test scores, reduced employment opportunities). The capacity of the school system does not seem to have much of a bearing on enrolment rates. At the same time there has been a substantial increase in the skill level of teachers during the nineties and this should be working towards reducing the negative effects of other factors. On the basis our limited information we were unable to draw any link between the spread of HIV and enrolment rates.

So far our discussion has been temporal in nature and has provided a broad sweep of enrolment patterns based on descriptive statistics. In the remainder of the paper we use household survey data and regression analysis to provide a more detailed picture of enrolment patterns between 1992 and 1997. We try to pin down the relative importance of at least some of the factors that influence enrolment and examine their effects across expenditure groups.

IV. Data, enrolment statistics and specification

IV.1 Data

Three Welfare Monitoring Surveys (WMS) have been conducted in Kenya. These were carried out in 1992, 1994 and 1997. The remainder of this paper is based on data sets that have been created by combining information from the Welfare Monitoring Surveys (WMS) and district level information for the same year. The district level data were obtained from the

Ministry of Education. The WMS contain information on about 10,000 households and over 50,000 individuals from *almost* all districts in Kenya. These multi-purpose surveys contain information on a variety of dimensions including consumption, child health, fertility, and other individual and family characteristics. The surveys also contain detailed information on the education of all household members, including expenditures on education. These individual and household data were merged with district level information on school inputs. The combined data sets allow us to explore the role of demand and supply-side variables in determining enrollment.[16]

While the use of the three WMS in combination with the district data sets does permit a more complete analysis, there are some data-related drawbacks that need to be pointed out. First, the school input measures are district level averages and therefore ignore any variation in school inputs within schools in the same district. The limited variation in the school input data probably affects the standard error of our estimates and reduces their precision. On the other hand a potential advantage of using average school input data is that such variables are less likely to be endogenous. While parents may be able to choose the school that their children attend it is less likely that they can influence district wide school inputs.

Second, it may be argued that school inputs are correlated with unobserved differences across districts, in other words, the district level school input/cost variables may be capturing district fixed effects. While we do include regional fixed effects to partially account for the latter objection, including a full set of district effects and a set of district school inputs is not possible in our cross-section work. However, as discussed in section II, to tackle the potential problem

[16] As pointed out by Moulton (1986), in cases where regressors include variables with repeated values within groups (as in the present context), ignoring intra-group error correlation may lead to incorrect statistical inference. Acknowledging this possibility our estimates of the enrolment equation are corrected for the effects of intra-group correlation.

of biased estimates due to time-invariant fixed effects, we construct a panel data set of district means and allow differences in school costs and school inputs over time to identify the parameters of interest. This estimation approach based on differenced data allows us to sweep out district fixed effects.

Third, while the availability of three WMS permits a more detailed analysis, differences across these surveys in the questionnaires, the time of the year that the surveys were conducted, and differences in geographical coverage hinders temporal comparisons. For instance, the 1992 survey has no information on the gender of children. Furthermore, the limited information on the gender of other household members prevents us from linking parents to their children. The surveys were conducted at different times of the year. The 1992 survey was carried out between November and December of 1992, the 1994 survey was carried out in June-July while the 1997 survey was conducted in August-September.[17] In terms of geographical coverage, the WMS 1994 is comprehensive and nationally representative while the surveys conducted in 1992 and 1997 exclude the North Eastern province and Turkana, Marsabit and Samburu districts. While these districts are thinly populated, they are amongst the poorest districts in Kenya and their exclusion prevents the composition of a national picture.[18]

From the preceding discussion it is clear that the data are subject to errors. Despite these shortcomings we feel that careful use of the data while acknowledging its drawbacks is the best possible way to proceed. Accordingly, in our analysis we attempt to use the three data sets as fully as possible.

---

[17] The 1992 and 1997 surveys correspond to the third term of the school calendar while the 1994 survey corresponds to the second term. Usually enrolment rates tend to decline as the school year progresses and, *ceteris paribus*, we expect enrolment rates to be lower in 1992 and 1997 as compared to 1994. However, given that there are changes in several variables over time, it is difficult to discern the effect of the different timings of the surveys on enrolment rates.

[18] The North Eastern province and the three excluded districts have the lowest enrolment rates in Kenya. As reported in Table 1b, the primary school enrolment rate in the North Eastern province was about 26 percent in 1999.

IV.2 Enrolment - full sample and by expenditure quintiles

We begin by presenting three measures of enrolment calculated on the basis of the three WMS. We present the gross enrolment rate, the net enrolment rate and enrolment rates based on the variable (ever attended school) that we use as the dependent variable in our regression analysis. Estimates based on the full sample are presented in Table 5, while Table 6 presents enrolment estimates based on the "ever attended school" variable by expenditure quintiles. There are several noticeable features about these figures. For the entire sample gender differences in enrolment are minor. Enrolment figures controlling for expenditure show that while gender differences are higher among poorer households the gap is not very large and it appears to decline over time. In 1994 gender differences at the lowest quintile were about 3 percentage points in favour of boys. This gap fell to about 1 percentage point in 1997.

In terms of temporal trends, according to the MOE data, GER declined between 1992 and 1994 and remained relatively stable thereafter. The WMS support a pattern of declining GER between 1992 and 1994 but display a sharp increase thereafter. The net enrolment rate and the ever attended school variable record a similar pattern. Although smaller in magnitude, there is a pattern of decline between 1992 and 1994 and a sharp pickup thereafter. Temporal enrolment patterns by expenditure quintiles show that between 1994 and 1997 enrolment increased across all expenditure quintiles. The increases for the bottom forty percent of households were about 3-4 percentage points while for the top three quintiles the gains ranged between 6-7 percentage points. Thus, despite the overall increase, enrolment differences between the poorest forty percent of households and the richer households increased. For instance, the enrolment gap between the richest and the poorest quintiles increased from 6.9 percentage points in 1992 to 10.1 percentage points in 1997.

While the increase in enrolment after 1994 may seem surprising it appears to be consistent with temporal patterns in school expenses and school inputs. Descriptive statistics

presented in Table 7 show that total school expenses (in current prices) increase from about 53 shillings per month in 1992 to 98 shillings a month in 1997. However, in real terms there are no increases in expenditure (see Table 7) and educational expenses as a proportion of per capita consumption decline from 13 percent in 1992 to about 7 percent in 1997. These numbers display a clear increase in the affordability of primary education. Over the same time period, there is a sharp increase in the skill levels of teachers. Consistent with the patterns in Table 1, there is an increase in the proportion of teachers at skill levels 1 and 2 and a decline in the number of teachers at lower skill levels.[19] The numbers suggest a clear government policy of upgrading the skill level of teachers while keeping the total number of teachers fixed. The increase in the skill level of teachers and the increase in the affordability of education are consistent with increasing school enrolment.

A final point that needs to be highlighted is the sharp difference between the level of the GER presented in Table 5 and the GER based on the MOE data. The gross enrolment rates presented here are considerably higher than the GER presented in Table 1. Calculations based on the WMS 1992 yield a GER of 102 percent while the corresponding figure obtained from the Ministry of Education (MOE) is about 10 percentage points lower. For 1994 the WMS yield a GER of 95 while the MOE figure is 7 percentage points lower at 88 percent.[20] For 1997 the gap is larger. The WMS yield a GER of about 106 while the MOE figure is about 88.

A possible explanation for the differences between the two sets of numbers is school coverage. While the MOE figures are restricted to students enrolled in public schools, the

[19] Teachers in Kenya are placed at different levels (S1, P1, P2, P3 and P4) according to their qualifications. Our classification of skilled teachers is defined as follows. The highest level, skill level 1 consists of graduate teachers or teachers with S1 qualifications. Skill level 2 corresponds to P1 teachers, skill level 3 to P2 and P3 teachers and skill level 4 corresponds to P4 and untrained teachers.

household surveys include students enrolled in all schools - public and private. If there were a shift in enrolment from public to private schools this would show up as a decline in enrolment according to the MOE figures. While this is a possible explanation the existing information on enrolment in private schools suggests that the gap between the two sets of numbers is too large to be explained by private school enrolment (see footnote 10). Having said that, the existing information on private schools is limited and further assessment of enrolment in private schools is required before the proposed explanation can be verified.

Specification

Our analysis is restricted to children in the age group 6 to 15.[21] Depending on the specification, our regressions are estimated over samples ranging from 10,108 observations to 13,510 observations. The dependent variable in our analysis is whether a child has ever attended school. Children who are currently in school and children who had enrolled in school but have subsequently dropped out provide a positive response to this question.[22] The specification of the independent variables follows equation (9).

[20] Our GER for 1994 is very similar to the numbers presented in the basic report on the WMS 1994, prepared by the Kenyan Central Bureau of Statistics (CBS). The CBS estimates a gross enrollment rate of 94.5 (Republic of Kenya, 1996, p. 71).

[21] We consider children in the age group 6 to 15 rather than the age group which should be in primary school, i.e., 6 to 13, in order to allow for the possibility of late enrolment in primary school. Estimates based on the smaller age group (6-13) and for a sample of 8-15 year old children were not substantially different.

Vector *X* corresponds to a set of child and family variables. The child-specific variables include age, sex (except for 1992) and order of birth. The average child in our samples is 10 years old and there is an even split between males and females. Family characteristics include maternal and paternal years of schooling (except for 1992), and three indicators of household wealth, i.e., whether a family owns its dwelling, the number of rooms in the house and the amount of land per capita that the household possesses. Across the three surveys, average schooling of fathers is about 6 years and for mothers about 5 years. The average house has 3 rooms and home ownership is substantial at between 78 to 88 percent. A noteworthy feature of these variables is that except for statistically significant differences in landholding per capita (0.9 acres in 1994 and 0.6 in 1997) the means of all the other variables are stable.[23]

Corresponding to *SF*, the measure of school costs that we use in our regressions consists of household expenditure on school fees, school uniforms, transport and boarding. We exclude other elements of school expenditure as they may contain a discretionary element (endogenous) and could obscure the relationship between school costs and enrolment. The measure of school costs that we use in the regressions is displayed in Table 7. As the table

---

[22] In our data sets there are two variables that may be used to capture enrolment. We have information on whether a child (in the age group 6-15) has ever attended school (which includes children who are currently attending school) and also whether a child is currently in school. The difference between the two variables indicates children who have dropped out of school. In the WMS 1994 we have a total of 13,306 children. 3,553 of these children have never attended school while the remaining 9,753 have "ever attended school". Of these, 9,440 are currently still in school and 313 have dropped out. Thus, on the basis of "have you ever attended school", 9,753 have and 3,533 have never attended school. On the basis of "are you currently attending school", 9,440 are in school and 3,846 (313 drop outs and 3,533 never attended school) are not in school. These numbers display that the main problem appears to be whether an individual ever enters the school system. To focus on this issue and to avoid mixing the initial enrolment decisions with dropping out we decided to use responses to the query, "Have you ever attended school", as our dependent variable.

[23] It is hard to believe that the large differences in the mean land per capita variable across the two surveys can be attributed entirely to sampling variability. However, we are unable to explain the discrepancy as the questions and the units of measurement across the surveys appear to be similar.

shows the measure of school costs used in our regressions is considerably smaller than the total school costs which also includes expenditure on textbooks, individual tutorials and *harambee* contributions. In terms of the individual expenditure components, in 1992 and in 1994, school uniforms account for the largest share (28-29 percent), followed by school fees (26-27 percent), textbooks (21-23 percent) and *harambee* contributions (13-21 percent). In 1997, the breakdown was somewhat different with school fees accounting for 51 percent of total expenditure followed by expenditure on books (20 percent) and uniforms (17 percent).

The average district score on the KCPE examination is included in an attempt to capture the expected benefits of attending school (*H*). If parental decision making is responsive to the expected benefits of attending school then this variable should exert a positive influence on enrolment (see Bedi and Marshall, 2002). The *SI* vector consists of the pupil-teacher ratio, and three variables that represent different levels of teacher qualifications. The average pupil-teacher ratio is around 32 and remains at the same level across the three years that we consider. In terms of international comparisons this ratio is not particularly high (UNESCO, 1999). The composition of skilled teachers shows a substantial increase in the level of skilled teachers over the three years. In 1992, the composition of skilled teachers (defined in terms of educational qualifications) consists of around 4 percent at the highest level, followed by 51 percent at level two and 23 percent at level three. The corresponding numbers in 1997 are 9, 65 and 20 percent.

In terms of geographical spread, more than 90 percent of the sample lives in rural areas. Accordingly, we don't estimate separate specifications for rural and urban areas and given the rural-urban composition, our results should be viewed as applicable mainly to rural areas.

V. Results

We begin by presenting estimates of school enrolment probit equations based on each of the three WMS. This is followed by estimates of a school enrolment probit equation based on pooled data and estimates of an enrolment equation based on the district-level panel data set.

The year-specific estimates permit an examination of patterns in the effects of the independent variables on the enrolment decision and provide an idea of the robustness of the results. The advantage of estimates using pooled data and the pseudo panel data are that variations over time and across space are used to identify the effect of the school input and school cost variables on enrolment.

In addition to the probit estimates we present price and school input elasticities. These elasticity estimates are presented for the full sample and for five per capita expenditure quintiles. The quintile-specific estimates are based only on WMS 1994, as it is the only geographically comprehensive WMS. Estimates based on 1992 and 1997 would exclude families living in some of the poorest regions of the country and would not lead to a complete picture of the manner in which school-inputs and school costs affect different expenditure quintiles.

V.1 School Enrolment - Cross-Section Estimates

Marginal effects based on several specifications of a probit model of school enrolment are presented in Table 8. The first column presents estimates based on WMS 1992. Columns 2 and 3 present estimates based on WMS 1994. Estimates in columns 4 and 5 are based on WMS 1997.

Consider the characteristics of children. Estimates based on WMS 1992 and 1994 imply that there is a non-linear relationship between age and enrolment. Till about 12-14, age is positively linked to enrolment. However, beyond that there is a rapid drop in the probability of attending school. This indicates that opportunity costs of attending school become important in reducing school participation only at the age that a child should be finishing primary school. From a policy perspective this suggests the importance of ensuring that children start school at the expected age of six. Surprisingly, estimates based on WMS 1997 do not display such a pattern. The marginal effect is much smaller than that for the previous years and implies that the probability of attending school is a linear function of age. Estimates for 1994 display that there

is a slight male advantage in terms of school enrolment. Being male increases the probability of attending school by approximately 2 percentage points. However, this male advantage appears to have dissipated by 1997 and implies that male and females are equally likely to be enrolled in school. The order of birth is not linked to school enrolment.

Turning to the family characteristics, the coefficients on maternal and paternal education reveal a well-known picture. A one-year increase in parental education is associated with a 0.5-1 percentage point increase in the probability of enrolling in school.[24] Of the three remaining family variables, home ownership and number of rooms in a house are intended to capture the wealth status of the household, while land per capita may reflect wealth as well as household demand for labor. Across the three surveys the number of rooms in a house is positively correlated with enrolment and is associated with a marginal effect of about 0.8-2.1 percentage points. The effect of land per capita is statistically significant across surveys but the sign on the coefficient varies. Estimates for 1994 suggest that the household demand for labor effect dominates and ownership of larger plots is negatively correlated with enrolment. In 1997 the effect is exactly the opposite. The changes in the coefficient may reflect seasonal fluctuations linked to the time of the year when the surveys were conducted.[25] Home ownership and enrollment are not correlated. Home ownership rates at about 77-87 percent are quite high and it is likely that this does not adequately capture differences in household wealth.

---

[24] In preliminary regressions we included a set of controls for parental occupational and industrial affiliation. However, the inclusion of parental education variables eroded most of the effects associated with these variables. Accordingly, we decided to work with a more parsimonious specification.

[25] The 1994 survey was carried out in June-July 1994 while the 1997 survey was carried out in August-September 1997. While both the surveys were conducted during Kenya's long dry season (June-October), the 1994 survey was carried out at the start of the dry season or at the end of the long rains (March-May). The rainy season is usually the busiest period of the agricultural calendar and the negative link between land per capita and enrolment may reflect the demand for agricultural labor towards the end of the long rains.

The effect of the cost of attending school varies across the three surveys. For 1992, there is a negative effect which suggests that doubling the costs of schooling (about 30 shillings a month) would reduce the probability of school attendance by 2.4 percentage points. However, the cost effect is not precisely measured. For 1994, the marginal effect is considerably smaller, about half the magnitude of the effect in 1992 and is statistically significant at conventional levels. For 1997 there is no discernible direct school cost effect. However, for this year an alternative dimension of schools costs, that is, the time taken to reach school has a sharp effect on school enrolment. A 10 minute increase in getting to school is associated with a reduction in school enrollment of about 0.8 percentage points. The variation in the effect of costs may be linked to the affordability of education. As shown in Table 7, school costs as a proportion of per capita consumption decline over time. This declining pattern is consistent with the decline in the effect of school costs on enrollment. Overall, the estimates suggest that school costs do not play a large role in determining enrolment. This conclusion should be tempered by noting that these cross-section estimates rely only on geographical variation (which may be limited) to identify price effects, and that the 1992 and 1997 WMS exclude some of the poorest districts in Kenya. These two features may lead to an underestimate of the price effect.

A relative novelty in our paper is the use of the KCPE exam score as a determinant of enrolment. We argue that this score provides parents with a signal of whether school enrolment yields sufficient human capital benefits. Our estimates show that for the most part (although not for 1992), there is a positive link between the KCPE score and school enrolment, indicating that parents living in districts with higher KCPE scores are more likely to send their children to school. The marginal effect suggests that an increase in the mean KCPE score by one standard deviation (36 points) is associated with an increase in enrolment probability by 1.4-2.1

percentage points.[26] While this estimate clearly demonstrates the importance of expected benefits in determining school enrolment decisions it does not suggest how these increases may be achieved. To determine the appropriate policy interventions one requires an analysis of the factors that lead to higher test scores. While our data do not permit such an analysis, based on an analysis of KCPE scores of students from 50 schools, Appleton (1995) reports that the provision of text books, and the educational qualifications of teachers (at least for boys), appear to be among important determinants of test scores.

The school input variables in our specification are the student-teacher ratio and the skill (educational) composition of teachers in a district. These variables probably exert an indirect influence on the school enrolment decision through their effect on test scores. If this were the only channel of influence then it would suggest that once KCPE scores have been included, these variables should be excluded from the enrolment specification. However, allowing only this indirect channel of influence is too restrictive. Accordingly, we allow these school inputs to exert a direct effect on enrolment.[27] With regard to the student-teacher ratio there does not

[26] Alternatives to the use of test scores as a measure of expected benefits are the earnings of individuals who have completed primary school and/or the rates of return to primary education. While information on earnings is not available for 1992 and 1997, we were able to create these two measures of expected benefits using the 1994 data. We found a positive and statistically significant correlation between KCPE scores and earnings of those who have completed primary school (0.23) and between KCPE scores and returns to primary education (0.18). However, there appeared to be no impact of these two measures on enrolment. Moreover, KCPE scores continued to exert a statistically significant impact even after these controls were included in the enrolment equation. This pattern of results suggests that primary school enrolment may be driven by consumption benefits and not by the economic benefits that accrue due to human-capital acquisition.

[27] We also estimated enrolment specifications that excluded the KCPE score. These specifications reflect the direct and indirect effect of school inputs on enrolment. The exclusion of the KCPE scores did not alter the statistical significance of the estimates and the changes in the magnitude of school input variables were minor. The small changes suggests that KCPE scores and school inputs have independent effects on the enrolment decision.

appear to be a link between this measure and enrolment rates. Given the relatively low student-teacher ratio this is not particularly surprising. Furthermore, as mentioned earlier, the use of district-level data as opposed to school-level data should mitigate concerns about the endogeneity between the pupil-teacher ratio and enrolment.

Three variables capturing different levels of teacher skill are included in the regression. This allows teacher skills to exert a non-linear impact on enrolment. Overall, the pattern across the individual estimates suggests that enrolment rates and the skill level of teachers are positively correlated. Consistent with a pattern of increasing investments in the skill level of teachers, over time, there is a decline in the marginal effect of this input. For instance, the marginal effect associated with investments in teachers at skill level 2 declines from 0.004 in 1994 to about 0.0017 in 1997. In terms of magnitude the estimates imply that an increase in the percentage of skilled teachers at level 2 by about 5 percent would lead to an increase in the enrolment by between 0.85-2 percentage points. The estimates presented here provide support for the government's policy of upgrading the skill level of teachers.[28] Additional investments in teachers at skill levels 1 and 2 and the gradual phasing out of teachers with lower skill levels should lead to increases in enrolment.

V.2 School Enrolment - Pooled and Pseudo-panel data estimates

Table 9 presents pooled estimates of a school enrolment probit equation and estimates of the school enrolment equation based on the district-level panel data set. The results based on the pooled data are quite similar to those for the individual years. Thus, in this section we focus mainly on the panel data estimates. These estimates are based on differenced data, implying that any time-invariant fixed effects have been removed. These estimates provide an idea of the

---

[28] The government of Kenya continues to pursue policies of upgrading the skill levels of teachers. In 2002, for the first time, prospective teachers admitted to primary teacher training

extent to which changes in primary school enrollment between 1992 and 1997 may be attributed to changes in school costs and changes in the skill level of teachers. The parsimonious specification is dictated by the limited changes in several variables. The KCPE scores, the pupil-teacher ratio, the child characteristics and for the most part the family characteristics do not display substantial changes over time.

We first present OLS estimates of the differenced equation. Despite the frugality of the specification it is notable that almost 40 percent of the change in primary school enrollment is explained by the variation in the two independent variables. The marginal effect of school costs is statistically significant at the 10 percent level and in terms of its magnitude is similar to those obtained from the pooled estimates and from the 1994 cross-section estimates. The estimates suggest that doubling the cost of schooling (about 30 shillings a month) from its 1992 level would reduce enrolment by about 1.2 percentage points. The message provided by the coefficients on the skill-level of teachers is consistent with the cross-section estimates. The estimates clearly show that reducing the number of skilled-teachers at the lowest levels (P2 and P3) encourages enrolment.[29]

As mentioned earlier, since the district-level means are based on sample information they may be error-ridden estimators of the district-level means based on population information. In such circumstances it is important to account for measurement error especially in the independent variables. In our case, the district-means of the teacher-skill variables have been computed on the basis of population data. Thus, it is only the school cost variable that is subject to measurement error. To account for measurement error and attenuation bias in the school

---

colleges must have a minimum average grade of C at the secondary school level rather than a D+ (Nation, July 26th, 2002).

[29] The number of observations used to compute the district means differs considerably. To account for these differences each of the observations in the pseudo panel data set has been weighted by the square root of the number of observations in each district.

costs variable we resort to instrumental variable (IV) estimation. These estimates are presented in columns 3 and 4 of Table 9.[30] Depending on the instrument set used the effect of school costs on enrolment is negative, statistically significant at conventional levels and 2-3 times larger than the cross-section estimates. According to the IV estimates, doubling the cost of schooling from its 1992 level would reduce enrolment by about 2.4-3.6 percentage points. The overall impression emerging from the cross-section estimates was that school costs do not play an important role in determining enrolment. On the other hand, the panel data estimates suggest that this conclusion may have been premature. The precision and size of the effects reveal the importance of changes in school costs in determining enrolment.

V.3 Price and Input Elasticities by Expenditure Quintiles

So far the discussion has concentrated on the effect of the various educational characteristics on mean enrolment. Given the sharp income inequalities in Kenya, it is likely that there are sharp differences in the effect of school costs and school inputs across different households. To examine these patterns we estimates separate probit enrolment models for five per capita expenditure groups. Subsequently, these estimates are used to determine price and school input elasticities for each expenditure group. The analysis presented in this section is based only on the survey conducted in 1994 data as it is the only survey that is geographically complete. Given that the 1992 and 1997 surveys exclude the poorest areas, estimates based on these surveys are likely to underestimate the effect of school costs and other educational variables on enrolment decisions. Furthermore, since the marginal effects and the price elasticities based on the panel data are 2-3 times larger than those based on the cross-section

[30] The variables used to instrument the differenced school cost variable are differenced versions of district means of age, order of birth, ownership of household and number of rooms in a house. The two sets of IV estimates rely on different combinations of the instruments. The instrument set explains 46 to 59 percent of the variation in school costs and does not have an influence on changes in enrolment.

data, the magnitude of the price elasticities discussed below should be thought of as a lower bound.

The price and input elasticities are presented in Table 10. Looking across the table a discernible pattern is the decline in price elasticities as income rises. For the richest quintile, price increases have no impact on the school enrolment decision while at all other quintiles there is a statistically significant effect. The effect is largest at the lowest quintile where a 10 percent increase in costs would lead to a reduction in enrolment of 1.2 percent (computed at the mean). Price elasticities computed at a higher price (mean plus one standard deviation) are considerably higher. Elasticities computed at the higher level of school costs show that a 10 percent increase in school fees would reduce enrolment at the lowest quintile by 3 percent.

Elasticities with respect to the KCPE score and the two school inputs are also presented in Table 10. For the entire sample an increase in the KCPE score by 1 percent translates into a 0.3 percent increase in enrolment. The effect of this quality signal is particularly large at the lower quintiles. At the lowest quintile a 1 percent increase in this measure may lead a 1.2 percent increase in enrolment while the effect at the highest quintile is more muted and results in a 0.4 percent increase in enrolment. The differential response across quintiles suggests that households at the lower end require a more convincing demonstration of the gains from education (at least as measured by the KCPE score) to send their children to school as compared to households at the upper end of the distribution. The relatively muted effect of this variable may also be explained by the greater ability of richer households to compensate for any educational deficiencies and the possibility that richer households treat education as consumption and an investment good. All these reasons support the idea that richer households will be less responsive to expected benefits while making enrolment decisions as compared to poorer households.

Regardless of the expenditure quintile the student-teacher ratio does not exert an effect on school enrolment decisions. In terms of teacher skills the clearest impact between enrolment and teacher qualifications emanates from teachers at skill level 2. Across quintiles a marginal increase in this measure is associated with a 0.18-0.66 percent increase in enrolment. The pattern of elasticities across quintiles is similar to that for test scores. Once again, the relatively higher effects of this measure at the lower quintiles suggests that poorer households are more sensitive to the quality of school inputs and need to be convinced that the sacrifice of household consumption will yield adequate benefits.

V.4 Policy Scenarios

Our analysis shows that there are several ways in which the school enrolment decision may be influenced by policy interventions. Interventions could consist of subsidies designed to reduce the cost of schooling or measures that would increase the availability of skilled teachers or some combination of these interventions. While it is important to identify the marginal impact of each of these measures on the outcome under consideration it is also important to compare the relative costs of various policies. In this section we compare the cost effectiveness of a policy designed to increase enrolment by reducing the cost of schooling and a policy of increasing the availability of skilled teachers.

Estimates of such a cost-effectiveness analysis are presented in Table 11. Using price adjustments to increase enrolment requires a 25.6 percent reduction in school fees to increase enrolment by 1 percent (reciprocal of the elasticity). At the mean schooling expenditure of 82 shillings per month, this implies that an average subsidy of around 21 shillings per month to students who are not enrolled in school would result in a 1 percent increase in enrolment. This cost estimate does not include the cost of designing, managing and administering such a subsidy program.

In terms of the school inputs, a 3.29 percent increase in KCPE scores may be expected to increase enrolment by 1 percent. However, we have limited information on how this increase may be achieved. One possibility is to increase the supply of skilled teachers at level 2. As shown in the previous section this policy may influence enrolment through its effect on KCPE scores but also directly. Since we don't have estimates of the effect of school inputs on test scores we concentrate only on the direct link. Increasing enrolment by 1 percent requires an increase in the number of skilled teachers at level 2 by 2,758 teachers (an increase of 2.62 percent). Based on salary costs in 1994 this translates into monthly costs of 309 shillings per additional enrollee (see Table 11 for details). There are several policy combinations and possibilities that that may be used to increase enrolments. However, our purpose is not to carry out such an exhaustive analysis but to illustrate the manner in which these estimates may be used to guide policy. Detailed budgetary implications associated with increasing enrolment are worked out in a companion paper, see Vos et al. (2003).

VI. Summary and Concluding Remarks

Motivated by the decline in primary school enrolment and the importance attributed to education as a means of alleviating poverty, this paper tried to identify the factors responsible for determining primary school enrolment in Kenya. Although we have tried to pull together several sources and present a comprehensive picture, we are aware that in terms of policy measures our analysis focused mainly on the role of school inputs in determining outcomes. The concentration on school inputs is driven by data considerations. We realize that pedagogical processes, school management practices, motivation of teachers, the strength of teacher's unions and their lobbying power may play important roles in determining policies and educational outcomes. Despite these limitations, our analysis is one step towards understanding

the factors that motivate enrolment in Kenya. Our work led to several points that need to be showcased.

First, we considered a variety of explanations for the decline in educational enrolment between the mid-eighties and mid-nineties. Based on the assembled empirical evidence we are led to the conclusion that the enrolment decline is largely associated with two factors. These are the introduction of a new school curriculum between 1984 and 1985 and the introduction of a cost-sharing policy between 1989 and 1990. Both these changes led to a sudden and sharp increase in the cost of attending school and are the most likely causes for the decline in enrolment. We were unable to find strong support for other explanations such as lack of school availability, lack of employment and earning opportunities for educated individuals, inadequate school inputs, and the spread of HIV/AIDS. The last factor is often identified as a key explanation for the decline in enrolment rates. On the basis of the available (extremely limited) information we were unable to find any link between the spread of the disease and the decline in enrolment rates.

Second, and an intriguing aspect of our work, is that since the mid-nineties enrolment rates have remained stable according to MOE data. In contrast, based on our analysis of the WMS we detected a sharp increase in enrolment rates between 1992 and 1997. The discrepancy may be due to the coverage of the two sets of data. The MOE data does not cover private schools while the survey data covers enrolment regardless of school type. With the available information we are unable to investigate whether this is the main source of the discrepancy. If correct, it suggests that there may be a diversion of students from public to private schools. Furthermore, it also indicates that while in the short run households may be forced to withdraw children from schools, in the long run alternative and cheaper service providers may allow children to re-enter school. Between 1992 and 1997 we also detected an increase in the affordability of education. In real terms school expenditure fell by about 19 percent between

1992 and 1997. This increase in affordability may be reflecting the increased availability and use of cheaper private schools by poorer households. Further research on the role of private schools in stemming the decline in enrolment as well as a study of the quality of the education that they provide is clearly required.

Third, while enrolment increased between 1992 and 1997, the gains were different across expenditure quintiles. The increases for the bottom 40 percent of household were about 3-4 percentage points while for the top three quintiles the gains ranged between 6-7 percentage points. Thus, despite the overall increase, enrolment differences between the poorest forty percent of households and the richer households increased. For instance, the enrolment gap between the richest and the poorest quintiles increased from 6.9 percentage points in 1992 to 10.1 percentage points in 1997.

Fourth, analysis of price and input elasticities displayed sharp differences across expenditure quintiles. Price elasticites are 13 times higher for households in the lowest quintiles as compared to the richest quintile. This sharp differences across quintiles highlights the importance of focusing specifically on the effects of cost-sharing policies on the poor.

Fifth, throughout the paper a clear element was the importance of the skill level of teachers in determining enrolment. The estimates clearly showed that the issue is not one of crowded classrooms but the knowledge of teachers. The quintile-specific input elasticities displayed that the poor are 4 times more responsive to changes in inputs as compared to the rich. Thus, a policy of upgrading the skill level of teachers and phasing out unskilled teachers should have a larger effect on the poor as compared to the rich.

Sixth, a methodological innovation in our paper was the construction of a pseudo panel data set using the three cross-section surveys. Although based on a small set of observations, it may be argued that the pseudo-panel data estimates are more credible than cross-section estimates as they are not contaminated by fixed effects and exploit variation over time to

identify price and input elasticities. Results based on the pseudo-panel data also supported a policy of upgrading teacher skills. The consistent effect of this variable across the two different approaches lends strong support to a continuation of this policy. With regard to school costs, the effects were quite different as compared to those based on cross-section data. Based on the pseudo panel, the school-cost effects were negative, statistically significant and 2-3 times larger than the cross-section estimates. The estimates highlighted the importance of using panel data and variation over time to estimate price elasticities. It is quite clear that the justification of cost-sharing policies based on cross-section estimates leads to an underestimate of the negative enrolment effects.

Seventh, our analysis was supplemented by a cost-effectiveness exercise. This exercise was carried out to illustrate the trade-off between alternative courses of action and to display the manner in which research results may be linked to policy. While it is not intended to be a definitive exercise it shows how the research presented in this paper may be used as a tool to rationalize resource allocation. [31]

Our paper has shown that conventionally estimated cross-section price elasticities computed at the mean severely underestimate the impact of pro-market cost-sharing policies on poor households. Ideally, a cost-sharing policy with a progressive system of fee-exemptions for households in different quintiles could generate resources without substantially affecting enrollment. However, such schemes have been difficult to enforce (in the Kenyan context see Nganda, 2002). As suggested by this paper, an alternative approach to ease the fiscal strain and increase enrollment is to retain the current system of cost-sharing while at the same time following a policy of hiring skilled teachers (higher salaries), phasing out unskilled teachers and

[31] Based on the estimates presented in this paper we have designed a tool that may be used to determine the resources required to achieve a particular education target and/or determine how resources may be allocated to achieve given targets in a cost-effective manner (see Vos et al. 2002).

allowing the student-teacher ratio to increase. Moderate increases in the student-teacher ratio should not affect enrollment. Such a strategy would pit the government against teacher's unions and will not be painless. However, if the aim is to balance fiscal constraints with the needs of poorer households such a strategy may be apt as the estimated marginal effect of such a policy is four times larger for the poorest forty percent of households as compared to the richest twenty percent of households.

This paper has been concerned with the tensions arising from trying to raise adequate financial resources to fund a decent education system while at the same time ensuring access to households at the lower end of the expenditure distribution. In contrast, the new Kenyan government, elected in 2002, has committed itself to a policy of upgrading the quality of teachers *and* at the same time reducing the costs of primary education. Whether such a policy can be sustained is debatable. If it can, then educational enrolment will increase and Kenya will be on its way to ensuring universal access to a key public good. Although we succumb to the temptation of concluding on this optimistic note, we are aware that it may be premature.

REFERENCES

Abagi, O. (1997a). "Public and Private Investment in Primary Education in Kenya: An Agenda for Action." IPAR Discussion Paper No.5, Nairobi.

Abagi, O. (1997b). "Status of Education in Kenya: Indicators for Planning and Policy Formulation." IPAR Special Report, Nairobi.

Abagi, O. Olweya, J and Otieno, W (2000). "Counting the Social Impact of Schooling: What Kenyans say about their School System and Gender Relations." IPAR Discussion Paper No.24, Nairobi.

Abagi, O. (1997). "Efficiency of Primary Education in Kenya: Situational Analysis and Implications for Educational Reforms." IPAR Discussion Paper No.4, Nairobi.

Abagi, O. and Olweya, J. (1999). "Educational Reforms in Kenya for the Next Decade: Implementing Policies for Adjustment and Revitalisation." IPAR Special Paper Series No. 3, Nairobi.

Appleton, S. (1995). "Exam Determinants in Kenyan Primary School: Determinants and Gender Differences." The World Bank, Economic Development Institute, Washington D.C.

Appleton, S., Bigsten, A. and Manda, D.K. (1999). "Educational Expansion and Economic Decline: Returns to Education in Kenya, 1978-1995." CSAE Working Paper Series 99-6, Oxford.

Ainsworth, M. Beegle, K. and Koda, G. (2000). "The Impact of Adult Mortality on Primary School Enrolment in Northwestern Tanzania." Manuscript.

Bedi, A.S. and Marshall, J.H. (1999). "School Attendance and Student Achievement: Evidence from Rural Honduras." *Economic Development and Cultural Change* 47, 657-682.

Bedi, A.S. and Marshall, J.H. (2001). "Primary School Attendance in Honduras." *Journal of Development Economics* 69, 129-153.

Behrman, J. and Knowles, J.C. (1999). "Household Income and Child Schooling in Vietnam." *The World Bank Economic Review* 13, 211-252.

Boissiere M., Knight, J. and Sabot, R.H. (1985). "Earnings, Schooling, Ability and Cognitive Skills." *American Economic Review* 75, 1016-1029.

Deolalikar, A.B. (1998). "Public Spending on Education in Kenya: International Comparisons." The World Bank, Washington D.C.

Family Health International/AIDSCAP (1996). *AIDS in Kenya: Socioeconomic Impact and Policy Implications.*

Filmer, D. (1999). *Educational Attainment and Enrolment Profiles: A Resource Book based on*

Analysis of Demographic and Health Survey Data. The World Bank, Washington DC.

Gertler, P. and van der Gaag, J. (1988). "Measuring the Willingness to Pay for Social Services in Developing Countries." LSMS Working Paper No. 45, The World Bank, Washington D.C.

Gertler, P. and Glewwe, P. (1992). "The Willingness to Pay for Education for Daughters in Contrast to Sons: Evidence from Rural Peru." *The World Bank Economic Review* 6, 171-188.

Gertler, P. and Glewwe, P. (1990). "The Willingness to Pay for Education in Developing Countries: Evidence from Rural Peru." *Journal of Public Economics* 42, 251-275.

Glewwe, P. (2002). "Schools and Skills in Developing Countries: Education Policies and Socioeconomic Outcomes." *Journal of Economic Literature* XL, 436-482.

Handa, S. and Simler, K. (2000). "Quality or Quantity? The Supply-Side Determinants of Primary Schooling in Rural Mozambique." Manuscript.

Kenya Human Development Report (1999).

Kimalu, P. K., Nafula, N., Manda, D.K, Bedi A.S., Mwabu G., and Kimenyi, M.S. (2001). "Education Indicators in Kenya." KIPPRA Working Paper No.4, Nairobi.

Knight, J.B. and Sabot, R.H. (1990). *Educational Productivity and Inequality: The East African Natural Experience*. New York: Oxford University Press.

Lockheed, M., Verspoor A., and Associates (1991). *Improving Primary Education in Developing Countries*. London: Oxford University Press.

Maas, J.L (1982). "Distribution of Primary School Enrolments in Eastern Africa." World Bank Staff Working Papers No. 511, The World Bank, Washington D.C.

Moulton, B.R. (1986). "Random Group Effects and the Precision of Regression Estimates." *Journal of Econometrics* 32, 385-397.

NASCOP (1999). *AIDS in Kenya: Background, Projections, Impact and Interventions*. Nairobi.

Ministry of Education, Science and Technology, Statistics Section (1999). *Education Statistics and Indicators*. Nairobi.

Nganda, B.M. (2002). "Service Pricing Practices in Public Health Facilities." Ministry of Health, Nairobi, Mimeo.

Patrinos, H.A., Psacharopoulos, G., (1995). "Educational Performance and Child Labor in Paraguay." *International Journal of Educational Development* 15, 47-60.

Patrinos, H.A., Psacharopoulos, G., (1997). "Family Size, Schooling and Child Labor in Peru-An Empirical Analysis." *Population Economics* 10, 387-405.

Republic of Kenya (1992). *Education for All: Issues and Strategies*. Government Printer, Nairobi.

Republic of Kenya (1985). *Report of the 8-4-4 Implementation, Evaluation Committee*. Government Printer, Nairobi.

Republic of Kenya. (Various Issues). *Economic Survey*. Government Printer, Nairobi.

Republic of Kenya. (Various Issues). *Statistical Abstract*. Government Printer, Nairobi.

Republic of Kenya.(Various Issues). *National Development Plans*. Government Printer, Nairobi.

Republic of Kenya (1996). *Welfare Monitoring Survey II: Basic Report*. Government Printer, Nairobi.

Republic of Kenya (1965). *Sessional Paper No.1 on African Socialism and its Application to Planning in Kenya*. Government Printer, Nairobi.

Republic of Kenya (1964). *Kenyan Education Commission Report: Part I*. Government Printer, Nairobi.

Republic of Kenya (1965). *Kenyan Education Commission Report: Part II*. Government Printer, Nairobi.

Republic of Kenya (1988). *Sessional Paper no.6 on Education and Manpower Training for the Next Decade and Beyond*. Government Printer, Nairobi.

Republic of Kenya (1976). *Report of the National Committee on Education Objectives and Policies*. Government Printer, Nairobi.

Republic of Kenya/UNICEF (1994). "Comprehensive Education Sector Analysis: An Analytical Report on Education and Training in Kenya." CESA Draft Report, Nairobi.

Stover J. and Bollinger, L. (1999). "The Economic Impact of AIDS." The Policy Project. Manuscript.

UNDP (1999). Human Development Report. Oxford University Press, Oxford.

UNESCO (1999). Statistical Yearbook.

Vos, R., Bedi, A., Kimalu, P., Kulundu, D. and Nafula, N. (2002). "Budget Implications of Achieving Education Targets." Social Sector Division. KIPPRA, Nairobi, Kenya. Mimeo.

Table 1a
Gross Primary School Enrolment Rates 1970-1989 (%)

Year	1970	1975	1980	1982	1984	1985	1986	1987	1988	1989
Total	62.1	103.9	115.2	112	107.1	99	98.1	98.2	96.5	98.2
Male	72.3	111.9	120.2	115.8	110.2	101.8	101	100.9	98.7	99.9
Female	51.8	95.9	110.1	112	103.9	96.1	95	95.4	94.4	96.3

Source: World Bank Africa Database 2001, The World Bank

Table 1b
Gross Primary School Enrolment Rates 1990-1999 (%) [a]

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Change (1990-99)	Cost (%) [b]
Total	92.19	91.40	91.54	87.84	88.49	86.80	86.44	87.61	88.80	86.91	-5.28	2.8
Male	94.16	93.30	93.07	88.83	89.13	87.35	87.33	88.61	89.36	88.11	-6.05	.
Female	90.21	89.40	90.00	86.84	87.83	86.25	85.54	86.60	88.24	85.71	-4.50	.
By province												
Coast	79.93	78.80	78.85	75.09	71.40	73.30	75.57	75.17	73.25	75.95	-3.98	1.85
Central	103.60	102.60	103.56	102.80	101.04	104.95	100.22	100.44	98.20	93.81	-9.80	5.03
Eastern	96.82	97.40	96.35	92.57	91.76	89.86	90.46	90.75	93.84	94.88	-1.94	1.90
Nairobi	66.32	65.30	64.57	50.46	61.47	60.65	58.91	57.12	56.87	54.07	-12.25	7.70
Rift Valley	91.73	90.90	89.53	82.35	83.93	83.32	84.01	85.35	86.68	86.94	-4.79	2.20
Western	104.08	103.00	103.90	100.53	101.65	100.46	99.88	100.33	103.4	100.31	-3.77	2.81
Nyanza	91.06	89.70	92.47	93.54	95.25	86.99	86.22	90.53	92.92	85.75	-5.31	2.28
North Eastern	23.84	22.70	21.80	16.57	21.64	14.94	20.99	24.57	24.83	26.30	+2.46	3.70

Notes: [a] Enrolment rates are based on figures from the Ministry of Education, Science and Technology, Statistics Section, 1999.
[b] Cost is defined as the primary school fee as a percentage of per capita expenditure. These computations are based on data from the Welfare Monitoring Survey, 1994.

Table 2
Primary School - Selected Statistics

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
KCPE Scores [a]	.	.	.	337.6	330.3	.	340.9	.	.	340.6
English (%)[b]	49.9	50.3	50.0	49.2	48.3	48.0	.	.	.	.
Mathematics (%)	48.4	48.1	48.4	47.5	47.4	47.6	.	.	.	.
School Completion Rates (%) [c]	43.2	44.1	46.4	43.4	43.9	42.6	44.3	46.1	47.2	47.7
Trained-Untrained Teacher Ratio [c]	70.2	74.5	72.7	82.0	87.4	90.1	92.8	94.3	96.6	96.1
Student-Teacher Ratio	31.2	31.5	29.9	31.4	31.2	30.5	30.2	30.9	30.8	32.3
Student-Trained Teacher Ratio	44.4	42.2	41.1	38.3	35.7	33.8	32.6	32.8	31.9	33.6

Notes: [a] Average KCPE scores out of a maximum of 700. Figures are from the Kenya National Examination Council, 2000. [b] From, Abagi (1997b) [c] Figures are from the Ministry of Education, Science and Technology, Statistics Section, 1999.

Table 3
Labor Markets in Kenya - Selected Statistics

Year	1989[a]		1997[b]	
Unemployment Rate (%)				
National	6.5		18	
By Education				
No Education	.		21	
Grade 1-4	.		15	
Grade 5-8	.		19	
Secondary	.		19	
University	.		8	
Year	1996	1997	1998	1999
Informal Sector Employment [c] (%)	61.1	63.6	65.9	68.3

Notes: Unemployment rates are for the age group 15-64. [a] Figures are from the National Population Census. [b] Own computations based on the Welfare Monitoring Survey, 1997. [c] Figures are from the Economic Survey, 2000.

Table 4a
HIV/AIDS Prevalence in Kenya (%)
Percent of HIV Positive Adults (15-49)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
National HIV Prevalence [a]	4.8	6.1	7.4	8.7	9.9	11.0	11.9	12.8	13.9	13.5	13.5
Urban	8.8	10.5	12.0	13.4	14.5	15.5	16.3	16.9	18.1	17.8	17.5
Rural	4.1	5.3	6.5	7.7	8.7	10.0	11.0	11.9	13.0	13.0	13.0

Notes: [a] National AIDS and Sexually Transmitted Diseases Control Program (NASCOP), 1999 and Economic Survey 2001.

Table 4b
AIDS Prevalence Rates among Pregnant Women
and Gross Primary School Enrolment Rates in the Sentinel Sites (%)

District, (Province)	HIV [a] Prevalence 1990	Enrolment [b] Rate 1990	HIV Prevalence 1999	Enrolment Rate 1999
Busia, Western	14.4	100.28	28.3	102.97
Garissa, North Eastern	4.0	26.54	6.3	22.16
Kajiado, Rift Valley	1.6	64.16	9.0	59.39
Kakamega, Western	9.1	102.13	12.3	96.02
Kisii, Nyanza	0.0	92.28	15.7	82.25
Kisumu, Nyanza	15.3	87.75	30.7	73.85
Kitale, Rift Valley	2.4	87.55	16.0	94.65
Kitui, Eastern	0.1	103.39	11.4	102.76
Mbale, Western	2.9	102.13	15.9	96.02
Meru, Eastern	0.0	84.29	30.0	78.56
Mombasa, Coast	12.0	73.52	14.3	62.01
Nairobi, Nairobi	10.5	66.32	16.7	54.07
Nakuru, Rift Valley	10.0	96.54	26.5	84.50
Nyeri, Central	2.8	107.02	13.7	90.34
Thika, Central	6.6	87.06	22.5	86.63
Tiwi, Coast	12.8	74.0	23.4	75.3
Correlation, (p-value)	-0.026, (0.925)		0.328, (0.214)	

Source: [a] National AIDS and Sexually Transmitted Diseases Control Program (NASCOP)
[b] Ministry of Education, Science and Technology, Statistics Section

Table 5
Primary Education Participation Rates, 1992-1997
(Standard Errors)

	1992	1994 Full Sample	1994 Restricted Sample [b]	1997
Gross Enrollment Rates (%)[a]				
Total	102.1	94.9	98.5	106.5
	(0.009)	(0.010)	(0.009)	(0.009)
Male	.	95.7	99.3	107.7
		(0.011)	(0.010)	(0.012)
Female	.	94.0	97.7	105.4
		(0.013)	(0.012)	(0.010)
Net Enrollment Rates (%)				
Total	82.9	77.7	80.6	86.9
	(0.007)	(0.008)	(0.007)	(0.006)
Male	.	78.8	81.7	86.6
		(0.008)	(0.008)	(0.008)
Female	.	76.5	79.5	87.2
		(0.009)	(0.009)	(0.007)
Ever Attend School (%)				
Total	85.1	81.8	84.9	90.3
	(0.006)	(0.007)	(0.006)	(0.005)
Male	.	82.7	85.8	90.4
		(0.008)	(0.006)	(0.006)
Female	.	81.0	84.0	90.2
		(0.008)	(0.007)	(0.006)

Notes: [a] Own computations based on Welfare Monitoring Surveys conducted in 1992, 1994 and 1997. [b] To enable comparisons across the three years, estimates based on the 1994 restricted sample exclude individuals living in areas where the survey was *not* conducted in 1992 and 1997.

Table 6
Ever Attend School by Expenditure Quintiles, 1992, 1994 and 1997
(Standard Errors)

	1992	1994 Full Sample	1994 Restricted Sample	1997
Total				
Quintile 1	81.6	74.9	80.6	85.0
	(0.013)	(0.015)	(0.011)	(0.011)
Quintile 2	83.7	79.4	83.7	87.5
	(0.012)	(0.012)	(0.011)	(0.009)
Quintile 3	85.3	82.5	85.1	91.6
	(0.010)	(0.011)	(0.011)	(0.008)
Quintile 4	86.4	84.7	86.7	92.5
	(0.013)	(0.009)	(0.009)	(0.007)
Quintile 5	88.5	87.0	88.7	95.1
	(0.013)	(0.010)	(0.010)	(0.008)
Male				
Quintile 1	.	76.4	82.1	85.5
		(0.017)	(0.013)	(0.014)
Quintile 2	.	80.6	84.8	88.0
		(0.014)	(0.013)	(0.011)
Quintile 3	.	82.6	85.3	91.3
		(0.013)	(0.012)	(0.010)
Quintile 4	.	86.9	88.8	92.4
		(0.011)	(0.010)	(0.009)
Quintile 5	.	86.6	88.5	95.2
		(0.013)	(0.014)	(0.008)
Female				
Quintile 1		73.2	79.1	84.4
		(0.018)	(0.014)	(0.013)
Quintile 2		78.3	82.5	87.1
		(0.015)	(0.015)	(0.011)
Quintile 3		82.4	84.9	91.9
		(0.015)	(0.015)	(0.010)
Quintile 4		82.5	84.4	92.5
		(0.013)	(0.014)	(0.009)
Quintile 5		87.4	89.0	94.8
		(0.014)	(0.012)	(0.010)

Notes: To enable comparisons across the three years, estimates based on the 1994 restricted sample exclude individuals living in areas where the survey was *not* conducted in 1992 and 1997.

Table 7
Selected Descriptive Statistics, 1992-1997

Variable	Mean (Std. Dev.) 1992	Mean (Std. Dev.) 1994 Full Sample	Mean (Std. Dev.) 1994 Restricted Sample [a]	Mean (Std. Dev.) 1997
Child characteristics				
Age	10.27	9.99	10.00	10.26
	(2.83)	(2.85)	(2.84)	(2.86)
Male = 1	.	0.510	0.508	0.508
		(0.499)	(0.499)	(0.499)
Order of Birth	3.278	3.373	3.359	2.918
Family characteristics	(1.717)	(1.659)	(1.645)	(1.533)
Father's schooling	.	5.83	6.14	6.30
		(4.33)	(4.22)	(4.22)
Mother's schooling	.	4.45	4.71	4.93
		(4.14)	(4.11)	(3.99)
Land per capita (acres)	.	0.823	0.863	0.565
		(9.253)	(9.532)	(1.238)
House owner = 1	0.757	0.882	0.879	0.871
	(0.428)	(0.322)	(0.325)	(0.334)
Number of rooms in house	2.617	2.557	2.628	2.670
	(1.509)	(1.513)	(1.518)	(1.318)
Educational characteristics				
Total Expenditure on Primary Education	52.51	81.62	82.29	97.60
(Shillings per month - Current)	(27.52)	(71.34)	(73.22)	(118.67)
Total Expenditure on Primary Education	52.51	43.65	44	42.25
(Shillings per month - 1992 prices)	(27.52)	(38.15)	(39.15)	(51.37)
Total Expenditure on Primary Education/Per	13.04	9.57	9.52	7.06
Capita Consumption (%)	(0.334)	(0.352)	(0.365)	(0.092)
Expenditure on Primary Education [b]	29.27	52.2	52.8	70.2
	(19.3)	(60.6)	(63.8)	(95.7)
Primary Education Test Scores(Max. = 700)	347.89	338.73	341.38	345.52
	(22.34)	(29.47)	(24.89)	(25.96)
Pupil-Teacher Ratio	31.90	31.91	31.65	31.64
	(3.33)	(5.64)	(4.62)	(4.83)
Teacher - Skill Level 1 - (%)	4.15	5.00	5.05	9.54
	(2.03)	(2.32)	(2.19)	(3.97)
Teacher - Skill Level 2 - (%)	51.2	58.35	59.76	65.01
	(7.95)	(9.17)	(6.32)	(5.58)
Teacher – Skill Level 3 - (%)	22.7	23.87	23.00	19.7
	(3.33)	(5.73)	(3.85)	(4.54)

Notes: [a] To enable comparisons across the three years, estimates based on the 1994 restricted sample exclude individuals living in areas where the survey was *not* conducted in 1992 and 1997. [b] Measure of educational expenditure used in the regressions.

Table 8
Marginal Effects based on Probit Estimates of Primary School Enrolment, 1992, 1994 and 1997
(Standard Errors)

Variable	1992	1994 Full Sample	1994 Restricted Sample	1997	1997
	(1)	(2)	(3)	(4)	(5)
Child Characteristics					
Age	0.202*	0.193*	0.159*	0.020*	0.020*
	(0.013)	(0.011)	(0.011)	(0.0014)	(0.001)
Age squared	-0.008	-0.007*	-0.006*	0.0001*	0.0001*
	(0.0006)	(0.0005)	(0.0005)	(0.00003)	(0.00003)
Male	.	0.019*	0.014**	0.002	0.0025
		(0.007)	(0.006)	(0.003)	(0.003)
Order of Birth	0.004	-0.005***	-0.005***	-0.003***	-0.002***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.0014)
Family Characteristics					
Father's Schooling	.	0.010*	0.007*	0.005*	0.005*
		(0.001)	(0.001)	(0.001)	(0.001)
Mother's Schooling	.	0.011*	0.009*	0.004*	0.004*
		(0.001)	(0.001)	(0.001)	(0.001)
Land per capita	.	-0.001*	-0.001	0.004**	0.005***
		(0.0004)	(0.0008)	(0.002)	(0.0025)
Home Ownership	-0.006	-0.019	-0.021	0.036**	0.042**
	(0.020)	(0.022)	(0.017)	(0.021)	(0.023)
No. of Rooms in House	0.021*	0.021*	0.016*	0.010*	0.009*
	(0.004)	(0.005)	(0.004)	(0.002)	(0.002)
Educational Characteristics					
School Costs*100	-0.08	-0.06**	-0.04**	0.01	0.01
	(0.07)	(0.03)	(0.02)	(0.1)	(0.01)
Time taken to reach school	.	.		.	-0.8*
					(0.2)
KCPE Score*100	0.01	0.06**	0.04	0.04*	0.04*
	(0.05)	(0.03)	(0.03)	(0.01)	(0.01)
Pupil - Teacher Ratio*100	0.3	-0.002	-0.004	-0.03	-0.04
	(0.2)	(0.12)	(0.1)	(0.07)	(0.07)
Teacher - Skill Level 1 (S1)*100	1.6 *	0.7	0.5	0.01	0.02
	(0.6)	(0.5)	(0.5)	(0.1)	(0.1)
Teacher - Skill Level 2 (P1)*100	-0.05	0.4*	0.4*	0.16***	0.17***
	(0.15)	(0.08)	(0.1)	(0.1)	(0.09)
Teacher - Skill Level 3 (P2 & P3)*100	0.06	0.2	0.4*	-0.1	-0.09
	(0.2)	(0.2)	(0.1)	(0.1)	(0.13)
Number of Observations	10,108	13,306	10,967	11,229	11,229
Log Likelihood Value	-3207.01	-4234.77	-3230.42	-2675.09	-2653.70

Notes: Dependent Variable - Has individual ever attended school. All specifications include a set of 7 province indicators and an urban-rural indicator. The educational characteristics are district averages. Standard errors are heteroscedasticity consistent and corrected for the clustered design of the sample. To enable comparisons, estimates based on the 1994 restricted sample exclude individuals living in areas where the survey was *not* conducted in 1997. The symbol * represents significance at the 1 percent level, ** at the 5 percent level and *** at the 10 percent level.

Table 9
Estimates of Primary School Enrolment, 1992, 1994 and 1997
(Standard Errors)

Variable	Pooled Data 1992, 1994 and 1997 (1)	Pseudo Panel Differenced Data OLS (2)	Pseudo Panel Differenced Data IV-1 (3)	Pseudo Panel Differenced Data IV-2 (4)
Child Characteristics				
Age	0.036*	.	.	.
	(0.011)			
Age squared	-0.0001*	.	.	.
	(0.00005)			
Male	.	.	.	.
Order of Birth	0.002	.	.	.
	(0.002)			
Family Characteristics		.	.	.
Father's Schooling	.			
Mother's Schooling	.	.	.	.
Land per capita	.	.	.	.
Home Ownership	-0.009	.	.	.
	(0.010)			
No. of Rooms in House	0.021*	.	.	.
	(0.002)			
Educational Characteristics				
School Costs *100	-0.04	-0.04***	-0.08**	-0.13***
	(0.026)	(0.024)	(0.04)	(0.07)
KCPE Score*100	0.06*	.	.	.
	(0.02)			
Pupil - Teacher Ratio*100	-0.08	.	.	.
	(0.07)			
Teacher - Skill Level 1 (S1)*100	0.4	-0.06	0.04	-0.3
	(0.12)	(0.24)	(0.2)	(0.3)
Teacher - Skill Level 2 (P1)*100	0.14*	0.08	0.12	-0.01
	(0.05)	(0.1)	(0.08)	(0.1)
Teacher - Skill Level 3 (P2 & P3)*100	-0.16**	-0.7*	-0.6*	-0.9*
	(0.08)	(0.3)	(0.2)	(0.3)
Number of Observations	40,443	38	38	38
Log Likelihood Value	-12,252	.	.	.
R^2		0.377	0.396	0.235

Notes: In column 1 the dependent variable is a discrete variable indicating whether an individual has ever attended school. This specification includes a set of 7 province indicators, an urban-rural indicator and controls for year fixed effects. The educational characteristics are district averages. Standard errors are heteroscedasticity consistent and corrected for the clustered design of the sample. In columns 2, 3 and 4 the dependent variable is the change in average district enrollment between 1992 and 1997. The independent variables are changes in average district educational characteristics between 1992 and 1997. Columns 3 and 4 present instrumental variables estimates to account for measurement error in the school costs variable. The estimates in columns 2, 3 and 4 are based on data that have been weighted for differences in the sample size in each district. The symbol * represents significance at the 1 percent level, ** at the 5 percent level and *** at the 10 percent level.

Table 10
Point Elasticities by Expenditure Quintiles, 1994
(standard errors)

Characteristic	Total [a]	Quintile1 [b]	Quintile 2	Quintile 3	Quintile 4	Quintile 5
School Costs (Mean) [c]	-0.039**	-0.123*	-0.066*	-0.057*	-0.039*	-0.009
	(0.020)	(0.042)	(0.027)	(0.019)	(0.013)	(0.009)
School Costs (Mean + std. dev.)	-0.079***	-0.311**	-0.161**	-0.145**	-0.085*	-0.014
	(0.047)	(0.129)	(0.076)	(0.059)	(0.034)	(0.014)
KCPE Score	0.304**	1.200*	0.879*	0.423*	0.652*	0.399*
	(0.151)	(0.327)	(0.258)	(0.154)	(0.143)	(0.118)
Student-Teacher Ratio	-0.001	-0.083	0.128	-0.108	0.080	0.071
	(0.064)	(0.185)	(0.156)	(0.087)	(0.059)	(0.053)
Teacher - Skill Level 1 (S1)	0.053	0.210**	0.000	0.135*	-0.017	-0.024
	(0.038)	(0.096)	(0.067)	(0.040)	(0.031)	(0.027)
Teacher - Skill Level 2 (P1)	0.381*	0.661*	0.688*	0.252*	0.456*	0.177*
	(0.075)	(0.229)	(0.145)	(0.080)	(0.090)	(0.074)
Teacher - Skill Level 3 (P2 & P3)	0.085	0.011	0.050	-0.262*	0.026	-0.053
	(0.073)	(0.189)	(0.125)	(0.074)	(0.059)	(0.047)
Per Capita Monthly Consumption (Shillings)	853	208	432	636	903	1673
	(828.7)	(86.2)	(56.9)	(61.3)	(99.4)	(764.9)

Notes: [a] Calculations are based on estimates reported in Table 9, column 2. [b] Calculations are based on quintile specific estimates. Due to the smaller sample size and limited variation in district level educational indicators, the quintile specific estimates do not include province fixed effects. [c] Point elasticities calculated at the mean of the relevant characteristic. For school costs these elasticities are calculated at the mean and the mean plus one standard deviation. The symbol * represents significance at the 1 percent level, ** at the 5 percent level and *** at the 10 percent level.

Table 11
Effectiveness of School Inputs, 1994

Characteristic	Total	Quintile 1[b]	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Reducing School Costs [a]						
Percentage change	25.6	8.13	15.2	17.5	25.9	.
Cost of policy (shillings per month per additional enrolee)	21	6.67	12.5	14.4	21.2	.
Increasing KCPE Scores						
Percentage Change [b]	3.29	0.833	1.137	2.364	1.533	2.506
Increasing Teachers at Skill Level 2						
Percentage Change [c]	2.62	1.512	1.453	3.968	2.192	5.649
Cost of policy – scenario A (shillings per month per additional enrolee)	309	136	171	466	258	665
Cost of policy – scenario B [d]	166	73	93	253	140	358
Cost of policy – scenario C [e]	40.3	18	21.8	60	33	85

Notes: [a] Percentage change indicates the required reduction in mean school costs to increase the enrolment rate by one percent (1/0.039 = 25.6). Calculated at the monthly schooling expenditure of 82 shillings per month, this translates into a fee reduction of 21 shillings per month (82 x 0.256).

[b] Percentage change indicates the required increase in test scores to increase enrolment rates by one percent (1/0.30).

[c] Percentage change indicates the required increase in skilled teachers at level 2 (P1) to increase enrolment rates by one percent (1/0.381 = 2.62). Based on teacher composition in 1994, this translates into an increase of 2,758 teachers. The monthly salary cost of a teacher with these skills is 6232 shillings. The total monthly costs incurred are 17,187,856 shillings. Monthly costs per additional enrolee are 309 (17,187,856/55,569). These calculations do not include the cost of training teachers and account only for the direct effect of skilled teachers on enrolment.

[d] Increase in skilled teachers at level 2 (P1) accompanied by an equal reduction in the number of untrained teachers (monthly salary cost 2879 shillings). Monthly costs per additional enrolee are 166.41 (2,758 x (6232-2879)/55,569. These calculations do not include the cost of training teachers and account only for the direct effect of skilled teachers on enrolment.

[e] Increase in skilled teachers at level 2 (P1) achieved by training teachers at level P2 (monthly salary 5,420 Shillings) while keeping the total number of teachers unchanged. Monthly costs per additional enrolee are 40.3 (2,758 x (6232-5420)/55,569). These calculations do not include the cost of training teachers and account only for the direct effect of skilled teachers on enrolment.