# SOCIO-ECONOMIC INTERRELATIONS BETWEEN CHILD EDUCATION, HEALTH AND FAMILY SIZE

## AN APPLICATION OF THE CHILD QUALITY-QUANTITY MODEL

### THE CASE OF BARINGO DISTRICT

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This Research Paper is my original work and has not been presented for a Degree in any other university.

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The Research Paper has been submitted for Examination with our approval as university supervisors.

P.L. Jumi

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## CITATION

`Giving birth is something in which mankind and animals are equal, but rearing the young and especially educating them for years, is something which is a unique gift and responsibility of men. It is for this reason that it is important for human beings to put emphasis on caring for children and the ability to look after them properly, rather than thinking about the numbers of children and the ability to give birth. For it often happens that men's ability to give birth is greater than their ability to bring up the children in a proper manner',(Julius K. Nyerere,`Human Nutrition in Tropical Africa, Rome, 1965).

## DEDICATION

This paper is dedicated to the many innocent children of the world, who for situations not of their own making suffer physical, psychological and social anguish due to inadequate enabling environment for balanced growth.

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Finally, many thanks to others, whom in naming individually I would be running the risk of omitting some, but who in one form or the other contributed positively to my study.

However, any errors and omissions in this study are mine and should therefore not be blamed on the above mentioned persons.

## ABSTRACT

The main objective of this study is to identify the nature of the relationship between the quality and quantity of children in the Baringo district of Kenya. The analytical framework was the child quality-quantity model based on the consumer theoretical framework. Utilizing a static cross-sectional simultaneous model the relative magnitude and statistical significance of the influence of specific economic variables on this two aspects of children were estimated.

The main variables which were considered are : opportunity cost of time (measured by parental wages proxed by the number of years completed in school since labour market is undeveloped in the rural areas), assets (in this case land), market determined income, parental ages (as control exogenous variables) and the availability of facilities for health (proxed by an index of mortality) and education.

Three main hypotheses are tested:

(i) the quality and quantity of children are inversely related.

Multiple regression technique was used to analyze the cross-sectional primary data which was collected mainly from rural Baringo district. The sample included 357 household covering all the divisions in the district.

(ii) the level of child quality varies directly with the

availability of educational and health utilizable facilities. The degree of utilization is determined by the level of parental education which is a measure of the cost of information and the opportunity cost of rearing children.

(iii) the level of the quantity of children varies directly with the ownership of assets, parental age plus poor service environment and inversely with the parental education, income, area of residence (urban or rural), use of birth control devices and household size.

Quantity and quality of children are directly related implying that the area under study is still in the first stage of socio-economic development and therefore children are a `normal good'.

Empirical evidence indicate that the quality of children is positively influenced by parental education, income, developed service environment, size of family, modern items owned and negatively by size of households, area of residence.

On the other hand quantity of children is influenced positively by acres of land owned, parental age, developed service environment, area of residence, size of household, father's education and inversely by mother's education, income, utilization of birth control devices.

Two policy recommendations that emerge from the findings of the study are that:

(i) to increase the quality of children there is a need to improve the educational and health facilities.

(ii) to decrease sizes of families, policies to reduce desired family sizes should be introduced and the methods for birth control be made readily available.

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## DEFINITION OF VARIABLES

| VARIABLE | DEFINITION |
|---|---|
| Dependent Variable | |
| F - child quantity | Children ever born (standardized) |
| E - child quality | Age and sex standardized school attendance index (5-19 years old) |
| M - child quality | Child mortality index |
| RIGHT HAND SIDE VARIABLES | |
| MEDUC | father's years of education |
| FEDUC | mother's years of education |
| INC1 | natural log of total household income(KShs) |
| ACRES1 | natural log of land acreage owned |
| RES | dummy=1 if urban |
| SIZE | nucleus family plus other dependants in a household |
| CONTROL EXOGENOUS VARIABLES | |
| FAGE | father's age in years |
| MAGE | mother's age in years |
| MEDAGE | mother's age and education interactive variable |
| FEDAGE | father's age and education interactive variable |
| UBC | proportion of women in a division that use family planning methods |
| SCH | percent of children (5-19) years actually enrolled in schools |
| MIO | percent of houses with semi or permanent housing structure |
| WAT1 | distance from nearest water point during the dry season |

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# CHAPTER ONE

## INTRODUCTION

### 1.0 Background

One of the most important resources of a nation is found in the quality and quantity of its children. This category of the population gives an indication of the present and future welfare of a given society. Whereas the number of children in a household is determined by fertility levels, mortality incidence is a general indicator of their quality.

High fertility rates and declining infant and child mortality rates result in large family sizes,(Kenya Contraceptives Prevalence Survey,1984). Family size and the quality of children vary from one household to the other depending on a number of factors which include the place of residence (rural or urban), parental levels of education, incomes, knowledge and acceptance of family planning methods.

In Kenya like other developing economies there is a noticeable difference in fertility between the rural and urban areas. For instance five years before the Kenya Demographic and Health Survey (1989) women in urban areas on average had a total fertility rate of five children compared to seven in rural areas. Variation in fertility levels between provinces also exist. During the same period, Nairobi had the lowest total fertility rate, while Western Province had the highest overall rate.

The effect of education on fertility can be measured by the use of the following indices: the proportion of household members who ever attended school, women's education and the fraction of children between 5-15 years of age in the household who are attending school. The last index shows whether or not children's education has any feedback effect on mother's fertility behaviour. Women in households with low literacy levels have high fertility rates. The relationship between the two is curvilinear since fertility first increases and then decreases with literacy level of the household. In the case of women's own education, the relationship is such that with up to four years of primary education fertility rises but it declines after twelve years of education. As a result secondary education is associated with a decline in fertility. However a few years of schooling leads to a rise in family size due to a noticeable decline in mortality rate. Fertility therefore, varies according to the presence and the intensity of certain factors.

Table 1 gives other factors that affect fertlity. The availability of social amenities could be measured by the distance from the clusters of residence to the nearest facility ie water, bus stop, market, primary school, government secondary school, private secondary school, health centre and post office. Fertility of women with access to a facility is higher than those without access to the same facility. The average number of children born show a positive fertility effect between fertility and the level of socio-economic development.

The number of children born increases from 4.3 to 5.3 as the availability of facilities increase among all the women combined together. This trend is similar to the positive fertility effect of household income and other measures of the individual's economic status. However, the negative trend between mother's own education and fertility is inconsistent.

Fertility differentials may also be caused by the type or source of income. Household income may be divided into five possible sources: crops, livestock, wages, self-employment and cash receipts including transfers. The average number of children born tends to be positively related to the proportion of household income derived from crops, livestock, cash receipts and transfers. However, the average number of children born decreases as the income from wages increase. Women in households that derive income from wages are more likely to be found in the formal urban sector which encourages smaller family sizes. Therefore, the fertility behaviour of women depend on the type of households they live in. The fertility of women living in households that depend upon wages is the lowest while that of those who rely on cash transfers and receipts is the highest. The transfers occur mainly from urban to rural areas where the man works for a wage in town as the wife tills the family landhold on whose livelihood the majority of family members depend.

In rural Kenya, higher economic status is associated with higher fertility ie general income has a positive effect on

fertility (CBS, 1989:26). The poor in kenya do not necessarily have more children than the rich as is generally believed elsewhere.

Given that a number of these variables are interrelated we need to isolate the effect of each factor that is independent of the other. Table 1 shows the number of live births per currently married women given their ages, sources of income and levels of education in Kenya.

TABLE 1 AVERAGE NUMBER OF LIVE BIRTHS PER CURRENTLY MARRIED WOMAN BY HER AGE, SOURCE OF INCOME, AND INDICES OF EDUCATION: RURAL KENYA, 1982

| INDEX OF EDUC. | AGES OF WOMEN | | | | All | |
|---|---|---|---|---|---|---|
| | 15-19 | 20-29 | 30-39 | 40-49 | Av. | N |
| All Women N | 302 | 1664 | 1294 | 917 | | 4177 |
| Average | 1.0 | 3.2 | 6.3 | 7.6 | 5.0 | |
| 1) Education of Women | | | | | | |
| a) None | 0.9 | 3.3 | 6.3 | 7.4 | 5.5 | 2571 |
| b) Lower Primary | 1.1 | 3.3 | 6.3 | 8.4 | 4.8 | 688 |
| c) Pri.(upper) | 1.0 | 3.1 | 6.2 | 8.4 | 3.9 | 771 |
| d) Secondary+ | (1.2) | 2.4 | 5.0 | (6.1) | 2.9 | 177 |
| 2) Per Cent of Children 5-15 years in School** | | | | | | |
| a) None | 1.0 | 3.0 | 5.1 | 6.4 | 3.9 | 408 |
| b) 1-50 | 0.7 | 3.7 | 6.4 | 8.0 | 5.3 | 493 |
| c) 51-70 | 0.5 | 4.3 | 6.9 | 8.4 | 6.3 | 362 |
| d) 71-90 | 1.2 | 4.7 | 7.7 | 8.6 | 7.1 | 396 |
| e) 91-100 | 1.1 | 3.6 | 6.3 | 7.8 | 5.5 | 1576 |
| 3) Per cent of Household Members Who Ever Attended School | | | | | | |
| a) 0-30 | 1.1 | 2.9 | 5.2 | 6.0 | 3.9 | 918 |
| b) 31-50 | 1.2 | 3.2 | 6.5 | 7.4 | 4.8 | 1363 |
| c) 51-60 | (1.1) | 4.2 | 7.0 | 8.5 | 6.2 | 294 |
| d) 61-70 | 1.1 | 3.3 | 6.9 | 8.1 | 5.4 | 715 |
| e) 71+ | 0.6 | 3.2 | 6.2 | 8.0 | 5.6 | 881 |
| 4) Gross Household Income* | | | | | | |
| a) Up to 2999 | 1.1 | 3.1 | 5.8 | 6.8 | 4.5 | 798 |
| b) 3000-4999 | 1.0 | 3.0 | 6.3 | 7.5 | 4.9 | 783 |
| c) 5000-7499 | 0.9 | 3.2 | 6.2 | 7.8 | 4.8 | 797 |
| d) 7500-14999 | 1.1 | 3.2 | 6.4 | 7.9 | 5.1 | 1104 |
| e) 15000+ | 1.0 | 3.4 | 6.6 | 7.9 | 5.5 | 695 |
| 5) Size of land Holding | | | | | | |
| a) None | 0.9 | 2.9 | 4.6 | 6.3 | 3.7 | 424 |
| b) 0.1-1.9 | 1.1 | 3.2 | 6.1 | 7.8 | 4.7 | 601 |
| c) 2.0-2.9 | 1.4 | 3.1 | 6.2 | 7.4 | 4.6 | 564 |
| d) 3.0-4.9 | 1.1 | 3.2 | 6.5 | 8.0 | 5.2 | 878 |
| e) 5.0+ | 0.8 | 3.3 | 6.7 | 7.5 | 5.4 | 1709 |

TABLE 1. CONT

| | | | | | | |
|---|---|---|---|---|---|---|
| 6) Province | | | | | | |
| a) Coastal | 1.0 | 3.0 | 6.1 | 7.6 | 4.7 | 580 |
| b) Eastern | 0.9 | 3.1 | 6.4 | 6.7 | 5.0 | 570 |
| c) Central | 0.9 | 3.3 | 6.5 | 7.7 | 5.5 | 587 |
| d) R. Valley | 1.2 | 3.2 | 6.2 | 7.5 | 4.8 | 1154 |
| e) Nyanza | 1.0 | 3.2 | 6.2 | 7.9 | 5.0 | 748 |
| f) Western | 1.2 | 3.3 | 6.2 | 8.4 | 5.0 | 531 |
| 7) Number of Facilities Avail.at Cluster Of Residence | | | | | | |
| a) 0 | 1.0 | 3.0 | 5.7 | 7.1 | 4.3 | 554 |
| b) 1-4 | 1.0 | 3.2 | 6.2 | 7.5 | 4.9 | 2397 |
| c) 5-8 | 1.0 | 3.3 | 6.4 | 7.7 | 5.3 | 1226 |
| 8) Receipts & Transfers | | | | | | |
| a) 0 | 1.0 | 3.0 | 5.5 | 6.8 | 4.1 | 676 |
| b) 1-749 | 1.0 | 3.1 | 6.1 | 7.1 | 4.6 | 936 |
| c) 750-1999 | 0.9 | 3.3 | 6.3 | 7.7 | 5.0 | 977 |
| d) 2000-4999 | 1.0 | 3.1 | 6.4 | 7.7 | 5.2 | 915 |
| e) 5000+ | 1.2 | 3.5 | 6.9 | 8.3 | 5.9 | 613 |

SOURCE: IMPACT OF SOCIO-ECONOMIC DEVELOPMENT ON FERTILITY IN RURAL KENYA, CBS, MPND (1989).

Mortality tends to be high in households in which mothers have no education and declines as the level of education increases.

A number of studies in Kenya have shown that mortality rates tend to be lower among the female children. The infant mortality differentials by the age of the mother are not clear. However, this is high for children born to mother's under the age of twenty. On the other hand childhood mortality declines steeply as the age of the mother increases.

Infant mortality is higher for first births, declines for second to sixth births and then rises steeply for seventh birth.

The length of birth interval has a strong effect on Infant and Child mortality levels. Infant mortality rates are estimated at 76 per thousand for births occurring after an interval of less than two years. This level declines for births after an interval of 2-3 years and the downward trend continues for births after an interval of four years or more. Childhood mortality also exhibits the same trend.

In Kenya over 10 per cent of all children born to women of 15-49 years die on average due to poor nutrition, hygiene, adverse health environment and a number of other factors (Kenya Contraceptives Prevalence Survey, 1984).

Table 2 shows mortality differentials by mother and demographic characteristics.

TABLE 2 INFANT AND CHILDHOOD MORTALITY RATES BY SELECTED DEMOGRAPHIC & MOTHER CHARACTERISTICS, FOR THE TEN YEAR PERIOD PRECEDING THE SURVEY, KENYA, 1989

| | IMR $_1q_0$ 1979-89 | CMR $_4q_1$ 1979-89 | U5MR $_5q_0$ 1979-89 |
|---|---|---|---|
| A) Demographic Characteristics | | | |
| 1) Sex of Child | | | |
| a) Male | 63.0 | 35.4 | 96.1 |
| b) Female | 54.3 | 33.2 | 85.7 |
| 2) Age of mother at Birth | | | |
| a) <20 | 67.5 | 43.8 | 108.3 |
| b) 20-29 | 54.8 | 35.8 | 88.6 |
| c) 30-39 | 60.2 | 26.4 | 85.0 |
| d) 40-49 | 58.3 | 15.0 | 72.5 |
| 3) Birth Order | | | |
| a) First | 65.3 | 37.5 | 100.3 |
| b) 2-3 | 54.8 | 32.5 | 85.5 |
| c) 4-6 | 49.7 | 33.4 | 81.5 |
| d) 7+ | 71.9 | 36.4 | 105.6 |
| 4) Previous Birth Interval | | | |
| a) <2 years | 75.6 | 41.1 | 113.6 |
| b) 2-3 years | 47.7 | 32.6 | 78.7 |
| c) 4 years or more | 35.9 | 17.9 | 53.2 |
| B) Mother Characteristics | | | |
| 5) Residence | | | |
| a) Urban | 56.8 | 34.2 | 89.0 |
| b) Rural | 58.9 | 34.3 | 91.2 |
| 6) Education | | | |
| a) None | 71.7 | 39.9 | 108.7 |
| b) Some Prim. | 59.1 | 38.3 | 95.2 |
| c) Prim.Complete | 49.3 | 24.4 | 72.5 |
| d) Secondary | 41.8 | 23.4 | 64.2 |
| 7) Region | | | |
| a) Nairobi | 46.3 | 35.7 | 80.4 |
| b) Central | 37.4 | 10.0 | 47.0 |
| c) Coast | 107.3 | 54.5 | 156.0 |
| d) Eastern | 43.1 | 22.2 | 64.3 |
| e) Nyanza | 94.2 | 60.0 | 148.5 |
| f) Rift Valley | 34.6 | 16.9 | 50.9 |
| g) Western | 74.6 | 62.9 | 132.8 |

Note: Rates include Calendar year 1988 up to the month preceding date of interview.
IMR - Infant Mortality Rate
CMR - Child Mortality Rate
U5MR - Under five mortality rate

SOURCE:KDHS (1989)

Therefore there are several socio-economic variables which create fertility and mortality differentials among individuals and households. The effect of these variables may be indirect through physical and biological factors which in turn affect the health status of mothers and households in general.

## 1.1 Statement of the Problem

As the socio-economic and other variables improve, the production (supply) of children by households increase. This implies that the demand for children before the improvement in the welfare of households was higher than their possible production due to certain constraints. Implicitly, we can state that the demand for children is the main determinant for their supply and not vice-versa. If parents opt for more children as a result of a better favourable environment, then it means they derive utility from their quantity. Children can then be seen as commodities which can satisfy a need. In the second phase of socio-economic development, the number of children across households decline with such development. Consequently the fall in the `production' of children means that their demand has dropped. Why does the quantity of children demanded now decline and yet couples are in an even better position to get the number of children desired given the improved survivorship rates? Does it mean the quantity of children is now an `inferior good'? If so, will parents opt for no children in the extreme or will they substitute their number with some other `good'?

In summary, the two main questions are-

(i) What are the determinants of the number of children a family has or desires to have?

(ii) What is substituted for the quantity of children that continues to give utility to couples?

## 1.2 Objectives of the Study

The aims of this study are to :-

(i) determine whether the quality and quantity of children are substitutes or complements.

(ii) identify the determinants of child quality[1]

(iii) identify the main determinants of the quantity of children.

(iv) to make policy recommendations on the basis of the above findings.

## 1.3 Hypotheses

Hypotheses that are put forward to form a basis for testing the empirical results are :-

(i) the relationship between the quality and quantity of children is negative[2].

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1 According to Amodi(1980) quality of children can be defined as the properties of a child which yield utility (or disutility) to parents. Child quality may be household produced as in the case of health, intellectual development and school attainment or it may be endowed for example natural intelligence and beauty.

In this study only households produce child qualities will be considered since it is assumed that all children in a family are equally endowed.

2 These two aspects of children are assumed to be good substitutes i.e. there is a high and positive substitution effects.

$\partial ME/\partial P_f > 0$ where utility is held constant, ME represent the quality of children and $P_f$ is the price of children's quanmtity.

(ii) educational standards of children in a household is positively related to availability of schooling facilities, mother's education, income, father's education, area of residence (urban) and negatively related to acres of land owned, size of a household and parental ages.

(iii) mortality is negatively related to parental education, income, acres of land owned, area of residence (urban), modern tems owned and positively related to the size of household, the distance from water source and parental ages.

(iv) the number of children desired by a couple is negatively related to the area of residence (urban), income, level of utilization of family planning services, father's education, mother's education, size of household and is positively related to property-owned (in this case acres of land), parental ages and the distance from water sources.

## 1.4 Significance of the Study

This study looks at the way parents view the two aspects of children (their quality and quantity). Once the behaviour of parents is determined, different groups of people will benefit from this information.

Those interested in the welfare of children will be able to identify the circumstances in which parents can opt for quality children.

Demographers concerned with the rate of population growth may find out that the size of families need not be controlled only from the supply side. There may be a need to put more emphasis on the variables that influence the demand for children instead of relying heavily on family planning and other methods that only control the production of children.

The society in general will benefit from the improved socio-economic environment which gives more chances to the survival of their children and hence lowers the cost of rearing them.

Employers will benefit from future generations who will be of a higher quality such that the future labour force will be able to enhance productivity, output and general welfare.

## 1.5 Organization

The study is divided into several chapters as given below. In the next chapter, a general description of the area of study will be given in order to understand the variables that will be used in this study. Methods and techniques of data collection will also be discussed.

Chapter 111 deals with a review of the theories, methodologies and results of other related studies (Literature Review).

Chapter 1V will look at the justification of the selected variables. The relationships are presented in a Theoretical Framework of the consumer theory.

# CHAPTER TWO

## AREA OF STUDY AND DATA

### 2.0 Background

Baringo district, with a population of about 259,000 (1979 census), is located in a semi-arid environment of rural Kenya. It covers an area of 10,638 sq. km. of land surface and 165 sq. km. of water surface. The density of population is between 20-30 persons per sq. km. (Ministry of Planning, National Development and UNICEF, 1990)

The most densely populated areas of the district are the high and medium potential zones of Kabarnet, Kabartonjo, Eldama Ravine and Tenges divisions with 61 per cent of the district's total population. The low and marginal areas of Marigat, Mogotio and Nginyang divisions are sparsely populated and account for about 40 per cent of the population, with some areas having a density of as low as 2 people per sq. km. The population in these low and marginal areas is usually concentrated around water sources and grazing areas.

During the 1989/93 plan period, assuming a decline in both fertility and mortality, the population of Baringo district is estimated to grow at a rate of 3.1 per cent to reach 355,674 people by 1993.[3]

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3 This is based on the macro-economic assumptions of the Sessional Paper NO. 1 of 1986.

About 20 per cent of the high and medium potential land is suitable for dairy production and rain fed crops. The marginal and rangelands which comprise 82 per cent of the total land area in the district is suitable for beef production, camel rearing and bee-keeping. Resistant crops like sorghum, finger millet, groundnuts and green grams also do well in this area.

Nearly 80 per cent of the population in the district does not have access to piped water.

Education facilities are evenly distributed throughout the district. According to the district development plans there are 289 pre-primary, 411 primary, 37 secondary schools and 9 youth polytechnic including 188 literacy centres for adult education.

TABLE 3 PRIMARY SCHOOL ENROLMENT BY GENDER,1991

| DIV. | BOYS | PERCENT | GIRLS | PERCENT | TOTAL |
|---|---|---|---|---|---|
| Nginyang | 1,178 | 61.0 | 752 | 39.0 | 1,930 |
| Marigat | 3,072 | 53.9 | 2,631 | 46.1 | 5,703 |
| Kabartonjo | 10,441 | 48.4 | 11,114 | 51.0 | 21,555 |
| Kabarnet | 8,058 | 49.2 | 8,325 | 50.8 | 16,383 |
| Tenges | 2,204 | 51.4 | 2,083 | 48.6 | 4,287 |
| Ravine | 9,903 | 50.0 | 9,920 | 50.0 | 19,383 |
| Mogotio | 3,754 | 52.4 | 3,406 | 47.0 | 7,160 |
| Tangulbei | 535 | 68.1 | 251 | 31.9 | 786 |
| Mochongoi | 815 | 42.3 | 1,112 | 57.7 | 1,927 |
| Whole Dist. | 39,960 | 50.2 | 39,594 | 49.8 | 79,554 |

SOURCE: A Household Welfare Monitoring and Evaluation Survey of Baringo district, July 1991 (p.65)

Encouraging efforts have been made in providing schooling facilities resulting in reasonable enrolment of school-going age children (Table 3). There is little difeerence in enrolment between boys and girls. School enrolment is low in areas west of Tugen Hills, Nginyang division and east of Mogotio which are predominantly under pastoral way of life. The rate of literacy in the district is estimated at about 40 per cent according to the latest Baringo district development plan.

According to the 1988 Economic Survey (CBS) the per capita income for the district was Kenya Pounds 446.4 in 1982.
Agricultural activities are essentially for subsistence particularly in the marginally dry areas which are the largest part of the district. Most income in the agricultural sector is derived from food crops particularly maize which account for over 70 per cent of the total income from both food and cash crops.
In Nginyang division and parts of Marigat the sole source of livelihood for the nomadic people is livestock.

Table 4 gives the distribution of household sizes according to divisions in Baringo district. The Household Welfare Monitoring and Evaluation Survey of the district defines a household as,` people who live within the same compound, fenced or unfenced, and share meals, have a common source of major income, and have a common provision for other essentials of general livelihood'. Household sizes determine the extent of the utilization of resources (land in particular) and the general quality of life.

Decision-making process with regard to desired family size and the level of investment in the quality of children is determined to a significant extent by the already existing household size. Quality of children could be enhanced by small or large families depending on the background of the respective households.

TABLE 4: PERCENTAGE DISTRIBUTION OF HOUSEHOLD SIZE BY DIVISION

| Division | Household Size (persons) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6+ |
| Nginyang | 0.0 | 7.1 | 14.3 | 14.3 | 14.3 | 50.0 |
| Marigat | 8.3 | 16.7 | 11.1 | 8.3 | 16.7 | 38.9 |
| Kabartonjo | 12.8 | 6.4 | 10.6 | 11.4 | 9.9 | 48.9 |
| Kabarnet | 17.0 | 14.9 | 17.0 | 6.4 | 4.3 | 40.4 |
| Tenges | 9.1 | 7.6 | 9.1 | 6.1 | 10.6 | 57.6 |
| Ravine | 7.8 | 9.8 | 2.0 | 7.8 | 5.9 | 66.7 |
| Mogotio | 5.3 | 0.0 | 10.5 | 15.8 | 10.5 | 57.9 |
| Tangulbei | 0.0 | 17.7 | 5.9 | 23.5 | 0.0 | 52.9 |
| District | 9.9 | 0.4 | 10.2 | 9.7 | 10.4 | 49.5 |

SOURCE: A Household Welfare Monitoring and Evaluation Survey of Baringo district, July 1991 (p.11)

Generally household sizes in the district are large. Most of them have six persons and above. The average size is 5.3 persons per household as per the survey results.

Another variable that has a direct influence on a family's quality of life is the occupation of the head of the household. In rural Kenya heads of families, who are usually men, greatly determine the quality of their families. Table 5 shows the distribution of household heads by occupation in the district.

TABLE 5: PERCENTAGE DISTRIBUTION OF HOUSEHOLD HEADS BY OCCUPATION

| Division | Farmer | Pastoral | W/Earner | Casual | Bus. | Dom. | Stud. | None | N/A |
|---|---|---|---|---|---|---|---|---|---|
| Nginyang | 8.3 | 50.0 | 8.3 | 25.0 | 0.0 | 8.3 | 0.0 | 0.0 | 0.0 |
| Marigat | 22.1 | 30.0 | 13.7 | 27.4 | 1.1 | 1.1 | 3.2 | 1.1 | 0.0 |
| Kabartonjo | 47.8 | 17.7 | 14.7 | 8.8 | 4.4 | 1.5 | 0.0 | 5.2 | 0.0 |
| Kabarnet | 38.4 | 0.0 | 37.0 | 3.0 | 4.4 | 8.7 | 0.0 | 8.7 | 0.0 |
| Tenges | 62.5 | 0.0 | 15.6 | 9.4 | 11.0 | 0.0 | 0.0 | 1.6 | 0.0 |
| Ravine | 48.9 | 4.3 | 21.3 | 4.3 | 2.1 | 4.3 | 4.3 | 6.4 | 4.3 |
| Mogotio | 66.7 | 5.6 | 11.1 | 0.0 | 16.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tangulbei | 13.3 | 66.7 | 6.7 | 6.7 | 6.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| District | 41.6 | 16.6 | 17.1 | 12.9 | 4.9 | 2.3 | 1.2 | 3.0 | 0.4 |

SOURCE: A Household Welfare Monitoring and Evaluation Survey of Baringo District, July 1991 (p.14).

According to this classification most household heads are farmers particularly in Mogotio and Tenges divisions. Occupation influences the extent to which an individual is receptive to new ideas. This variable is likely to be positively correlated with income and level of education. Hence the socio-economic status of households can be deduced from these factors.

## 2.1 Reasons for choosing Baringo district

Baringo district of Kenya has been chosen for study due to the availability of data. The district also has a varied socio-economic environment that can give significant differences in the the effect of independent variables.

The infant and child mortality rates in this district are some of the highest in the country.[4] According, to the 1979 census, the mortality rate of children under two years of age per thousand population was estimated at between 160 to 194. The breakdown of this figure was as follows

(i) more than 195 children per thousand of mother's who had no education

(ii) between 90 and 124 children per thousand of mothers who had some formal primary education

(iii) between 55 and 89 children per thousand of mothers with some secondary education.

Education therefore appears to exert a strong influence on the reduction of the mortality rates, because the higher the level of education, the lower the infant mortality rate.

## 2.2 Mode of Data Collection

The data used in this study was collected by a `Household Welfare Monitoring and Evaluation Survey of Baringo District' (July 1991). The Survey was based on the second phase of National Sample Survey and Evaluation Programme (Nassep II) of the Central Bureau of Statistics. This programme has a multi-purpose sampling frame for most of the districts in Kenya.

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4 Infant mortality rate is usually calculated as the number of deaths occuring among infants under one year of age in a given calendar year per thousand live births over the same period while child mortality refers to under five years.

The master frame is based on the population of the enumeration areas in each district. These areas are based on the latest population census results which are constantly revised to take into account changes taking place in the structure and distribution of the population. The enumeration areas are in turn divided into clusters of between 100 and 200 households which were selected randomly. Population and number of households are used as a measure of size in order to allow enumeration areas with larger population to have higher probabilities of being sampled for any given survey.

## 2.3 Sampling Techniques

The study drew a reasonably large sample to cover all the various socio-economic groups within the district. A sample of 20 per cent of listed households was drawn which covered all the 21 rural clusters. NASSEP II (1984-89) list frames were used after relisting them for rural clusters. The 21 clusters were represented by 571 households.

The selection of households was done by systematic random sampling, which was desirable due to the pattern of listing. The response rate was 85.1 per cent of the sampled 571 households. The newly created divisions of Tangulbei and Mochongoi were treated as part of Nginyang and Marigat respectively. Other divisions of Baringo are Kabarnet, Kabartonjo, Eldama Ravine, Mogotio and Tenges.

## 2.4 Reliability of Data

The survey data on socio-economic amenities was desegregated down to the divisional level instead of community level. This is still a significant contribution given that the desegregation of this data had earlier gone only up to the district level. This data coupled with that of individual households is adequate for the purposes of this study.

# CHAPTER THREE

## LITERATURE REVIEW

### 3.0 General Review

Fertility studies in Kenya and elsewhere have shown that there is some special relationship between the number of children ever born to a family and their quality. A negative correlation between the quantity and quality of children in a family has been observed in both cross-section and time series data. These studies have also observed that child education is an important determinant of reduced family size. Couples tend to have fewer children as their incomes rise. According to the consumer theory this means that children are `inferior goods' (Lancaster, K.J., 1966 : 132-157). This is a puzzling finding that New Home Economists have tried to resolve for the last decade or so.

A large number of models were developed to resolve this paradox. The most familiar paradigm in this respect is the child quality-quantity model propounded by Becker and Lewis (1973) and refined later by Becker and Tomes (1976).

The basic assumptions underlying this model is that households obtain utility both from the number of children that they have, and from the average `quality' of the children. The quality of children is given by their level of education, health, nutrition etc. Implicitly the model shows that there is a trade-off between quality and quantity of children. The more children a household desires, the higher the cost of increasing average quality. Alternatively, the higher the average quality desired, the

higher the cost of additional children.

This study will use a version of this framework to estimate jointly the determinants of fertility, child education and health in Baringo district of Kenya.

The child quality-quantity model by Becker and Lewis (1973) has been applied in many countries. The model is based on the prepositions advanced by New Home Economists. The mechanism of the relationship between child quality and quantity at the micro level is the central issue of this model. An increase in the number of children (quantity) decreases the demand for child quality and vice-versa. This substitution process depends on the market or shadow prices, income, level of child investment and the parents own consumption level of other goods. This model is presented in the theoretical framework.

Such a basic model which has worked in developed countries can be practically applicable in the developing ones only under certain conditions. Human time in these countries is cheap given the low opportunity cost of labour. Other characteristics of developing countries are high illiteracy rates, high mortality rates, poor knowledge of family planning methods, greater use of children as security in the old age and the existence of strong simultaneity in market activity and child production. These characteristics weaken the explanatory power of the basic model as developed by Becker and others. The present chapter attempts to give an account of the extend of the applicability of this model mainly in developing countries.

BECKER and TOMES (1976) dropped the assumption that all children are of equal quality and considered the effect of differences in child quality and endowment in the family and they found these to have significant effect on family sizes.

WOLFE B.L. & BEHRMAN J.R. (1982) used household data from Nicaragua. They were interested in child health and nutrition status since these variables determine adult productivity and the earnings of children. They referred to this notion as the inter-generational socio-economic mobility. The study begun finding out how a household makes joint decisions on child quality variables ie health, nutrition and survival. They also bring out the determinants of these variables. Economic models of household behaviour are used in this analysis. Current health and nutritional status are given by child standardized weight while long run or permanent health and nutrition status is given by standardized height and biceps circumference.

This study has made the following contributions in this area-

a) The additional time for child care which women who work in the informal sector have, tends to improve current but not permanent child health in the urban centres.

b) Male's schooling is associated significantly with permanent but not current child health implying that this variable represents basic genetic endowment in the case of the father.

c) Income and purchasing power in general is not a major determinant of child mortality, health and nutrition status.

d) Parental schooling particularly that of the mother does have a significant positive association with child health and nutrition status.

e) Family size and the number of siblings in particular are inversely associated with child health and nutrition.

f) Average household caloric intake and the presence of refrigeration are significant determinants of child quality.

g) Sewer systems and better water supplies are also significant in regard to child quality.

h) The impact of the length of time taken in breast-feeding on child health and nutrition was not conclusive.

BEHRMAN AND WOLFE (1987) studied the roles of family background and school availability on education levels attained by members of a household in two generation in the pre-revolutionary Nicaragua. These factors underlie the demand and supply of schooling, but are usually ignored in empirical estimates. The data is on adult sisters and their offsprings which is used to identify inter-familial and intra-familial effects and also to control for unobserved family background.

The study concludes that-

a) unobserved family backgrounds and school supply factors are important in the level of schooling achieved.

b) omission of these factors lead to overestimates of the impacts of parental schooling and family size.

c) both parental schooling and family size primarily represent

unobserved family background and school supply in the standard estimates.

WOLPIN K.I. & ROSENZWEIG M.R. (1982) studied the joint effects of government health, education and family planning programmes as well as sources of water on fertility, child mortality and schooling. They used rural household data from India, which showed that fertility and the two characteristics of children ie schooling and health are substitutes. On the other hand it was also found out that schooling and child health are complements. Therefore, the provision or subsidization of the cost of contraceptives or medical services and/or improvement of water sources are mutually reinforcing strategies in pursuing jointly lower population growth rates, improvement in child survival and education. The results in this study are consistent with household optimizing behaviour.

BIRDSALL (1985) carried out a study on public inputs and child schooling in Brazil using household data from a one percent sample of the 1970 Brazilian Census. The data was to analyze the effect of public inputs eg the availability of schools on child's school attainment. The data was combined with measures of school availability and quality of education derived from the same census data. The measures of quality are based on the income and education of schoolteachers in each of the 169 different areas of the country.

Several conclusions were given-

a) elasticities of demand with respect to these public inputs were estimated and found to be high in both rural and urban areas.

b) In urban areas, the positive effects of public inputs is greater for children from households with poorer and less educated parents.

c) In rural areas, the positive effect of public inputs is greater for children from households that are relatively better-off compared to other rural households.

H0RTON (1986) using household data from the Philippines examined jointly household decisions regarding family size and child quality. Nutritional status of children is used as a measure of their quality. Maximization of the family production function is used as the theoretical basis for analysis. The empirical analysis is based on the quantity-quality framework.

Parental education, Maternal occupation and the infant and child mortality rates were found to bring about the substitution between child quality and quantity. Parental education is the only variable that features significantly in both the quality and quantity equations. The prediction that mother's rather than father's education would have more significant effects were not confirmed in this study.

Horton concluded her study by examining the effects of birth order and the sex of the children on nutritional status in the quality equation.

BEHRMAN & WOLFE (1987) in a study in Nicaragua from 1977-78, they collected data on women of childbearing ages (15-45 years) to test the hypothesis that mother's education has a positive effect on her own and her children's health and nutrition in the developing countries.

In this study child health is proxed by weight, height and biceps circumference. Household nutrition is given by calorie intake, protein and the ownership of a refrigerator.

The study assumes that only mother's education and not her endowment or that of the community had an effect on child quality. In summary the study concluded that the strong positive effect of mother's schooling on health and nutrition is most likely an overstatement. Therefore there is need to control for mother's endowment of health knowledge , habits and health status formed during childhood.

BEHRMAN (1988) studied the intra-household allocation of nutrients among children in Rural India to find out the birth-order effects. Critical issues determining the way parents allocate this resource between and among their children is the essence of this study.

When food is scarcest, parents follow more closely a pure investment strategy. This strategy usually results in the exposure of their more vulnerable children to greater malnutrition risk.

HOSSAIN S. I. (1990) studied the inter-relations between Child education, health and family size using data from Bangladesh between 1979 and 1980. He used the consumer theory for his analysis. The aim of his study was to design a model that tests the empirical applicability of the New Home Economics as postulated by Becker and Lewis. He came up with a number of findings.

The reduced form estimates suggested that mother's education and mother's childhood background have a significant effect on demand for child quality. The demand for child quantity does not have direct effects with these variables. Hossain also examined the issue of whether a greater number of children causes a lower per child education and survival per child. He found out that an increase in the number of children does not exert pressure on child schooling since the coefficient estimates of fertility and schooling were found to be positive and significant. Therefore households in this sample do not view fertility and child education as strong substitutes. Child schooling does not rise indirectly by lowering the family size. Quality of children is not necessarily higher in households with low fertility. With regard to the mortality structural equation there is some evidence that,larger family sizes affect negatively the quality of children. He also found out that income elasticity for child quality is negative. Results indicate that direct and indirect costs(ie opportunity cost or forgone alternatives of child labour) are low because only younger children attend school. He also noticed that economies of scale exist in financing education since the older

siblings and members of the household pay for younger sibling's school-fees. This can even result into a positive relationship between child education and parental fertility in the extreme cases.

THOMAS, STRAWS & HENRIQUES (1990) studied the impact of household characteristics on child survival, health and their nutrition status using household data from Brazil. Parental height are used to proxy for unobserved family background characteristics. Child height for age and sex is used to represent the health and long-run nutrition status of the child.

The following were their findings-

a) Parental education was found to have a strong positive effect on both child survival and height.

b) Parental heights are also important determinants of both child height and survival. Here the influence of maternal height is greater than that of the father which could be due to the fact that the mother plays a greater role in child care. The impact of maternal height is even larger in the poor rural areas.

c) Maternal education has a greater impact on child survival in poorer areas than the relatively better-off areas.

d) Income also has a similar effect to that of maternal education. The income effects are significant and positive for child survival but insignificant for child height.

BARRERA (1990) analyzed data from the Philippines in her study on the role of maternal schooling and its interaction with public health programmes in child health production.

A number of questions are answered in this study ie

a) does mother's schooling affect child health?

b) If so, does its impact vary across child age groups?

c) How and why does maternal schooling affect child health?

The endogenous variable in this study is the health of the child proxed by standardized height for age. The proxy is chosen because it represents long-run measure of nutritional status and it is not subject to transitory shocks.

A more educated mother has better health knowledge which enables her to control her immediate environment and to better appreciate the value of heath inputs.

Therefore maternal education affects child health by influencing the productivity of health inputs ie efficiency effect and by lowering the cost of information,that is allocative effect.

BEENSTOCK AND STURDY (1990) studied the determinants of infant mortality in regional India. Factor analysis was used to estimate a model in which infant mortality across Indian states is explained by socio-economic variables. The following were the significant variables discovered-

a) availability of medical services b) medical attention at birth c) nutrition levels d) clean drinking water e) poverty levels f) literacy of the parents g) vaccinations at birth h) religious beliefs i) caste j) tribe k) extend of overcrowding of the family in a small place of dwelling.

BARRERA (1991) estimated a non-linear relationship between duration of breast-feeding and child health. The health of the child is measured by taking measurement on height-for-age. The sample consisted of 498 children below 25 months of age. In order to estimate this relationship a health production function of the standard household production model was used.

Results of this study show that-

a) Health benefits from unsupplemented breast-feeding differs according to the mother's education. Children of less educated mother's derive the most gains.

b) On the other hand more educated mothers are able to provide wholesale substitutes to breast milk without producing ill effects.

### 3.1 Literature Review on Kenya

Studies on the determinants of the socio-economic wellbeing of children and their joint interrelations have not been carried out in Kenya extensively. Most studies in this regard have dwelt mainly on one variable ie fertility. Other studies have looked at mortality, nutrition and education in isolation and mainly from demographic, social and medical point of view.

AMODI N.K. (1980) carried out a study on the determinants of family size using urban data from the developing economies of Kenya and Nigeria. He used both static and dynamic (sequential) models in the multivariate analysis based on modern techniques in microeconomics. In a simultaneous equation context the determinants of the quality and quantity of children were also

investigated.

The following findings were forthcoming :

a) family income, duration of marriage, age of women, the proportion of sons in the family are all positively related to family size while polygamy has no significant effect on fertility.

b) education of women, infant mortality rate, migration, family planning practices and separate habitation of married couples all depress fertility.

c) the lifetime family income and wife's education interactive variable has a negative effect on family size while the individual variables have positive effects. Thus the interaction model explains the non-linear effects of these individual variables.

d) the income elasticity of the quantity of children and that of their quality are both positive, but the former is larger.

e) the sequential model analysis of the additional number of sons desired showed that the motive of at least one more son is very strong.

There were no major differences in the results from the data on the two countries under study.

KIBUA (1977) using secondary data on Kenya found out a positive relationship between population growth and the growth of GDP and an increase in urbanization. An inverse relationship was found between population growth and female employment, health, marketed agricultural output and family planning utilization.

MUHINDI (1980) found that household average income and fertility are positively related. Parental education, female labour participation were negatively related to fertility. Family planning utilization, land holdings, infant and child mortality were positively related to fertility. Infant mortality was very significant in its influence on fertility while parental ages were found to be otherwise.

KIBUA (1981) using regression analysis found a positive relationship between fertility and mortality, husbands education, income and property. On the other hand there is a negative relation between fertility and the number of livestock owned, wife's education and land. Mortality was found to be the most crucial explanatory variable in the model.

AOKO (1989) carried out a study in the Mathare and Nairobi South regions of Nairobi to find out the effect of status on fertility. Socio-economic status (measured by educational levels, occupational status, age of a woman, age of the woman at first marriage, infant mortality and family planning practice) was found to be the main determinant of fertility levels in urban areas. People with low socio-economic status have more children than those with higher status.

## 3.2 Overview of the Literature

The above review shows that there is a close relationship between the quality and quantity of children. The quality of children has been represented by a number of variables. Some of these variables are health, education, genetic endowment and nutritional status of children. Health status is a crucial indicator of welfare after nutrition and food security. Indicators of the health status are crude death rate, infant and child mortality rates, life expectancy at birth and the availability of medical staff and facilities per capita among others. In this study we shall use the child mortality rate as an indicator of the health status of children.

We shall adopt the methodology used by Hossain (1990) in Bangladesh to test the applicability and relevance of the child quality-quantity model in Baringo district. The methodology will be adopted since it uses variables that can easily be quantified in terms of cost, time and availability of data. However, this study will substitute some variables with those that are relevant given the socio-economic background of Kenya and Baringo district in particular. The area under study is representative of the whole country in as far as attitudes towards family size are concerned.

# CHAPTER FOUR

## THEORETICAL FRAMEWORK

### 4.0 Theoretical Foundation

Within the household choice models, households are expected to maximize utility by choosing an optimal combination of consumption `goods' given their income. This is the framework within which the present analysis will be carried out. The unit of observation for testing the model is the married woman. One of the consumption goods will be children's services, since households derive utility from the services provided by children either directly or indirectly. Several assumptions will have to be made in order to utilize this framework satisfactorily:

(i) all variables and the functions formed from them are continuous and differentiable.

(ii) the price of market goods and the optimal quantities are positive.

(iii) parents are able to rank their preferences in regard to the quantity and quality of children they desire.

(iv) parents are also assumed to consume non-child related commodities apart from children.

(v) there is a relationship between the quantity and quality of children in the parents utility function.

(vi) the quality of children in a given household is the same because the endowment of each child and parental expenditure on each child is assumed to be equal.[7]

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7 A model in which this assumption has been relaxed can be found in Becker G.S. and Tomes Nigel (1976).

(vii) there is no birth-order effect and no influence from the gender of the child.[8]

(vii) households can choose and obtain with certainty any number of children they desire.

Apart from the above assumptions all others relating to consumer utility maximization apply.

The house-hold utility function can be expressed as follows

$$U=U(F, M, E, Z) \quad \text{----------} \quad (1)$$

where F is the fertility level of a household (FERT1)

M is the index of child mortality (MORT2)

E is the average education of surviving children (EDUC)

Z is a composite of other consumption items

The utility function is maximized subject to a full income budget constraint of the following form

$$Y= FE\pi_c + FM\pi_d + PfF + P_eE + P_mM + P_zZ \quad \text{---------} \quad (2)$$

Where $\pi_c$ and $\pi_d$ are the cost minimizing levels of quality inputs required to increase the quality of one child by one unit, i.e, the cost minimizing shadow prices.

$P_f$ is that part of total child cost that is independent of the levels of E and M chosen.

$P_e$ is that part of total child cost that is invariant with respect to the levels of F or M chosen.

8 Behrman J.R. (1988) : 43-62, has relaxed some of these assumptions.

$P_m$ is that part of total child cost that is independent of the levels of F or E chosen.

In this modified equation, it can be seen that the expenditures on EDUC and MORT2 depend on the levels of FERT1 chosen. Therefore, for fewer children parents will encounter a lower actual shadow price for quality, and for more children the actual shadow price is higher. If mortality falls, then parents will face a lower shadow price for quality since increases in the chances of children surviving would normally mean higher child productivity and thus create the need to reduce FERT1 among parents.

## 4.1 Justification of Variables

Child quality, unlike the quantity of children can be expanded or contracted in order to adjust the utility derived from children. An indifference curve can be drawn in the utility space to represent this observation if we assume that actual family sizes represent the desired quantity of children (Fig.1). Desired number of children can be revised from time to time while the actual numbers are not easily adjustable particularly downwards.

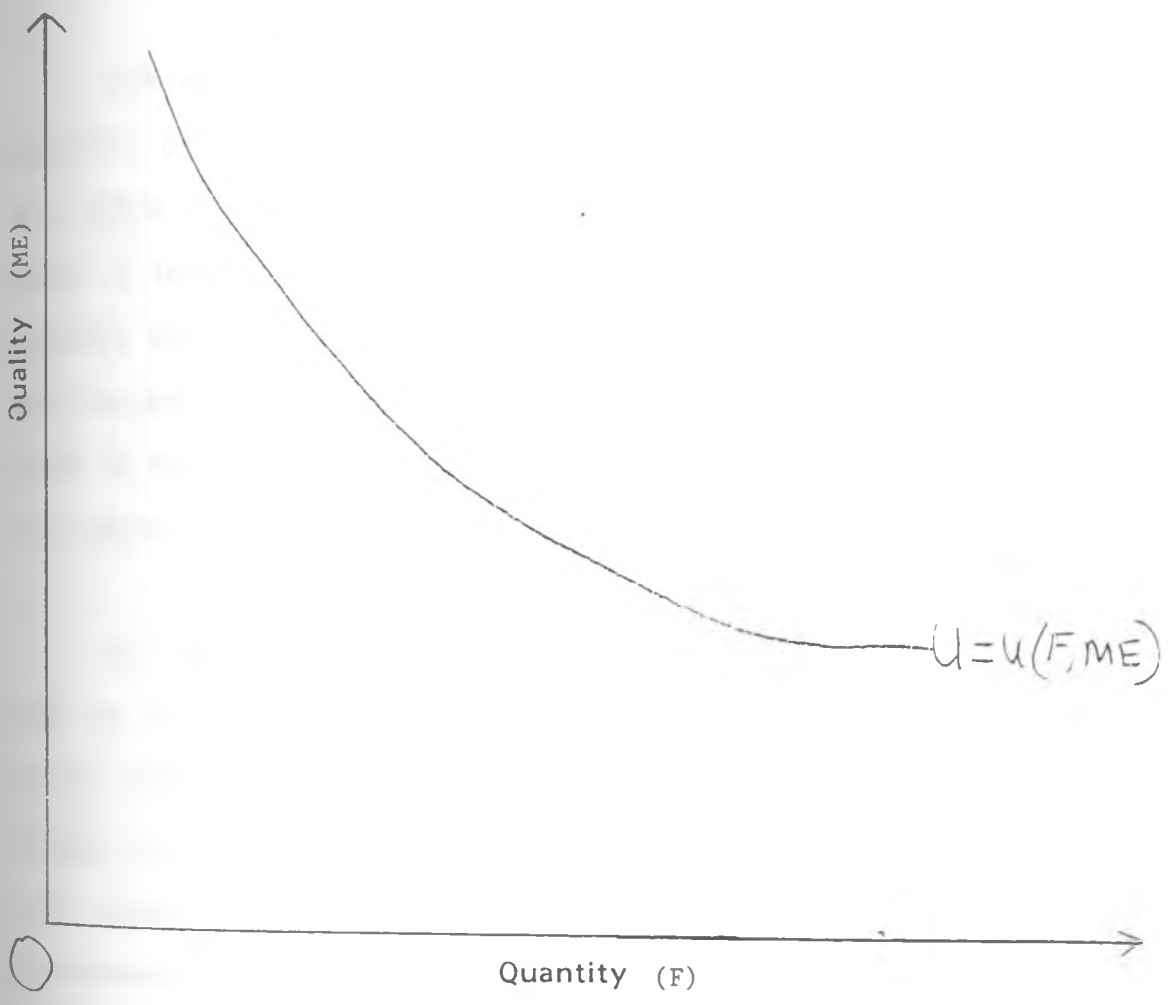



Figure 1: The Utility Curve

The quality of children is dependent on their quantity given the limited resources and income parents face. Again the quantity of children can only be adjusted downwards if the preferred or desired number of children is the issue in question.

However, upward adjustment could also be limited by biological and environmental factors. Enviromental factors like parental education, parental age, religion, information availability on several issues influence the degree or efficiency with which households can adjust to changes.

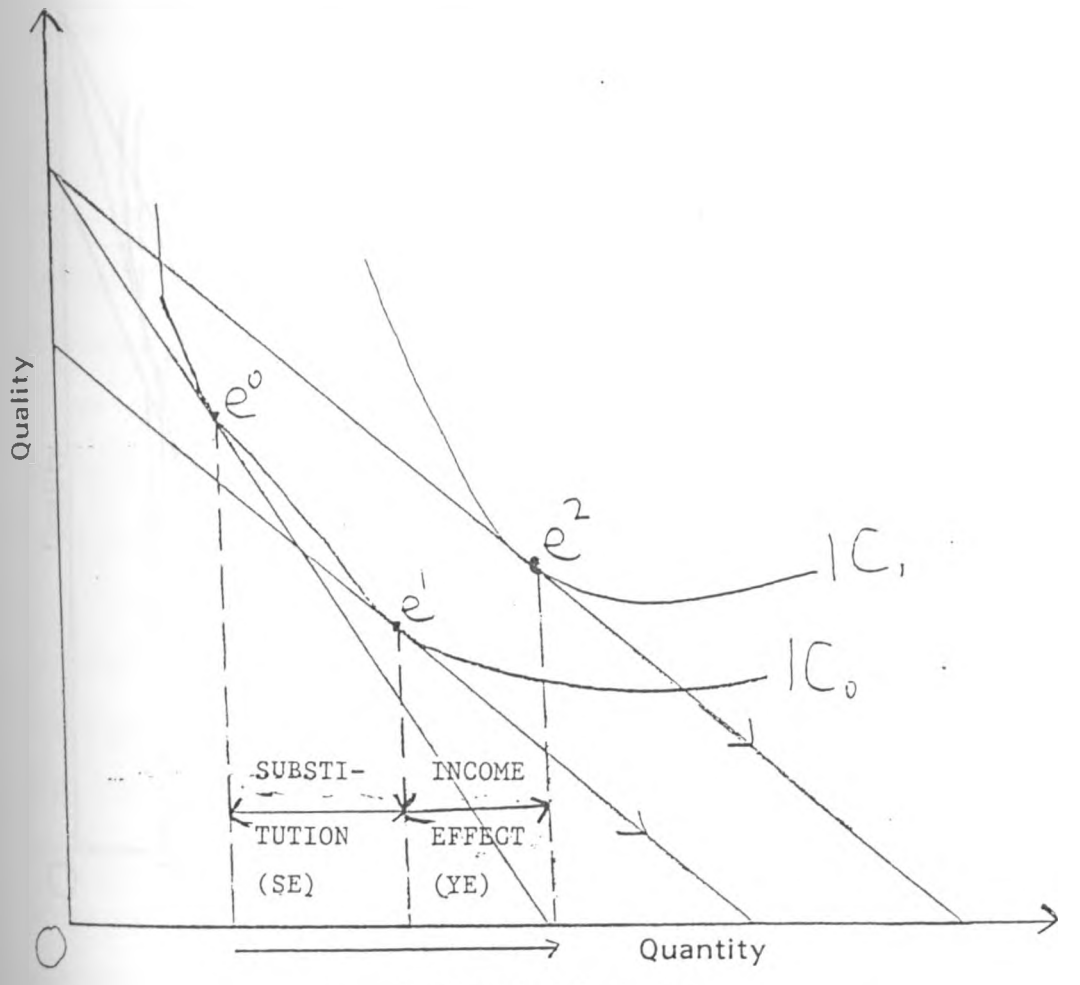
The level of income (determines the time allocated to the attention of children or to the production of consumption goods) and other property owned (in this case land) by the household show a family's constraints to utility maximization. The level of parent's education can be used as a proxy for market wage rates and consequently their value of time. The level of education is used to measure the value of time due to the undeveloped market for wages in most developing countries.

An increase in income or land owned will shift the budget line to higher indifference curve. Before the 'threshold level', a family will now consume more in terms of child quantity ie a desire for more children is created. Beyond this level a family will consume more in terms of child quality ie increased investment in the existing children as a result of the rise in income.

Father's income (proxed by years in education) is likely to be more important in the desire for quality children because it represents an uncompensated rather than compensated wage effects. This implies that income effects of the father's wage are

greater than that of the mother.

A change in the general price level (ie $P_f$, $P_m$, or $P_e$) will likely create the substitution (utility held constant) and income (price held constant) effects. Changes in prices could be caused by the degree of availability of services like family planning, schooling and health facilities.

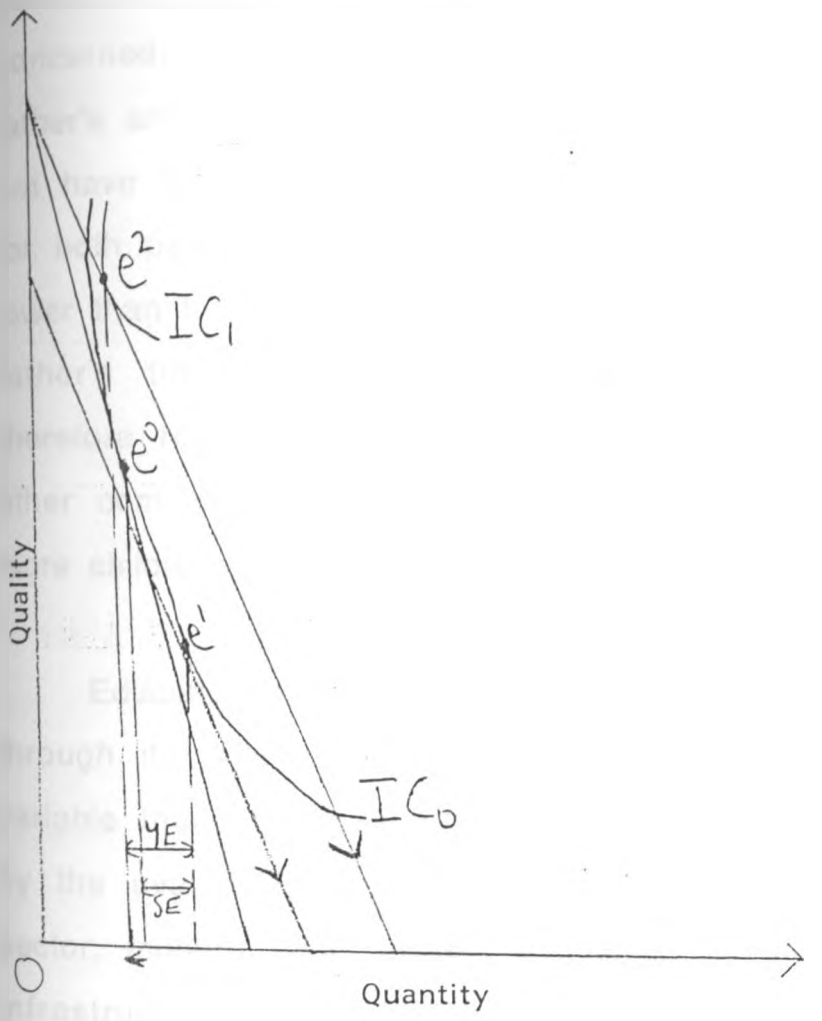



$e^o$ - before fall in price

$e^2$ - after fall in price

Figure 2 shows the case where a fall in the price of birth control devices, $P_f$ leads to a higher demand for children.

In economic terms, a desire for more children as a result of a fall in price means that they are a `normal good' and this is the first stage of socio-economic development.




$e^{\circ}$ - before fall in price

$e^{2}$ - after fall in price

On the other hand Fig.3 represents the case where a fall in the same price results in a lesser desire for more children.

The implication is that the quantity of children is an inferior good and according to our definition this is the second stage of socio-economic development.

This study will emphasize the changes in the price of time, particularly that of mothers in as far as child rearing is concerned. Given differences in the intensity of children in father's and mother's time an increase in the price of time will not have similar effects on the quality and quantity of children for both parents. The price effect of father's time on fertility is lower than that of the mother because children's quantity are not father's time intensive. An increase in the father's wage therefore reduces the price of children relative to the price of other commodities. This substitution effect creates a desire for more children and hence re-enforces the income effect.

Education affects the decision making process of the family through its influence on parental tastes and preferences. This variable thus creates information effects similar to those caused by the availability of birth control devices, residence in urban sector, modern items owned, availability of schooling and other infrastructural facilities. Besides information effects these variables also reduce the cost of acquisition and utilization of inputs which go into the decision making process for instance knowledge of hygiene, nutrition and birth control.

Mother's education can also enhance the quality of children through better use of available health inputs (efficiency effect) and cheaper access to information about the availability of these inputs (allocative effect).

Maximization of utility function subject to the modified budget constraint yields the first order conditions as follows-

$$\frac{\partial u}{\partial F} = MU_f = (\pi_d E + P_f) = \varsigma\pi_f \quad \text{----------} \quad (3)$$

$$\frac{\partial u}{\partial E} = MU_e = (\pi_c F + P_e) = \varsigma\pi_e \quad \text{----------} \quad (4)$$

$$\frac{\partial u}{\partial M} = MU_m = (\pi_d F + P_m) = \varsigma\pi_m \quad \text{----------} \quad (5)$$

$$\frac{\partial u}{\partial Z} = MU_z = \varsigma P_z \quad \text{----------} \quad (6)$$

where ç is the marginal utility of full income and $\pi_f$, $\pi_e$ and $\pi_m$ are the shadow prices of FERT1, EDUC and MORT2 dependent in part on the level of FERT1, EDUC and MORT2 chosen, while MU represents marginal utility. By solving the first order condition of the utility function the following demand equations are obtained

$$F = F(Y, \pi_c, \pi_d, P_f, P_e, P_m, P_z) \quad \text{----------} \quad (7)$$

$$E = E(Y, \pi_c, \pi_d, P_f, P_e, P_m, P_z) \quad \text{----------} \quad (8)$$

$$M = M(Y, \pi_c, \pi_d, P_f, P_e, P_m, P_z) \quad \text{----------} \quad (9)$$

$$Z = Z(Y, \pi_c, \pi_d, P_f, P_e, P_m, P_z) \quad \text{----------} \quad (10)$$

Equations (7) to (10) are unconditional (reduced form) demand equations, which can be estimated using OLS. In order to represent interactions between FERT1, EDUC and MORT2 in accordance with equation (2) the following conditional demand equations can be obtained-

$$F = \phi(E, Y, \pi_c, \pi_d, P_f, P_m, P_z) \quad \text{----------(11)}$$

$$E = \phi(L, Y, \pi_c, \pi_d, P_e, P_m, P_z) \quad \text{---------- (12)}$$

$$M = \phi(L, Y, \pi_c, \pi_d, P_m, P_e, P_z) \quad \text{---------- (13)}$$

These conditional demand equations are obtained by solving for Pf in FERT1 equation and substituting the results into equation EDUC. Similarly by solving for Pe in the EDUC equation (and Pf in the FERT1 equation) and substituting the results into the FERT1 and MORT2 equation. These demand functions are assumed to have continuous partial derivatives, are single valued functions in price and income, are homogenous of degree zero in price and income and are negatively sloped with respect to price.

## 4.2 Choice Variables

The study considers the following three choice variables facing households ie

### 4.2.0 child quantity (FERT1)

This variable can be given as Children Ever Born to a woman, although this is appropriate only when women of the same age are considered. Since we shall deal with women of various ages,

fertility will be standardized by a natural fertility schedule. Hence fertility will be given as follows

$$\text{Fertility} = \frac{\text{Children ever born}}{\text{Children which a woman at a certain age can get if she does not practice birth control (ie natural fertility)}}$$

The ratio takes into account both women who have completed and not completed fertility.[5] The natural fertility schedule which will be used is the one developed by Rosenzweig (1978) for developing countries and has been use by Kibua (1981).[6]

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5 Amodi (1980) defines completed fertilty as the cumulative fertility of a cohort at the time when all its living members (in the case of birth cohort) or its youngest living members (in the case of marriage cohort) reach the end of reproductive period.

6 See appendix 1 for the schedule developed by Mark Rosenzweig for developing countries.

4.2.1 child quality

Quality is represented by the educational and health status of a particular child.

(i) the education variable (EDUC)

This variable is a household index of the school attendance of children aged 5 and over in a particular household (Birdsall Nancy, 1980: 115-150). This Index standardizes for the age distribution of children given fixed age patterns of attendance based on mean population age-groups. The education index ($I_K$) for household K, with $n_I$ children in each age group i is given as follows

$$I_k = \frac{\Sigma n_{ki} e_{ki}}{\Sigma n_{ki} e_i,}$$

where i=5-9, 10-14, 14+

$e_i$ = mean school attendance rate for boys or girls in age group i in the population

$E_{ki}$= dummy indicating whether or not a child in age group i in household k is attending school.

Sex specific rates could be computed from the data for children aged 10 and above. This study does not consider sex differences.

(ii) Mortality variable (MORT2)

Health status represented by mortality Index, $M_i$ is calculated as given in Appendix (II).

# CHAPTER FIVE

## METHODOLOGY

### 5.0 Model Specification

Based on the analytical framework, the structural equations corresponding to the conditional demand equations (11) to (13) are as follows:

$$FERT1=\partial_0 + \partial 1\ EDUC + \partial 2\ MEDUC + \partial 3\ INC1 + \partial 4\ FEDUC + \partial 5\ MAGE + \partial 6\ MEDAGE + \partial 7\ ACRES1 + \partial 8\ UBC + \partial 9\ RES + \partial 10\ FAGE + \partial 11\ SIZE + \partial 12\ WAT1 + U1 \quad \text{-------} \quad (14)$$

$$EDUC = \beta 0 + \beta 1\ FERT1 + \beta 2\ MEDUC + \beta 3\ INC1 + \beta 4\ FEDUC + \beta 5\ ACRES1 + \beta 6\ RES + \beta 7\ SCH + \beta 8\ FAGE + \beta 9\ SIZE + U2 \quad \text{----------} \quad (15)$$

$$MORT2= \yen_0 + \yen 1\ FERT1 + \yen 2\ MEDUC + \yen 3\ INC1 + \yen 4\ FEDUC + \yen 5\ MADAGE + \yen 6\ RES + \yen 7\ MIO + \yen 8\ FADAGE + \yen 9\ SIZE + \yen 10\ WAT1 + U3 \quad \text{----------} \quad (16)$$

F, E, M are endogenous to the household

where

F - fertility level of a particular household

E - the investment in education per child

M - a measure of childhood mortality that represents child health

U - stochastic error term

From both empirical and theoretical literature, it is explicit that the relationship between child quality and quantity is comprised of complex interrelations. In order to make a realistic mathematical framework of such relations there is a need to capture all the variables involved and take into account their feed back effect.

## 5.1 Estimation Techniques

Regression methods are utilized in the analysis in order to examine the statistical significance of each explanatory variable as well as that of all the explanatory variables combined.

COEFFICIENTS OF THE STRUCTURAL EQUATIONS

| | EDUC | FERT1 | MORT2 | SCH | MEDUC | INC1 | FEDUC | MAGE | MEDAGE | ACRES1 |
|---|---|---|---|---|---|---|---|---|---|---|
| FERT1 | -∂1 | 1 | 0 | 0 | -∂2 | -∂3 | -∂4 | -∂5 | -∂6 | -∂7 |
| EDUC | 1-β1 | | 0 | -β7 | -β2 | -β3 | -β4 | 0 | 0 | -β5 |
| MORT2 | 0 | -¥1 | 1 | 0 | -¥2 | -¥3 | -¥4 | 0 | -¥5 | 0 |

| | UBC | RES | MIO2 | FEDAGE | FAGE | SIZE | WAT1 |
|---|---|---|---|---|---|---|---|
| FERT1 | -∂8 | -∂9 | 0 | 0 | -∂10 | -∂11 | -∂12 |
| EDUC | 0 | -β6 | 0 | 0 | -β8 | -β9 | -β10 |
| MORT2 | 0 | -¥6 | -¥7 | -¥8 | 0 | -¥9 | -¥10 |

This model is mathematically complete since it contains as many equations as endogenous variables.

Estimates with OLS will be biased and inconsistent because of the inter-correlation between error terms and the right- hand-side (RHS) variables ie because of the simultaneity between F and E on one hand and between F and M on the other. In order to avoid this problem the following procedure shall be carried out-

a) reduced form estimates of the unconditional demand equations (7) to (9) are required and then

b) two-stage-least-squares (TSLS) estimates ofthe structural equations E and M for conditional demand equations (12) and (13) are calculated since they give consistent although biased results.

F has to be treated as endogenous in these cases in order to preserve the property of consistency necessary for statistical estimation. We are likely to face the problem of identification in our estimations which is inherent in all simultaneous equation models. [9]

In order to uniquely estimate the parameters from the sample data we need to examine the statistical formulation of the model. Two rules for finding out the identification of the structural forms of models will be used here ie order and rank conditions (Koutsoyiannis, A., 1977 and Johnson J., 1972 : 342-344).

The order condition of identification requires that the total number of predetermined and endogenous variables excluded from an equation must be at least as large as the number of endogenous variables included in the equation less one.

$$(G - G^*) + (K - K^*) \geq (G - 1)$$

Where $G^*$ is the number of endogenous variables present in an equation.

$K^*$ is the number of predetermined variables present in the equation.

$G$ is the number of endogenous variables in the model

$K$ is the number of predetermined variables in the model.

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9 A discussion on simultaneous relations and econometric treatment is given by Rosenzweig M.R. and Wolpin K.I., (1980) : 209-225.
Also see Fisher, F.M., (1966).

| EQUATION | G-G* | K-K* | G-1 | IDENT. STATUS |
|---|---|---|---|---|
| FERT1 | 1 | 3 | 2 | OverIdentified |
| EDUC | 1 | 6 | 2 | OverIdentified |
| MORT2 | 1 | 5 | 2 | OverIdentified |

However, the order condition is only a necessary but not sufficient condition for identification. This condition may be satisfied and yet it is not possible to estimate the structural parameters of an equation from the model's reduced form coefficients.

Rank condition is both a necessary and sufficient condition for identification. This condition states that, in a system (model) of G equations any given equation is identified if it is possible to construct at least one non-zero determinant of order (G - 1) from the coefficients of the variables excluded from that particular equation but contained in the other equations of the model. For any equation to be considered as identified in this model we should get at least one non-zero determinant of order two.

| EQUATIONS | MATRICES OF EXCLUDED COEFFICIENTS |
|---|---|
| FERT1 | β7 0 0 0<br>0 ¥7 ¥8 -1 |
| EDUC | ∂5 ∂6 ∂8 0 0 0<br>0 ¥5 0 ¥7 ¥8 - 1 |
| MORT2 | 0 ∂5 ∂7 ∂8 ∂10 ∂1<br>β7 0 β5 0 β8 -1 |

All the above matrices have ranks of two and are therefore identified since G-1 = 2 where G is the number of equations in this model.

Since (G-G*) + (K-K*) > G-1 for the order condition and the rank of all the matrices is G-1, all the three equations are over-identified. Therefore, the parameters of these structural equations are estimatable.

Equation (14) above will use UBC MEDAGE and MAGE as instrumental variables for identification purposes.

Instrumental variables for equation (15) is SCH while MIO will be used for the identification in equation (16).[10]

Assumptions necessary for the application of the above techniques are again assumed to hold.

## 5.2 Model Independent Variables

The independent variables which will be considered in this study are as follows-

(a) Parental Education:

This variable is measured by the number of years in education and it indicates the opportunity cost of parents' time forgone in the rearing of children. Parent's education is a good proxy for female and male wages since the market for this income is underdeveloped particularly in the rural areas.

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10 Tomes Nigel (1978) identified by ommiting father's education from the quantity equation and father's age from the quality function.

Birdsall Nancy (1980) on the contrary enters an interaction variable between mother's age and her schooling in the quantity but not quality function.

(i) Mother's education (MEDUC)

Education of the mother indicates the `price' of child quantity which represents forgone income due to child care. The variable increases the economic resources available to the family through assortative mating with wealthier men, her own increased earnings from market efficiency gains and by an increase in full incomes brought about by non-market efficiency gains ( Schultz, T.P. 1984, Ware, H. 1984 and Michael, R.T. 1973 : 306-327).

Female education has been found to augment the productivity of health inputs through an increase in the mother's non-market efficiency (Michael, R.T. 1973). The allocation of resources is also improved due to better knowledge and access to information. In addition, household preferences are affected given prices, income, efficiency and information (Caldwell, J.C. 1979).

Mother's education is therefore indicative of the better socio-economic status and willingness of the parents (the mother) to make human capital investments such as better nutrition and better training in home-making which affect her (the mother's) current ability at raising children.

(ii) Father's eduction (FEDUC)

The education of the father represents the aspirations of the household as far as education is concerned. Education is used as a proxy for opportunity cost since it is positively related to income in developing countries and it is easier to compute in empirical research. Calculation of lifecycle full income in order

to get predicted earnings is difficult. This variable is captured in the average cost of a child by c and d in the demand equations (11) - (13).

b) Income (INC1):

Income corresponds to the Y variable in the demand equations. It is transformed into a natural log form in order to capture the likely diminishing returns to expenditure per child and household fertility over time.

c) Father's occupation and age (FAGE)

Occupation of the father affects child quality and quantity since it gives the extent to which the family is exposed to modern living. The urban occupations are likely to lead to greater mobility and greater ability to adapt to new ideas. This variable is represented by $P_Z$ in the demand equations.

d) Family Residence (RES)

This dummy variable shows whether the family's background is in the rural or urban areas. The background affects tastes of the family as far as quality and quantity of children is concerned. Urban families have been known to adapt to new ideas faster, for instance in the use of contraceptives. The cost or price of getting, utilizing and adopting new information is considerably reduced for urban dwellers particularly in poor countries where this information is inhibited by poor communication, restrictive traditions and low literacy rates

among others. Survival rates and life expectancy are as a result likely to be higher in the urban areas.[11] Accessibility to health care facilities is also easier in the urban areas. The establishment of health care facilities can serve as a source of information or as a subsidy to health inputs (by lowering time and monetary costs).

e) Acres of Land Owned (ACRES1)

In developing countries, labour is a crucial factor of production. The demand for labour is likely to increase the demand for children since they are seen as economic assets (Boserup E. 1965). Acres of land owned determines the quantity of labour service required and hence the opportunity cost of children. This variable will be used as a proxy for child labour remuneration and the quantity of children demanded. A number of studies have used this variable as exogenous since the hours and type of work in which children are engaged are mainly fixed and the wages (monetary or non-monetary) are largely determined by past human capital investment.[12]

In the study we assume that land is homogeneous and its utilization is proportional to labour supply.

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11 Factors which influence the levels and changes in mortality rates have been discussed at length by Preston S.H., (1980).

12 Rosenzweig and Evenson (1977) : 1065-1080 computed child labour as an exogenous variable since a separate regression with child labour as endogeneous variable did not significantly vary in terms of signs, magnitudes, or statistical significance.

Behram and Wolfe (1982) : 163-193 used male wage as the exogeneous variable for Nicaraguan data.

f) Mother's Age (MAGE)

Age of the mother is positively related to family size although the timing of children is concentrated at earlier stages of marriage. Amodi (1980) used the natural log of marriage duration in order to incorporate the natural lifecycle effects on fertility.

g) Contraception (UBC):

Use of contraceptives is measured by the number of women who actually use birth control devices and is represented by the availability and therefore the `price' of contraceptives. This is given by $P_f$ in the demand equations.

h) Schooling (SCH):

This variable represents the availability of schooling at household level and it is a proxy for the theoretical $P_e$ . It is given by the percentage of children aged 5-19 actually in school in the different regions of the study area.

i) Modern Items Owned (MIO):

This is a proxy for the theoretical $P_m$ and it is given by the percentage of houses with at least a modern facility, namely iron-roofed shelter. The variable indicates the ability of a household to acquire inputs necessary for the enhancement of the quality of children.

j) Size of a Household (SIZE):

Household size captures the concept of the extended family where opinion on desirable family size has a noticeable effect on the nucleus family.

k) Mother's age and education Interactive Variable (MEDAGE)

The interactive variable for the mother and Fedage (for the father) attempt to capture the influence of schooling on an individual vis a vis those in their age cohorts who are lesser or not educated at all.

l) Distance from water source (WAT1)

The most common source of water for households in a community is taken as an indicator of the predominant type of water connections in the community. Water connections functionally serve to subsidize health inputs (water in this case) and lead to an improvement in the healthiness of the environment.

## 5.3 Hypothesis Testing

The signs and magnitude of the resultant coefficients were tested in accordance with the hypotheses stated in the first chapter. The two main ones can be restated as follows

$\partial M/\partial F > O$ , $\partial E/\partial F < O$

The other hypotheses are presented in table 6 where it is assumed that components of child quality and quantity are substitutes.

TABLE 6 EXPECTED SIGNS OF PRICE CHANGES AND VARIABLE EFFECTS ON FERTILITY, MORTALITY AND EDUCATION OF CHILDREN

| PRICE | VARIABLE | FERTILITY | MORTALITY | EDUCATION |
|---|---|---|---|---|
| | MEDUC | - | - | + |
| | FEDUC | - | - | + |
| | INC1 | - | - | + |
| | ACRES1 | + | - | - |
| | RES | - | - | + |
| | FAGE | + | + | - |
| | SIZE | - | + | - |
| | MEDAGE | - | - | + |
| | MAGE | + | + | - |
| | WAT1 | + | + | - |
| $P_f$ | UBC | - | NA | NA |
| $P_e$ | SCH | NA | NA | + |
| $P_m$ | MIO2 | NA | - | NA |

NB signs assume that income effects are small and all components of child quality and the quantity of children are substitutes, while health and the education of children are complements.

The study shall not attempt to identify the level or magnitude of a threshold level between child quality and quantity due to the limitations of the computer package used (Time Series Computer Package, TSP).

# CHAPTER SIX

## EMPIRICAL ANALYSIS

### 6.1 Analysis

Analysis is based on the results obtained from the estimation of the reduced form equations (Indirect Least Squares estimation) and the structural equations (Two Stage Least Squares estimation).

Families will be divided into two groups depending on their sizes in order to show that family size has a significant influence on the average per child investment/quality.

In addition to family size, subdivision of the sample according to the potentiality (high or low) of the region under study, income per annum, the size of acreage owned (mean and median) and the ages of women (young and old).

Table 7 shows that although all variables are intercorrelated, the degree of correlation among the explanatory variables is not strong enough to cause instability or inefficiency in the estimated coefficients of the variables.

Table 8 shows the means, standard deviations, sample medians, maximum and minimum observations of all variables.

#### 6.1.1 Reduced Form Estimates

Reduced form estimates are presented in tables 9, 10 and 11 as given by the two quality equations and one quantity equation.

TABLE 7 CORRELATION MATRIX

| | MEDUC | INC1 | FEDUC | MAGE | ACRES1 | RES | FAGE | SIZE | MIO2 | MEDAGE |
|---|---|---|---|---|---|---|---|---|---|---|
| MEDUC | 1.00 | .20 | .71 | -.23 | .13 | .23 | -.15 | -.0009 | .08 | .96 |
| INC1 | | 1.00 | .17 | .01 | .20 | .12 | -.03 | .21 | -.16 | .20 |
| FEDUC | | | 1.00 | -.23 | .16 | .08 | -.15 | .06 | .07 | .69 |
| MAGE | | | | 1.00 | .10 | -.04 | .63 | .27 | -.003 | -.06 |
| ACRES1 | | | | | 1.00 | .07 | .18 | .14 | -.27 | .16 |
| RES | | | | | | 1.00 | -.05 | -.02 | -.06 | .19 |
| FAGE | | | | | | | 1.00 | .21 | -.005 | -.05 |
| SIZE | | | | | | | | 1.00 | -.07 | .08 |
| MIO2 | | | | | | | | | 1.00 | .06 |
| MEDAGE | | | | | | | | | | 1.00 |
| SCH | | | | | | | | | | |
| UBC | | | | | | | | | | |
| WAT1 | | | | | | | | | | |
| EDUC | | | | | | | | | | |
| FERT1 | | | | | | | | | | |
| MORT2 | | | | | | | | | | |

| SCH | UBC | WAT1 | EDUC | FERT1 | MORT2 |
|---|---|---|---|---|---|
| .23 | .15 | .09 | .17 | -.12 | -.12 |
| .002 | .23 | .02 | .10 | .009 | .015 |
| .22 | .12 | .04 | .23 | -.06 | -.12 |
| .17 | .03 | .06 | .30 | .45 | .10 |
| .40 | .14 | .12 | .25 | .18 | -.02 |
| .05 | .28 | .05 | .02 | -.03 | .05 |
| .18 | .02 | .05 | .26 | .39 | .08 |
| .13 | .13 | .06 | .31 | .43 | -.09 |
| .20 | -.14 | .10 | .09 | .06 | -.21 |
| .28 | .16 | .10 | .24 | -.02 | -.10 |
| 1.00 | .19 | .28 | .50 | .22 | -.11 |
| | 1.00 | .08 | .09 | .03 | -.03 |
| | | 1.00 | .19 | .03 | -.02 |
| | | | 1.00 | .37 | -.08 |
| | | | | 1.00 | -.21 |
| | | | | | 1.00 |

TABLE 8

MEAN AND STANDARD DEVIATIONS OF ALL VARIABLES

| Variables | Mean | Std dev. | Max. | Min. |
|---|---|---|---|---|
| Dependent Variables | | | | |
| F = child quantity | 4.69 | 2.34 | 11.00 | 0.00 |
| E = child quality | 0.68 | 0.53 | 1.70 | 0.00 |
| M = child quality | 0.84 | 1.30 | 11.57 | 0.00 |
| | | | | |
| Right-hand-side var. | | | | |
| MEDUC | 2.51 | 3.18 | 13.50 | 0.00 |
| FEDUC | 3.13 | 3.51 | 13.50 | 0.00 |
| INC1 | 9.49 | 1.30 | 13.60 | 5.23 |
| ACRES1 | -1.62 | 6.67 | 5.01 | -16.12 |
| ACRES | 10.58 | 18.17 | 150.00 | 0.00 |
| RES | 0.07 | 0.25 | 1.00 | 0.00 |
| FAGE | 39.42 | 11.36 | 90.00 | 16.00 |
| SIZE | 6.15 | 2.36 | 18.00 | 0.00 |
| Control exogenous var. | | | | |
| MEDAGE | 77.09 | 98.46 | 1.00 | 0.07 |
| MAGE | 33.45 | 8.29 | 49.00 | 16.00 |
| UBC | 0.07 | 0.07 | 0.23 | 0.00 |
| SCH | 0.70 | 0.24 | 1.00 | 0.07 |
| MIO | 1.24 | 0.60 | 2.63 | 0.63 |
| WAT1 | 1.61 | 0.61 | 2.00 | 0.14 |
| FERT | 0.71 | 0.28 | 1.68 | 0.00 |
| MIO2 | 1.24 | 0.60 | 2.63 | 0.63 |

a) Child Quantity Equation

The child quantity equation estimates are given in table 9 under various subdivisions.

As expected, mother's education has a negative influence on fertility although not significantly. The estimated coefficient of this variable is consistent with the prediction that fertility is a function of mother's price of time. It also shows that mother's education creates lower information cost of birth control devices.

Female education is not yet crucial in households' fertility decision-making process. The variable is however significant in those households with small land holdings. It appears that ownership of small farm sizes gives strength to the influence of this variable over that of the need for child labour on the farm. The contrary appears in those households that own large acres of land where the effect of the variable on fertility is reversed due to the strong desire for child labour.

Husbands' education is found to be positively related to fertility, but less significantly than the negative effect of mother's education. Since child production is less intensive in father's time, an increase in the husband's education (and consequently earned income) reduces the price of children relative to price of other household commodities. This substitution effect leads to large family sizes. The resulting income effects will also enlarge family sizes due to increased full incomes.

TABLE 9 RESULTS OF THE INDIRECT LEAST SQUARES REGRESSION PRINTOUT FERTILITY(FERT1)

| | CONS | MEDUC | INC1 | FEDUC | MAGE | ACRES1 | RES | FAGE | SIZE | MIO2 | MEDAGE | SCH | UBC | WAT1 | R2 | F STAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1) POTENTIAL | | | | | | | | | | | | | | | | |
| a) H.POT | .62 | -.06 | -.25 | .03 | .07 | .02 | .32 | .035 | .41 | .40 | .0007 | -.07 | -.25 | -.11 | .42 | 11.2 |
| | (.48) | (-.32) | (-2.48) | (.47) | (2.73) | (.6) | (.72) | (2.24) | (6.7) | (1.57) | (.13) | (-.08) | (-.12) | (-.49) | | |
| b) L.POT | -1.45 | -.05 | .16 | -.04 | .07 | .05 | -.61 | .01 | .22 | .10 | -.00001 | .83 | 5.85 | -.32 | .31 | 4.3 |
| | (-.73) | (-.19) | (.99) | (-.53) | (2.47) | (1.66) | (-.38) | (.51) | (2.9) | (.30) | (-.008) | (1.68) | (1.44) | (-1.09) | | |
| 2) FAMILY | | | | | | | | | | | | | | | | |
| a) <6 CHILD | 3.35 | .005 | -.25 | .038 | .0004 | .006 | -.38 | .02 | .17 | .11 | -.0005 | .17 | .61 | -.074 | .20 | 3.0 |
| | (3.9) | (.05) | (-3.28) | (1.24) | (.027) | (.38) | (-.97) | (1.84) | (3.66) | (.62) | (-.14) | (.40) | (.51) | (-50) | | |
| b) >5 CHILD | 1.84 | -.01 | .07 | .002 | .08 | .009 | -.06 | -.007 | .076 | .12 | -.001 | .48 | 1.22 | -.13 | .23 | 4.0 |
| | (1.65) | (-.07) | (.84) | (.04) | (3.82) | (.44) | (-.15) | (.58) | (1.54) | (.62) | (-.19) | (.80) | (.75) | (-.70) | | |
| 3) INC(MEAN) | | | | | | | | | | | | | | | | |
| a) < 35000 | -.45 | .04 | -.12 | -.04 | .08 | .04 | .17 | .02 | .37 | .37 | -0.002 | .75 | -.73 | -.05 | .38 | 12.7 |
| | (-.34) | (.22) | (-1.04) | (-.77) | (4.03) | (2.10) | (.34) | (1.74) | (6.93) | (1.87) | (-.40) | (1.31) | (-.44) | (-.29) | | |
| b) > 35000 | -.42 | -.52 | .15 | .21 | .02 | .03 | .10 | .06 | .19 | .68 | .01 | -.68 | 2.64 | -.98 | .36 | 2.6 |
| | (-.09) | (-1.56) | (.37) | (2.02) | (.32) | (.33) | (.11) | (1.48) | (1.66) | (1.06) | (1.01) | (-.40) | (.60) | (-1.87) | | |
| 4) ACRES(MEAN) | | | | | | | | | | | | | | | | |
| a) < 10.6 | -.74 | -.43 | .02 | -.01 | .05 | 0.03 | .45 | .01 | .34 | .39 | .01 | .77 | .25 | -.04 | .37 | 11.5 |
| | (-.61) | (-2.58) | (.22) | (-.33) | (2.59) | (1.58) | (.83) | (1.15) | (6.32) | (1.81) | (2.36) | (1.44) | (.15) | (-.22) | | |
| b) > 10.6 | 2.57 | .40 | -.29 | .16 | .13 | -.29 | .44 | .03 | .33 | .52 | -.02 | -.90 | -7.08 | -.90 | .41 | 4.05 |
| | (.93) | (1.27) | (-1.71) | (1.25) | (2.98) | (-.71) | (.54) | (1.24) | (8.51) | (1.19) | (-1.95) | (-.39) | (-1.62) | (-2.00) | | |
| 5) ACRES(MED) | | | | | | | | | | | | | | | | |
| a) <5 | .91 | -.66 | -.1 | -.04 | .03 | .03 | .79 | .01 | .31 | .53 | .02 | .7 | 1.13 | -.04 | .34 | 6.07 |
| | (.61) | (-3.14) | (-.77) | (-.68) | (1.14) | (1.47) | (1.17) | (1.22) | (5.12) | (2.18) | (3.23) | (1.14) | (.56) | (.18) | | |
| b) >4 | -.81 | .11 | -.07 | .06 | .09 | -.10 | .06 | .04 | .36 | .22 | -.007 | .88 | -3.3 | -.54 | .42 | 9.53 |
| | (-.54) | (.59) | (-.60) | (.92) | (3.18) | (-.53) | (.01) | (2.38) | (5.43) | (.82) | (-1.27) | (.94) | (-1.34) | (-2.11) | | |
| 6) INC(MED) | | | | | | | | | | | | | | | | |
| a) <13428 | 1.29 | -.03 | -.31 | .01 | .08 | .04 | .83 | .01 | .24 | .52 | -.002 | 1.18 | .84 | .08 | .36 | 7.07 |
| | (.73) | (-.12) | (-1.79) | (.18) | (3.4) | (1.59) | (1.05) | (.67) | (3.63) | (2.2) | (-.3) | (1.5) | (.41) | (.37) | | |
| b) >13428 | .36 | -.03 | -.14 | .03 | .07 | .03 | -.12 | .04 | .36 | .17 | .0003 | .39 | -1.95 | -.47 | .39 | 8.13 |
| | (.17) | (-.18) | (-.7) | (.56) | (2.32) | (1.23) | (-.21) | (2.04) | (5.07) | (.52) | (.05) | (.5) | (-.83) | (-1.7) | | |
| 7) AGES | | | | | | | | | | | | | | | | |
| a) 20-34 | -2.23 | .12 | -.05 | -.05 | .14 | .03 | -.53 | .02 | .36 | .27 | -.005 | .25 | -1.29 | -.17 | .45 | 11.32 |
| | (-1.66) | (.56) | (-.55) | (-1.36) | (3.85) | (1.63) | (-1.31) | (2.15) | (6.31) | (1.48) | (-.57) | (.51) | (-.88) | (-1.07) | | |
| b) 35-49 | 4.01 | .38 | -.15 | .25 | -.03 | .07 | .83 | .04 | .22 | .68 | -.02 | .99 | .22 | -.34 | .2 | 2.83 |
| | (1.45) | (.5) | (-.95) | (2.15) | (-.54) | (2.00) | (.97) | (1.79) | (2.81) | (1.85) | (-.9) | (.93) | (.08) | (-.95) | | |
| 8) GENERAL | -.173 | -.094 | -.094 | .014 | .071 | .040 | .178 | .023 | .324 | .395 | .001 | .713 | -.524 | -195 | .35 | 14.17 |
| | (-.17) | (-.69) | (-1.09) | (.33) | (3.84) | (2.13) | (.41) | (1.98) | (6.88) | (2.06) | (.26) | (1.33) | (-.34) | (-1.11) | | |

Education of husbands is positively correlated to property acquisition (Table 7). Family sizes are an increasing function of property ownership.

The income effect on fertility is negative implying that higher income leads to lower fertility levels. The insignificance of the coefficient implies that the role of income in fertility is over-emphasized in the framework developed by Becker (1981). An alternative reason for the low influence could be attributed to the importance of the `proximate' or biological determinants of fertility where households do not consciously limit their procreation. Studies in other areas with a similar socio-economic background to that of Baringo have also come out with the same findings (Ominde S.H. 1988). When mother's education and other characteristics were controlled for, household income estimates showed a lesser effect on fertility. We can conclude that the price effect of increasing the value of mother's time ( for instance by minimally increasing the years of education completed in school), does not reduce fertility significantly. The effect of land ownership on fertility is however positive and significant. Acreage of land owned determines the amount of labour demanded and hence it is likely to influence fertility rates. Majority of the people in Baringo are pastoralists and farmers. Acreage of land owned can be viewed as a proxy for permanent income. In brief we can state that the effect of wealth or property ownership on fertility is positive and significant while the stream of income from these assets has a negative effect although not significant.

The interactive variable (medage) influences fertility positively indicating that the better educated women have higher fertility levels than their less educated counterparts. The time difference in age of childbearing is not marked between educated and less educated women. In other words educated women do not delay their child bearing age except for those in the above average income group.

Mother's age significantly affects fertility and the implication is that child bearing increases at increasing rate given women ages. Possible explanation could be the reduced birth intervals. This phenomenum is more pronounced among the women between the age of twenty and thirty-four years.

Area of residence is not very important in explaining fertility differentials since the region under study has little urban influence. There is a tendency for women in the households below average income in the urban areas to have higher fertility rates.

Father's age has similar impact on fertility as does that of the mother although the variable is not very significant.

Large household sizes are associated with high fertility rates in a very significant manner particularly among the households with large acres of land. Family sizes determine the extent of utilization of available resources and hence the level of output of goods and services. Greater availability of labour releases more time for leisure and rearing of children.

Although the sign of birth control use (UBC) indicates an inverse association with fertility, which is consistent with the model's prediction, it is not statistically significant. The low

participation rate and scarce availability of these services in some areas due to poor infrastructure may be the cause of this weak association particularly among those below average income. Modern Items Owned by a household do influence fertility significantly in the same manner as land ownership. These two variables could be treated as measures of property ownership or permanent income.

Distances to water points influence fertility negatively contrary to the hypothesis. A less developed service environment has a depressing effect on fertility. The variable could however be related to fertility indirectly through the mortality function. The effect of the area of residence (RES) on fertility is positive contrary to our expectation that urban influence has a negative effect on fertility. Urban women are assumed to be more educated and their residence is expected to exert a negative influence on fertility since there are price differences for births (cost of contraceptives and travel) between the rural and urban areas that affect the taste of women. The price variation is thus expected to have more effect on the tastes of women with urban background compared to those with a rural one.

Acres of land owned (represents the valuation likely to be put on child labour) highly influences fertility levels. The relationship is consistent with the interpretation that under labour intensive technology, marginal productivity of child labour augments the utilization of the land resource. Therefore, households are induced to opt for more children.

b) Child quality equation

i) education

The results for the education equation appear in Table 10. Father's education has a strong effect on a child's education especially among the small family sizes and those households above the average income levels.

Mother's education is negatively related to the school attendance rate of the children however the effect is insignificant. The relation is significant among the younger women.

The strong positive association between children's education and that of the father reveals that fathers have more responsibility in the education of children just like mothers when it comes to their rearing.

Income is associated with higher school attendance rate for children particularly among the households with large family sizes. The minimal influence of this variable shows how much children are valued as a source of labour. This is likely to lead to a rather low school enrolment and irregularity of attendance besides high dropouts.

Household size is significantly correlated with school attendance rates. Large sizes enable work to go on even with the withdrawal of the labour force of those of school going age (ie 5-15 years). Infact large households experience diminishing returns to scale resulting in no decline in production as a result of an increase in school enrolment. This variable thus exhibits economies of scale to the larger families.

TABLE 10 RESULTS OF THE INDIRECT LEAST SQUARES REGRESSION PRINTOUT EDUCATION(EDUC)

| | CONS | MEDUC | INC1 | FEDUC | MAGE | ACRES1 | RES | FAGE | SIZE | MIO2 | MEDAGE | SCH | UBC | WAT1 | R2 | F STAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1) POTENTIAL | | | | | | | | | | | | | | | | |
| a) H.POT | -.85 | -.008 | -.006 | .02 | .007 | -.0002 | -.018 | .006 | .06 | -.09 | .0005 | 1.07 | -.85 | .06 | .38 | 9.75 |
| | (-2.96) | (-.20) | (-.26) | (1.69) | (1.14) | (-.03) | (-.18) | (1.66) | (4.49) | (-1.59) | (.43) | (5.43) | (-1.81) | (1.22) | | |
| b) L.POT | -1.2 | -.04 | .06 | .02 | .01 | .003 | .24 | .002 | .022 | .11 | .001 | .69 | -.59 | .04 | .32 | 4.49 |
| | (-2.6) | (-.7) | (1.48) | (1.2) | (1.76) | (.44) | (.66) | (.5) | (1.21) | (1.45) | (.59) | (2.77) | (-.63) | (.63) | | |
| 2) FAMILY | | | | | | | | | | | | | | | | |
| a) <6 CHILD | -.38 | -.08 | -.04 | .032 | .008 | -.0003 | .21 | .005 | .03 | -.008 | .003 | .72 | -.51 | .1 | .31 | 5.7 |
| | (-1.007) | (-1.69) | (-1.18) | (2.34) | (1.3) | (-.04) | (1.23) | (1.18) | (1.60) | (-.1) | (1.67) | (3.8) | (-.95) | (1.49) | | |
| b) >5 CHILD | -1.3 | .09 | .06 | .02 | .01 | .001 | -.07 | .001 | .03 | .02 | -.003 | .96 | -.04 | .03 | .41 | 9.23 |
| | (-4.45) | (1.83) | (2.57) | (1.70) | (2.26) | (.21) | (-.62) | (.44) | (2.68) | (0.36) | (-1.81) | (6.06) | (-.10) | (.54) | | |
| 3) INC(MEAN) | | | | | | | | | | | | | | | | |
| a) < 35000 | -1.01 | -.02 | .02 | .02 | .01 | -.001 | .02 | .003 | .05 | .02 | .001 | .83 | -.13 | .07 | .32 | 9.98 |
| | (-3.03) | (-.53) | (.64) | (1.59) | (1.98) | (-.16) | (.15) | (.94) | (3.90) | (.32) | (.61) | (5.79) | (-.33) | (1.50) | | |
| b) > 35000 | -.96 | -.0006 | .03 | .05 | .02 | .01 | -.06 | .003 | .01 | .02 | -.0002 | .97 | -.78 | -.08 | .63 | 7.6 |
| | (-1.34) | (-.01) | (.44) | (3.07) | (1.92) | (.91) | (-.39) | (.56) | (.88) | (-.18) | (-.13) | (3.93) | (-1.21) | (-1.02) | | |
| 4) ACRES(MEAN) | | | | | | | | | | | | | | | | |
| a) < 10.6 | -.81 | -.04 | -.01 | .02 | .01 | .003 | .09 | .004 | .05 | .02 | .002 | .75 | -.36 | .10 | .42 | 14.2 |
| | (-2.9) | (-1.06) | (-.51) | (1.99) | (2.42) | (.72) | (.74) | (1.36) | (4.1) | (.42) | (1.21) | (6.04) | (-.96) | (2.42) | | |
| b) > 10.6 | -.27 | -.01 | .04 | .05 | .007 | -.19 | -.02 | .002 | .02 | .04 | -.00031 | .21 | -1.55 | .16 | .33 | 2.8 |
| | (-.47) | (.18) | (1.26) | (2.12) | (.74) | (-2.26) | (-.12) | (.44) | (1.21) | (.46) | (-.18) | (2.50) | (-1.71) | (-1.68) | | |
| 5) ACRES(MED) | | | | | | | | | | | | | | | | |
| a) <5 | -.49 | -.09 | -.03 | .01 | .008 | .005 | .1 | .004 | .05 | .04 | .004 | .7 | -.91 | .11 | .45 | 9.52 |
| | (-1.38) | (-1.76) | (-1.01) | (.92) | (1.39) | (.95) | (.6) | (1.27) | (3.19) | (.74) | (2.12) | (4.77) | (-1.91) | (2.07) | | |
| b) >4 | -1.22 | .03 | .05 | .03 | .02 | -.08 | .05 | .002 | .04 | -.03 | -.001 | 1.25 | -.54 | -.06 | .35 | 6.3 |
| | (-3.69) | (.75) | (1.78) | (2.27) | (2.45) | (-1.92) | (.38) | (.46) | (2.67) | (-.45) | (-.96) | (5.93) | (-1.0) | (1.0) | | |
| 6) INC(MED) | | | | | | | | | | | | | | | | |
| a) <13428 | -1.30 | -.09 | .06 | .03 | .01 | -.01 | .03 | -.002 | .04 | -.05 | .003 | 1.14 | -.09 | .06 | .34 | 6.45 |
| | (-2.89) | (-1.49) | (1.31) | (1.85) | (2.00) | (-2.14) | (.15) | (-.63) | (2.16) | (-.91) | (1.63) | (5.71) | (-.18) | (1.1) | | |
| b) >13428 | -1.13 | .005 | .02 | .03 | .008 | .01 | .04 | .01 | .04 | .04 | -.0000 | .70 | -.71 | .04 | .49 | 11.98 |
| | (-2.76) | (.13) | (.64) | (2.2) | (.39) | (2.24) | (.39) | (2.44) | (3.21) | (.64) | (-.01) | (4.68) | (-1.55) | (.68) | | |
| 7) AGES | | | | | | | | | | | | | | | | |
| a) 20-34 | -.9 | -.16 | -.009 | .03 | .008 | -.0009 | .18 | .007 | .07 | -.05 | .006 | .67 | -.71 | .15 | .45 | 11.42 |
| | (-2.15) | (-2.48) | (-.32) | (3.04) | (.65) | (-.17) | (1.41) | (1.93) | (3.91) | (-.84) | (2.64) | (4.39) | (-1.57) | (2.96) | | |
| b) 35-49 | -.44 | -.13 | .04 | .03 | -.001 | .006 | -.16 | .0002 | .02 | .07 | .003 | .1 | -.1 | -.05 | .33 | 5.32 |
| | (-.89) | (-.94) | (1.57) | (1.54) | (-.11) | (.85) | (-1.04) | (.05) | (1.19) | (1.13) | (.82) | (5.21) | (-.19) | (-.76) | | |
| 8) GENERAL | -.939 | -.017 | .016 | .026 | .011 | .001 | .01 | .003 | .041 | .015 | .0001 | .832 | -.334 | .045 | .37 | 15.64 |
| | (-4.04) | (-.54) | (.85) | (2.75) | (2.69) | (.24) | (.10) | (1.04) | (3.86) | (.35) | (.59) | (6.92) | (-.98) | (1.14) | | |

Availability of school facilities is very significant in its influence on school attendance.

Mother's age is more significant than that of the father when it comes to its contribution in this equation. Older couples have a higher probability of having many children in the school going age than the younger couples.

Acres of land owned is weakly associated with investment in the education of children. The variable was expected to deter schooling (both enrolment and attendance) because an increase in the ownership of land of land requires more child labour and hence tends to keep children from school. However, according to our results the relationship is positive implying that economies of scale may exist resulting in the release of time for school attendance as will be explained later.[13]

More urbanized areas of residence are associated with higher availability of schooling facilities and hence a higher enrolment ratio.

ii) Mortality

Table 11 presents estimated coefficients of the mortality equation.

Mother's age has an expected positive effect on mortality, reflecting a gradual increase in child mortality over time.
Mother's education and modern items owned are negatively related to mortality in a very significant manner.

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13 In the TSLS estimation, the effect is negative showing that the indirect relationship is substantial.

TABLE 11 RESULTS OF THE INDIRECT LEAST SQUARES REGRESSION PRINTOUT MORTALITY(MORT2)

| | CONS | MEDUC | INC1 | FEDUC | MAGE | ACRES1 | RES | FAGE | SIZE | MIO2 | MEDAGE | SCH | UBC | WAT1 | R2 | F STAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1) POTENTIAL | | | | | | | | | | | | | | | | |
| a) H.POT | .76 | -.1 | .07 | .006 | .001 | -.02 | .36 | .005 | -.065 | -.37 | .001 | .07 | .43 | .03 | .08 | 1.38 |
| | (.9) | (-.83) | (1.07) | (.18) | (.06) | (-1.03) | (1.26) | (.53) | (-1.62) | (-2.2) | (.3) | (.12) | (.31) | (.19) | | |
| b) L.POT | 2.12 | -.25 | -.02 | -.02 | -.01 | -.004 | .28 | .01 | -.12 | -.51 | .01 | -1.41 | -2.1 | .14 | .18 | 2.02 |
| | (1.59) | (-1.36) | (-.18) | (-.46) | (.7) | (.16) | (.26) | (.8) | (-2.26) | (-2.29) | (1.56) | (-1.95) | (-.78) | (.74) | | |
| 2) FAMILY | | | | | | | | | | | | | | | | |
| a) <6 CHILD | 1.45 | -.22 | .01 | .03 | .01 | -.03 | .72 | .01 | -.14 | -.64 | .005 | -.12 | .07 | .25 | .14 | 1.83 |
| | (1.18) | (-1.52) | (.10) | (.68) | (.49) | (-1.33) | (1.27) | (.73) | (-2.09) | (-2.64) | (1.13) | (-.20) | (.04) | (1.15) | | |
| b) >5 CHILD | -.5 | .04 | .02 | -.07 | .04 | .003 | .26 | -.003 | .01 | -.34 | -.0008 | .19 | -.17 | .06 | .21 | 3.4 |
| | (-.82) | (.42) | (.48) | (-2.38) | (3.2) | (.26) | (1.14) | (-.46) | (.42) | (-3.27) | (-.26) | (.57) | (-.19) | (.55) | | |
| 3) INC(MEAN) | | | | | | | | | | | | | | | | |
| a) < 35000 | .95 | -.21 | .08 | .01 | .006 | -.01 | .17 | .01 | -.12 | -.44 | .006 | -.35 | -.19 | .09 | .11 | 2.6 |
| | (.99) | (-1.80) | (.96) | (.33) | (.41) | (-.70) | (.46) | (1.13) | (-3.05) | (-3.11) | (1.53) | (-.86) | (-.16) | (.65) | | |
| b) > 35000 | -2.00 | .22 | .16 | -.05 | .04 | -.02 | .57 | -.005 | .032 | -.47 | -.007 | .48 | 1.39 | -.12 | .26 | 1.53 |
| | (-.93) | (1.52) | (.87) | (-1.09) | (1.47) | (-.52) | (1.32) | (-.29) | (.64) | (-1.66) | (-1.54) | (.64) | (0.72) | (-.51) | | |
| 4)ACRES(MEAN | | | | | | | | | | | | | | | | |
| a) < 10.6 | 1.84 | -.18 | -.03 | -.005 | .01 | -.01 | .16 | .006 | -.09 | -.47 | .005 | -.41 | .007 | .07 | .11 | 2.34 |
| | (2.17) | (-1.51) | (-.48) | (-.17) | (.82) | (-.83) | (.42) | (.68) | (-2.36) | (-3.14) | (1.41) | (-1.08) | (.006) | (.57) | | |
| b) > 10.6 | -.23 | -.04 | .14 | -.02 | -.0004 | .19 | .23 | .01 | -.07 | -.58 | .0003 | -.50 | 2.77 | .15 | .13 | .88 |
| | (-.13) | (-.24) | (1.33) | (-.30) | (-.02) | (.76) | (.47) | (.67) | (-1.22) | (-2.20) | (.06) | (-.36) | (1.05) | (.56) | | |
| 5) ACRES(MED) | | | | | | | | | | | | | | | | |
| a) <5 | 1.88 | -.18 | -.02 | .04 | .008 | -.02 | .43 | .009 | -.12 | -.62 | .005 | -.42 | .21 | .13 | .13 | 1.9 |
| | (1.59) | (-1.07) | (-.18) | (.89) | (.45) | (-.89) | (.81) | (.83) | (-2.43) | (-3.1) | (.81) | (-.86) | (.13) | (.71) | | |
| b) >4 | .29 | -.06 | .06 | -.05 | .01 | .1 | .1 | .001 | -.04 | -.33 | .002 | -.06 | .81 | .002 | .09 | 1.25 |
| | (.32) | (-.57) | (.89) | (-1.38) | (.77) | (.86) | (.29) | (.1) | (-1.13) | (-2.04) | (.59) | (-.11) | (.55) | (.01) | | |
| 6) INC(MED) | | | | | | | | | | | | | | | | |
| a) <13428 | .11 | -.38 | .23 | -.01 | -.02 | -.01 | .39 | .02 | -.06 | -.46 | .01 | -.56 | -1.47 | .02 | .15 | 2.31 |
| | (.08) | (-2.14) | (1.79) | (-.24) | (-.91) | (-.51) | (.67) | (1.85) | (-1.33) | (-2.61) | (2.13) | (-.95) | (-.97) | (.13) | | |
| b) >13428 | .39 | .02 | .04 | -.02 | .04 | -.01 | .19 | -.01 | -.07 | -.34 | -.002 | .03 | 2.24 | .05 | .12 | 1.69 |
| | (.33) | (.24) | (.38) | (-.49) | (2.12) | (-.83) | (.59) | (-1.18) | (-1.66) | (-1.83) | (-.57) | (.06) | (1.68) | (.32) | | |
| 7) AGES | | | | | | | | | | | | | | | | |
| a) 20-34 | 1.69 | -.28 | .05 | .03 | -.03 | -.03 | .43 | .01 | -.1 | -.48 | .008 | .21 | .36 | .06 | .08 | 1.24 |
| | (1.25) | (-1.31) | (.53) | (.93) | (-.93) | (-1.47) | (1.06) | (.97) | (-1.68) | (-2.59) | (1.06) | (.42) | (.25) | (.38) | | |
| b) 35-49 | 1.63 | -.30 | .04 | -.11 | .02 | -.001 | .25 | -.002 | -.06 | -.52 | .01 | -.91 | .37 | .06 | .16 | 2.22 |
| | (1.22) | (-.8) | (.53) | (-1.94) | (.62) | (-.06) | (.62) | (-.16) | (-1.61) | (-2.95) | (1.07) | (-1.75) | (.27) | (.32) | | |
| 8) GENERAL | 1.730 | -.120 | .020 | -.007 | .009 | .002 | .282 | .006 | -.082 | -.407 | .003 | -.629 | .563 | -.152 | .10 | 3.0 |
| | (2.59) | (-1.33) | (.36) | (-.24) | (.74) | (.52) | (.98) | (.73) | (-2.66) | (-3.44) | (1.03) | (-1.88) | (.55) | (-1.77) | | |

The inverse relationship between mortality and mother's education on one hand and between mortality and modern items owned on the other reflect parental knowledge in hygiene and other areas which enhance the children' survival. Therefore education reduces information costs to mothers and as a result acts like a good proxy for price differences in adaptation to new methods. Modern Items Owned on the other hand acts like a proxy for permanent income as well as price differences in utilizing these items that enhance survivorship. Houses with indication of modernization appear to have an advantage as regards child survival prospects.

The magnitudes of the effect of income, husband's education, residence, acres owned, father's age is low relative to other variables. The low predictability of mortality by these variables could be attributed largely to the environmental factors and prevalence of disease-incidence in these areas as evidenced by the high child mortality rates in Baringo district. Those in the nonagricultural occupations are associated with higher mortality instances relative to those in farm occupations. The negativity of the coefficients of most independent variables reflect the importance of modernization in reducing mortality, while the smallness of the coefficients are an indication of their limited effectiveness in overcoming the cumulative environmental forces beyond the control of households.

Household size is negatively related to mortality rate implying that larger households offer more conducive survival environment than smaller ones. As explained earlier large

families are associated with higher standards of living due to the quantity of resources owned and the relative utilization of these resources. More availability of cheap domestic labour enables the households to produce more in terms of livestock and crops.

Water distance is associated with lower mortality rate.[14]

The relationship between the size of land owned and investment in the health of children is weak and positive, contrary to our expectations. This relationship may be due to the fact that the direct relationship which are not captured in the Indirect Least Squares estimates are significant. Higher fertility induced by greater ownership of land could increase the probability of mortality occurrence.

### 6.1.2 Two Stage Least Squares Estimates (TSLS)

The underlying theory can also be tested by other estimation techniques. As was mentioned in the early chapters Child quantity is an important input into the Child quality. The interaction between these two variables is properly captured by the use of the TSLS estimation technique.

a) Table 12 presents the Two-Stage Least Squares Estimates (TSLS) of the Education equation (EDUC).

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14 In contrast, the TSLS estimates show that less developed service environment leads to greater mortality rates.

TABLE 12 RESULTS OF THE TWO STAGE REGRESSION PRINTOUT EDUCATION(EDUC)

| | CONS | SCH | MEDUC | INC1 | FEDUC | ACRES1 | RES | FAGE | SIZE | FERT1 | R2 | F STAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1) POTENTIAL | | | | | | | | | | | | |
| a) H.POT | -0.99 | 0.92 | 0.01 | 0.03 | 0.01 | 0.002 | -0.07 | -0.004 | -0.004 | 0.15 | .26 | 8.6 |
| | (-3.3) | (4.92) | (O.88) | (.01) | (1.45) | (.38) | (-.74) | (-.19) | (-.11) | (1.98) | | |
| b) L.POT | -.84 | .71 | .003 | .03 | .02 | -.007 | .21 | .0005 | -.009 | .15 | .09 | 1.3 |
| | (-1.7) | (2.75) | (.12) | (.6) | (1.2) | (-.71) | (.56) | (.09) | (-.31) | (1.67) | | |
| 2) FAMILY | | | | | | | | | | | | |
| a) <6 CHILD | 5.99 | 1.28 | -.02 | -.5 | .11 | .002 | -.51 | .04 | .35 | -1.86 | -13 | - |
| | (.4) | (.97) | (-.27) | (-.46) | (.53) | (.06) | (-.31) | (.53) | (.48) | (-.43) | | |
| b) >5 CHILD | -1.27 | .95 | .01 | .05 | .02 | .00004 | -.09 | .0006 | .02 | 1 | .33 | 9.9 |
| | (3.9) | (5.8) | (.6) | (2.03) | (1.45) | (.009) | (-.81) | (.17) | (1.53) | (1.64) | | |
| 3) INC(MEAN) | | | | | | | | | | | | |
| a) < 35000 | -.83 | .71 | .008 | .03 | .02 | -.003 | .01 | .0004 | .0002 | .14 | .20 | 7.5 |
| | (-2.5) | (4.37) | (.57) | (.92) | (1.66) | (-2.07) | (.08) | (.09) | (.006) | (2.27) | | |
| b) > 35000 | -.409 | .86 | .02 | -.02 | .02 | .002 | -.1 | .003 | -.01 | .122 | .57 | 8.98 |
| | (-.63) | (4.15) | (.63) | (-.36) | (.73) | (.75) | (-.74) | (.35) | (-.36) | (1.22) | | |
| 4) ACRES(MEAN) | | | | | | | | | | | | |
| a) < 10.6 | -.54 | .62 | .013 | -.015 | .02 | .002 | .02 | .002 | -.006 | .17 | .17 | 5.9 |
| | (-1.88) | (3.99) | (.91) | (-.55) | (1.68) | (.21) | (.14) | (.51) | (-.23) | (2.8) | | |
| b) > 10.6 | -.96 | .92 | -.005 | .07 | .04 | -.003 | -.12 | -.0007 | -.007 | .08 | .37 | 5.2 |
| | (-1.86) | (2.07) | (-.19) | (2.00) | (1.8) | (-1.65) | (-.84) | (-.104) | (-.27) | (1.33) | | |
| 5) ACRES(MED) | | | | | | | | | | | | |
| a) <5 | -.72 | .57 | .02 | -.003 | .02 | .0004 | -.14 | .002 | -.006 | .2 | .10 | 4.10 |
| | (-1.59) | (2.75) | (.85) | (-.09) | (.97) | (.007) | (-.68) | (.44) | (-.18) | (2.48) | | |
| b) >4 | -.99 | 1.04 | -.003 | .05 | .03 | -.06 | .11 | .002 | .02 | .08 | .36 | 9.55 |
| | (-3.49) | (5.69) | (-.18) | (1.85) | (2.40) | (-1.80) | (.92) | (.42) | (.68) | (1.69) | | |
| 6) INC(MED) | | | | | | | | | | | | |
| a) <13428 | -1.52 | .75 | .01 | .1 | .03 | -.01 | .1 | -.003 | -.005 | .18 | .08 | 1.52 |
| | (-2.8) | (2.75) | (.64) | (1.89) | (1.67) | (-1.8) | (-.44) | (-.7) | (-.19) | (2.27) | | |
| b) >13428 | -.96 | .72 | .01 | .03 | .02 | .007 | .03 | .003 | -.01 | .15 | .36 | 10.25 |
| | (-2.25) | (4.86) | (.78) | (.71) | (1.41) | (1.14) | (.26) | (.42) | (-.36) | (1.82) | | |
| 7) AGES | | | | | | | | | | | | |
| a) 20-34 | -.83 | .69 | .008 | .002 | .03 | -.001 | .22 | .0006 | .007 | .18 | .31 | 9.03 |
| | (-2.39) | (4.37) | (.59) | (.08) | (2.72) | (-.21) | (1.49) | (.12) | (.17) | (2.35) | | |
| b) 35-49 | -.2 | 1.14 | -.04 | .03 | .05 | .007 | -.16 | .002 | .03 | -.07 | .11 | 2.00 |
| | (-.33) | (4.00) | (-.81) | (.73) | (1.17) | (.76) | (-.83) | (.41) | (.88) | (-.53) | | |
| 8) GENERAL | -.828 | .702 | .012 | .028 | .023 | -.003 | -.019 | -.001 | -.015 | .174 | .16 | 7.38 |
| | (-3.66) | (4.91) | (.91) | (1.28) | (2.09) | (-1.86) | (-.18) | (-.26) | (-.62) | (2.96) | | |

NB: The instrumental variables to identify the child quality equation (education) are UBC MEDAGE and MAGE of the Fertility equation
t statistics are in parentheses

As shown in the table, the estimated coefficients for the endogenous total living children (standardized) implies that an addition of one child per woman is expected to decrease almost twice (-1.86) a child's education in small families and it increases slightly more than one tenth (0.10) a child's education in larger families. The result implies that a child's education in large families is nearly twice higher than that in small families (1.96). This estimated results reinforce the conviction that child quantity (FERT1) and quality (EDUC) are substitutes at least in the small families. In the large families the sign of FERT1 and EDUC is positive and statistically significant implying that the two are complements. The numerical coefficients for schooling facilities, income, father's education and the general size of the household on FERT1 and EDUC variables remain significant in the large family sizes.

The sign of the coefficients of acres owned are in accordance with our hypothesis. There is a negative relationship which suggests that an increase in farm operations would keep children out of school. In large families an increase in acreage owned tends to decrease child education (quality), but less than it does in small families. Increase in acreage owned implies greater demand for child labour. The numerical value for child labour in small families shows that child quality is affected by an increase in the participation of children on the farms. In large families parents can release some of their children to school, which is difficult for small families.

Thus parents of large families are able to diversify their children's activities and hence their investments. A relatively high income effect on the education of children with TSLS estimates indicates a higher income elasticity and therefore shows how its underestimated in the reduced form equations.
A non-linear effect of fertility is reinforced by the SIZE variable. Older children help pay for the education of the younger ones. In some circumstances parents may increase their family sizes since children become less costly to bring up because of the help from older siblings.

b) Table 13 shows the Two Stage Least Squares Estimates of the structural mortality (health) equation.

These estimates differ only marginally from the reduced form estimates reported in table 10. The signs have also remained the same for all the coefficients. The estimated value of the endogenous fertility variable on child mortality shows that higher fertility decreases mortality but not significantly at the 0.05 level of significance.

Mother's education reduces child mortality in accordance with the theoretical prediction. In the present case child mortality is nearly 24% less in families with educated mothers compared with illiterate mothers. The estimates suggest that mothers with formal education are normally more efficient in utilizing scarce resources for child care. From the model, this means that educated mothers reduce the shadow price of survival since they enhance goods by utilizing them more efficiently.

TABLE 13 RESULTS OF THE TWO STAGE REGRESSION PRINTOUT MORTALITY(MORT2)

| | CONS | WAT1 | MEDUC | INC1 | FEDUC | MEDAGE | RES | SIZE | MIO2 | FEDAGE | FERT1 | R2 | F STAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1) POTENTIAL | | | | | | | | | | | | | |
| a) H.POT | 4.6 | 0.1 | -.52 | -.14 | -.29 | .01 | .8 | .4 | .12 | .008 | -1.02 | -1.68 | - |
| | (.82) | (.40) | (-.76) | (-.41) | (-.82) | (.65) | (1.01) | (.56) | (.17) | (.84) | (-.65) | | |
| b) L.POT | 2.6 | -0.003 | -.4 | .02 | -.08 | .01 | .86 | -.05 | -.59 | .0005 | -.16 | .18 | 2.68 |
| | (2.35) | (-.02) | (-2.04) | (.21) | (-.77) | (2.08) | (.89) | (-.88) | (-2.95) | (.17) | (-.99) | | |
| 2) FAMILY | | | | | | | | | | | | | |
| a) <6 CHILD | 9.02 | .01 | -.27 | -0.38 | -.15 | .006 | .03 | .22 | -.35 | .007 | -1.84 | -.96 | - |
| | (1.16) | (.05) | (-1.35) | (-.8) | (-1.14) | (.89) | (.03) | (.6) | (-.98) | (1.4) | (-.93) | | |
| b) >5 CHILD | -.2 | .1 | -.04 | .01 | -.1 | .002 | .27 | .0007 | -.33 | .0007 | .17 | -.04 | - |
| | (-.12) | .9) | (-.2) | (.23) | (-1.23) | (.33) | (1.03) | (.01) | (-2.6) | (.37) | (.5) | | |
| 3) INC(MEAN) | | | | | | | | | | | | | |
| a) < 35000 | 1.89 | .08 | -.34 | .07 | -.12 | .009 | .24 | -.005 | -.31 | .003 | -.25 | .12 | 3.9 |
| | (1.86) | (.60) | (-2.6) | (.76) | (-1.6) | (2.2) | (.67) | (-.05) | (-2.1) | (1.8) | (-1.2) | | |
| b) > 35000 | -1.46 | .09 | .26 | .17 | -.27 | -.008 | .75 | .04 | -.46 | .006 | .09 | .14 | .97 |
| | (-.67) | (.23) | (.95) | (.89) | (-1.27) | (-1.23) | (1.62) | (.34) | (-1.21) | (.76) | (.18) | | |
| 4) ACRES(MEAN) | | | | | | | | | | | | | |
| a) < 10.6 | 2.76 | .09 | -.46 | -.02 | -.16 | .01 | .45 | .07 | -.31 | .004 | -.40 | -.02 | - |
| | (3.26) | (.64) | (-1.95) | (-.21) | (-1.89) | (1.85) | (1.05) | (.58) | (-1.78) | (1.76) | (-1.34) | | |
| b) > 10.6 | 1.97 | -.13 | -.11 | .08 | -.1 | .0007 | .46 | .01 | -.36 | .003 | -.21 | .21 | 2.07 |
| | (.71) | (-.29) | (.54) | (.56) | (-.84) | (.15) | (1.08) | (.10) | (-.87) | (.93) | (-.53) | | |
| 5) ACRES(MED) | | | | | | | | | | | | | |
| a) <5 | 3.50 | .20 | -.52 | -.05 | -.14 | .02 | 1.08 | .04 | -.36 | .004 | -.49 | .01 | .18 |
| | (2.47) | (.99) | (-1.67) | (-.46 | (-1.45) | (1.48) | (1.63) | (.3) | (-1.51) | (1.850) | (-1.34) | | |
| b) >4 | 1.34 | -.02 | -.15 | .07 | -.16 | .004 | .23 | .02 | -.3 | .002 | -.13 | .13 | 2.31 |
| | (1.07) | (-.13) | (-1.09) | (1.06) | (-1.43) | (1.19) | (.73) | (.12) | (-1.47) | (.88) | (-.45) | | |
| 6) INC(MED) | | | | | | | | | | | | | |
| a) <13428 | 1.15 | .05 | -.5 | .18 | -.15 | .01 | .69 | .02 | -.28 | .004 | -.31 | .1 | 1.77 |
| | (.79) | (.29) | (-2.49) | (1.31) | (-1.83) | (2.28) | (1.08) | (.21) | (-1.46) | (1.94) | (-1.45) | | |
| b) >13428 | 2.28 | -.02 | -.18 | .03 | -.24 | .004 | .34 | .17 | -.2 | .006 | -.53 | -.3 | - |
| | (1.23) | (-.08) | (-1.3) | (.26) | (-1.1) | (.96) | (.9) | (.1) | (-.84) | (1.0) | (-1.39) | | |
| 7) AGES | | | | | | | | | | | | | |
| a) 20-34 | 2.68 | .004 | -.4 | .0004 | -.16 | .01 | .18 | .2 | -.21 | .005 | -.68 | -.02 | - |
| | (1.98) | (.02) | (-1.53) | (.004) | (-1.75) | (1.3) | (.39) | (.98) | (-1.04) | (2.19) | (-1.52) | | |
| b) 35-49 | 2.47 | -.00009 | -.36 | .02 | -.07 | .01 | .31 | -.03 | -.52 | -.0003 | -.13 | .18 | 3.23 |
| | (2.41 | (-.0005) | (-1.05) | (.3) | (-.5) | (1.17) | (.75) | (-.48) | (-2.89) | (-.1) | (-.85) | | |
| 8) GENERAL | 2.21 | .04 | -.24 | .02 | -.13 | .006 | .45 | .02 | -.32 | .003 | -.26 | .10 | 3.91 |
| | (3.05) | (.36) | (-2.07) | (.41) | (-2.08) | (1.73) | (1.61) | (.26) | (-2.37) | (1.96) | (-1.42) | | |

NB: The instrumental variables to identify the child quality equation (mortality) are UBC MEDAGE and MAGE of the Fertility equation
t statistics are in parenthesis

Mothers with more schooling are capable of taking advantage of new opportunities and obtaining more efficient information about child health care and nutrition. In fact the correlation coefficient between mother's education and the income of the husband was found to be strong and positive. This assortative mating reinforces the utilization of family inputs to health production and education acquisition.

Father's education is also found to be positively related to child health (ie negatively related to mortality) and it is significant at the conventional levels. A possible reason is that men in Baringo district spend most of their time in farming or other related activities, which improve the health status of the family. The fact that mortality is higher and significant among urban dwellers gives weight to this statement.

The sign of the income coefficients do not comply with the theoretical predictions however the estimated value is low and its impact on child quality is statistically insignificant. It seems that income enables a household to purchase inputs that improve quality of children, but to effect reasonable improvement in their quality other socioeconomic elements including government intervention is required.

Distance to water points (WAT1) increases mortality occurrences in accordance with the theoretical prediction made earlier.

## 6.2 Summary

Given the above results it appears that the area under study is in the first stage of socio-economic development whereby the demand for children increases with development. Such a situation creates conflicts in policy implementation. Trade-offs are necessary in order to work out practicable solutions. The next chapter attempts to throw some light on this issue.

# CHAPTER SEVEN

## CONCLUSION AND POLICY RECOMMENDATIONS

### 7.1 Conclusion

A statistical cross-sectional basic model of child quality-quantity model was used to identify the stage of development in Baringo district. The determinants of these two aspects of children were explicitly analyzed. Empirical evidence based on this data suggests that the relationship between these two aspects are positive implying that larger family sizes are associated with higher quality children.

The value of $R^2$ was found to be 30 per cent on average leaving out a greater portion of the variation unexplained. Variations in the mortality index were the least explained. However, the explanatory power of this model is close to those of other studies given in the literature review. The results should be treated with caution since not all relevant economic variables were included for the sake of simplicity.

Parental education has the expected substitution effect, away from larger families, and towards higher quality children. The effect of mother's education in the quantity equation is larger and more significant than the father's, a finding usual in fertility studies. The price effect of father's time on household fertility is lower than that of the mother because children particularly in rural households are not father's time intensive. Mother's education has two main effects on the quality of

children since it influences : the productivity of health inputs (efficiency effect) and the cost of information (allocative effect).

However, father's education is the more important in the quality equation, possibly because it represents an uncompensated rather than a compensated wage effect, and thus incorporates income effects which are larger for the father's than the mother's wage.

Parental age has the expected positive effect on fertility, with the larger and more significant effect being that of mother's age. The effect of parental age on child quality are not significant and probably represent a combination of lifecycle and cohort effects.

As mentioned earlier the area under study is basically a rural setting with little urban influence. Rural community life implies that the influence of cultural and traditional values is significant. Proper policies can only be derived with this in mind. The institution of the extended family should be singled out for particular mention. It can either enhance the quality of children or erode them through its influence on the quantity of children desired by a family. Since quantity is a crucial input in the quality equation policies to adjust the number of children desired by a family need to be identified in the first place. From the classification of data on Kenya's fertility levels based on

different socio-economic indicators in chapter 1, it was observed that there exists a possible `threshold level' at which the direction of the relationship between quality and quantity of children is reversed from positive to negative. From the analytical framework it can be concluded that the area under study is still in the first stage of this process. Policy recommendations in this section will be geared towards those variables that should be manipulated to steer the society to the second stage ie away from large families and towards even higher quality for children. These policies will be divided into two broad categories, namely those on quantity and those on quality aspects of a child.

## 7.2 Recommendations and Policy Implications

7.2.1 Policies to discourage large family sizes are as follows

i) demand side

In this section we shall only focus on economic and to a less extend social factors that contribute to the desire for large family sizes. Extended family as a social, economic and legal institution determines household behaviour significantly. The SIZE variable was used to capture the concept of extended family and it was found to be the most single explanatory factor of fertility levels in the study. In this context children are viewed as a source of labour and prestigious status besides being a guarantee of security in the parents' old age. This quality of children where they offer security in old age is one of the commodities in the utility function of the parents according to the basic model. Necessity for security in old age is due to the scarcity of programmes like welfare schemes, medicare, developed old age pension schemes and retirement benefits.

In order to attain a certain number of children high incidence of child and infant mortality rates result in higher fertility.

Confidence is also put in numbers due to the harsh, insecure and generally uncertain environment in which people find themselves. In order to reduce the value of children as a cheap and convenient source of labour, programmes should be developed to change the organization of labour in the production process. It has been argued that labour in rural agrarian societies is underutilized or

even redundant at certain seasons of the year. The main problem is the poor organization of labour. The division of labour according to age and sex leads to under-employment of certain categories of the members of the society depending on the season and the nature of work. Liberation of women would discourage the apportionment of work according to sex. Women are found to engage in a host of activities ranging from tilting land, searching for fuel, drawing water to the rearing of children. In such a set up children are also overworked. Boys are mainly engaged in looking after livestock while girls do the normal household chores like looking after the young ones usually at the expense of schooling as the mother is busy elsewhere. This institutional set up can be discouraged by directing income generating projects towards the sphere under the direct influence of women.

Since women income directly benefits households welfare, the quality of children would be immediately enhanced. An increase in such projects would also increase the opportunity cost of women's time at home resulting in less time allocated to child production. According to the results, the reduction in child quantity was very noticeable through the price effect of increasing the value of mother's time. Greater participation of women in the decision-making process in matters pertaining to the areas in which they play major roles like child rearing need to be encouraged. Enrolment in education institutes and opportunities of employment should be open both to the male and female on equal basis.

Although the effect of differences in the sex of children on

the family sizes was not investigated in this study it has been proved elsewhere that this is so.

The level of education of children was found to be positively related to the size of a family indicating that economies of scale exist in financing child education. The older children and members of the household pay for the younger ones' educational expenses. Given that this is the case, the link between child education and parental fertility can weaken or even turn positive as it is in the present case. Schemes and bursaries to assist those who are poor and do not enjoy this kind of transfer payment should be worked out.

ii) supply side

The afore mentioned policies influence the demand for children. We can now look at those that can help couples to restrict productivity (supply of children) to their requirements. Family Planning Programmes should continue to be encouraged given that the participation rate is poor resulting in low impact of this variable on fertility. Separate regression estimates indicated that compared to older women, the utilization of this service among younger women is higher by nearly 41%. This implies that exposure to modernization is higher among the younger women. Younger women being more educated, face lower costs of information compared to the older women. This price differences between the two groups of women imply that exposure and general enlightenment to the means and methods of achieving the required number of children is necessary.

7.2.2 Policies on the quality of children

As has been mentioned the quantity of children is the main input to their quality. This relationship was found to be positive. In order to reverse it we need to replace quantity with other variables that will equally enhance quality. Since child services offer parents some satisfaction, policies that will enhance these services from fewer children are required. Economic development is necessary in order to avail these services at cheaper costs and in particular schooling and health facilities. Awareness and knowledge for proper utilization of these facilities is necessary. Several recommendations can be given towards this eventuality as follows:

i) Education

The most significant contributory factor in improving the educational quality of children is the availability of schooling facilities. Accessibility to such facilities are still costly. Higher enrolment and lower drop-out cases from schools can be achieved by establishing medium cost boarding primary schools in marginal and arid areas where nomadism is still a prominent way of life. Existing secondary schools could be expanded in order to increase their utilization levels. Intensification of bursary scheme through harambee spirit will enable those financially handicapped to enrol in schools. Teachers morale and efficiency need to be boosted by construction of residential houses and in-service training. Apart from physical facilities and personnel to run the system, relevant and practical education programmes are

necessary. Literacy campaign will indirectly help in the creation of awareness as to the importance of education among the non-literate parents.

Parental education, particularly that of the father need to be emphasized. Compulsory education schemes at least for primary education would lead to an increase in school enrolment especially among the children whose parents do not want to accept the modern way of life. Inducement offered to children of school-going age should be able to encourage school enrolment. Inducement include allocation of employment on academic merit and rewarding labour according to ones academic qualifications. The `demonstration effect' will likely have reasonable success in such societies. The process of `status inversion' should be encouraged so that more value may be given to school attendance at the expense of undertaking traditional chores. In other words `opinion leadership' should be drawn more from those with modern achievements.

According to our results fertility was positively related to school attendance performance due to the advantage of large numbers. Rationalization of labour utilization in a community is needed in order to reduce the over-reliance on school-going children for cheap labour particularly among the small sized families. Such goals can be achieved through arrangements like self-help programmes which would increase the utilization of resources that would otherwise be idle due to shortage of labour especially during the peak seasons. In addition school enrolment would be increased and consequently the quality of children and

general welfare would be improved without resorting to large family sizes. Mechanization hire-services during the peak season can be made available in order to discourage the absenteeism at school and to increase productivity by greater utilization of otherwise idle resources. School curriculum should also be set to suit the needs of labour on the farm.

Since the size of acres under ownership is negatively related to school attendance index, policies to encourage more equitable distribution of land should be put into place. Taxation would discourage the state where land is held for speculation purposes.

Income was seen to have a complementary effect on school attendance performance. Income can be improved by promoting the formation of co-operative societies, development of infrastructure and the setting up of more small scale industrial units. Livestock and crop production development would immediately enhance the income of the people since majority of them rely on agriculture for livelihood.

A policy to encourage households to own income generating ventures is necessary since these do not have pure income (positive) effects on the demand for children. Hence those with large tracts of land could be encouraged to hire them out in order to `decapitalise' their wealth.

The extended family (SIZE), unlike the nucleUS one has a negative impact on the school performance since resources are thinly spread over many people hence affecting the quality of children. The situation is made worse if one takes into account

the fact that parents in such communities have poor knowledge in the allocation of available resources particularly during the `lean' season.

ii) Mortality

The most important factor in the reduction of mortality rates and thus improvement in the health status of the children is the availability of modern items and parental education. Both factors show the cost of information and adaptation ability of a household to new ideas.

As mentioned earlier greater fertility reduces mortality levels in contrast to our hypothesis. Small and poor families are therefore associated with higher mortality rates. Rational utilization of labour through government intervention was recommended. The inability of parents to allocate resources properly exposes children to greater risk of malnutrition which can eventually end up in death. From the analysis it seems children in large families have higher chances of being taken care-off. Older children in such households are most likely to be complementing the efforts of their parents in the rearing and up-bringing of the young ones. Besides, the older children are most likely to be more knowledgable in nutrition, hygiene and the allocation of resources due to their high mobility that exposes them to modern ways of life. They are also likely to be more educated and working away in urban centres where the cost of information on utilization of health inputs is low. Development strategies should discriminate against those who enjoy this sort of relationship in order to

benefit the poor and small families that rely on few people for livelihood. The concept of cost-sharing need to incorporate this phenomena in their guidelines, although it may not be easy due to logistic factors.

Children are generally accepted to be the most vulnerable group in terms of nutritional stress, morbidity and mortality. Programmes of direct assistance to them will improve their welfare. Improvement in the human capital of the mother is one possible way of assisting this group. Maternal education was found to be highly associated with better child quality. Maternal education is however only one way of enhancing human capital. Programmes which directly provide health information and training to the mother may also lead to an improvement in her skills and ability to efficiently use and effectively allocate health inputs for better child health. Such programmes are cheaper, more effective and less time consuming than those of educational nature. Primary health care (PHC) programmes like health mobile teams, maternal and child health (MCH) should focus not only on direct assistance to the child but also seek ways of improving the mother's ability at child rearing. This is particularly true in the case of very young children whose health shows relatively greater sensitivity to the mother's human capital.

Another policy implication is the distributional consequences of primary health care programmes. If maternal education affects child health mainly through efficiency and allocative effects and if less educated mothers generally come from poorer families, then equity considerations give preference to programmes which either lead to an improvement in the healthiness of the environment or disseminate health information. These types of programmes lead to relatively greater benefits for the poor, among whom children are at the greatest health risk. Programmes which primarily subsidize health inputs may not be optimal as they can have a regressive distribution of benefits.

The degree of the effectiveness of these policies on the quality and quantity of children will depend on the price and income elasticities of the demand for children.

Presence of developed service environment leads to better health among children. Given that 80 percent of the population has no access to piped water there is need to extend water piping systems to service a greater population. The supply can also be improved by harvesting rain water through the construction of roof tanks, pans and dams and rehabilitating underutilized water schemes.

## 7.3 Limitations of the study

The limitations of this study are

a) the relationship between some of the variables under study may not be linear as is assumed in the study.

b) quantitative analysis leaves out qualitative data which may be important to the study.

c) static cross-sectional analysis which is used in this study does not consider the time dimension on which households behaviour is dependent.

d) There are several weaknesses associated with multiple regression techniques.

e) political, cultural and psychological factors are almost wholly neglected in the study in order to simplify the analysis.

## 7.4 Need for further Research

There is a need to carry out further investigations on other variables like the effect of sex differences and composition among children, polygamous marriages, migrations, separate habitation of married couples, female employment and future expectations. Studies which have taken seasonality and the gender of children into account have found out that these significantly affect the quality of children. Taking into account the differences in genetic endowment among children will make the study more practical.

Birth order effects on children can be investigated in order to find out the causes of variation in quality.

Threshold level at which the relationship between the two aspects of children change also need to be identified.

More evaluation of the success of family planning programme given the above scenario is also necessary.

The study has used a static comparative model which does not take into account the dynamic effects. Parents adjust the quality and quantity of children they desire in the light of more information and the changing circumstances.

A multi-disciplinary research could yield better results that are tangible and more practical for policy purposes.

## BIBLIOGRAPHY

Amodi N.K. (1980), "Economics of Family Size: The case of developing economies of Kenya and Nigeria" P.hD Thesis, City University of New York.

Aoko M.I. (1989), "Determinants of fertility levels in urban areas: A comparative case study of Mathare and Nairobi South", Unpublished M.A. Thesis, University of Nairobi.

Barrera A. (1990) The Role of Maternal Schooling and its Interaction with Public Health Programmes in Child Health Production, Journal of Development Economics. Vol. 32.

Barrera A. (1991) The Interactive effects of Mother's Schooling and unsupplemented breast-feeding on Child Health, Journal of Development Economics. Vol. 34.

Becker G.S.,(1965) `A Theory of the Allocation of Time', Economic Journal. Vol.75 pg. 493-517.

Becker G.S.,(1981) A Treatise on the Family (Cambridge, Mass.: Havard University Press).

Becker G.S. and Lewis H.G.,(1973) `On the Interaction between the Quantity and Quality of Children,' Journal of Political Economy Vol.81, no.2, Part 2 (1973): pg.S279-S288.

Becker G. S. and Tomes N. (1976) Child Endowments and the Quality and Quantity of Children, Journal of political Economy. Vol. 84 No.4 Pt.2

Beenstock M. and Sturdy Patricia The Determinants of Infant Mortality in Regional India, World Development. Vol.18 No.3 (1990).

Behrman J. R. (1988) Nutrition, Health, Birth Order and Seasonality, Journal of Development Economics. Vol. 28

Behrman J. R. and Wolfe B. L. (1987) How does Mother's Schooling affect Family Health, Nutrition, Medical Care Usage and Household Sanitation? Journal of Econometrics. Vol. 36

Behrman J.R. and Wolfe B.L. (1987) Investment in Schooling in Two Generations in Pre-Revolutionary Nicaragua, Journal of Development Economics. Vol.27 pp.395-419.

Birdsall N. `A Cost of Siblings; Child Schooling in Urban Colombia, in Research in Population Economics. ed. J.L. Simon and J. De Vanzo (Greenwich Conn.: Jai Press, 1980), Vol.2 pg.115-150.

Birdsall N. (1985) Public Inputs and Child Schooling in Brazil, Journal of Development Economics. Vol. 18

Boserup E., The Conditions of Agricultural Growth (New York: Aldene,1965).

Brass W., `On the Scale of Mortality', in Biological Aspects of Demography, ed. W. Brass et al (London: Taylor and Francis, 1971).

Caldwell J.C.,1979, `Education as a factor in Mortality decline', Population Studies 33, No.3 Nov.

Chen, eds., `Child survival: Strategies for Research', Population and Development Review. supplement to Vol.10.

De Tray D.N., `Child quantity and the demand for Children,' Journal of Political Economy. Vol.81, No.2 (Supplement) March/April 1973, pg. S70-S95.

Fisher,F.M.,`The Identification Problem in Econometrics,' Identification-Hill Company, 1966.

Horton S. (1986) Child Nutrition and Family Size in the Philippines, Journal of Development Economics. Vol 23.

Hossain S.I. (1990) Interrelations between Child Education,Health and Family Size: Evidence from a Developing Country, Economic Development and Cultural Change

Johnson J. (1972), Econometric Methods 2nd Edition New York:Macmillan.

Kibua T.N. (1977), "Kenya's Population Policy: An Economic Analysis of Population Growth Control", Unpublished M.A. Thesis, University of Nairobi.

Kibua T.N. (1981), "The Impact of Economic Factors on Household Family Behaviour in Rural Kenya", Unpublished P.hD Thesis, University of Nairobi.

Kmenta J. (1971), Elements of Econometrics, New York: Macmillan.

Koutsoyiannis A., Theory of Econometrics, MacMillan Press Ltd., London, 1977.

Lancaster, K.J., `A new Approach to Consumer Theory', Journal of Political Economy Vol. 74, 1966, pg.132-157.

Maddala G.S., Econometrics (New York; McGraw Hill, 1977).

Michael R.T.,1973, `Education in non-market production', Journal of Political Economy, pg.306-327.

Muhindi F.M. (1980), "An Economic Analysis of Fertility Behaviour in Kenya: A Case Study", Unpublished M.A. Thesis, University of Nairobi.

Ominde, S.H (1988) (Ed.) Kenya' Population Growth and Development to the Year 2000 AD, Heinmann, Nairobi.

Pindyck R. and Rubinfeld D. (1976) Econometric Models and Economic Forecasts, New York: Macmillan

Preston S.H.,` Causes and Consequences of Mortality Declines in Less Developed Countries during the Twentieth Century', in Population and Economic Change in Developing Countries, ed. Richard A. Easterlin (Chicago; University of Chicago Press, 1980).

Republic of Kenya
1983 : Development Plans: 1984-88 and 1989-93, Government Printer, Nairobi

: Economic Surveys, Government Printer, Nairobi, Various Issues.

1991 : Household Welfare Monitoring and Evaluation Survey of Baringo district (July)

1989 : Impact of Socio-economic Development on Fertility in Rural Kenya, CBS.

1984 : Kenya Contraceptive Prevalence Survey, Central Bureau of Statistics.

1989 : Kenya Demographic and Health Survey, Central Bureau of Statistics.

1986 : Sessional paper No.1 of1986 on `Economic Management for Renewed Growth', Government Printer

1990 : Socio-economic Profiles by Government of Kenya, Ministry of Planning and National Development and Unicef (June)

: Statistical Abstracts, Government Printer, Nairobi, Various Issues.

Rosenzweig M.R. and Evenson R., `Fertility, Schooling and Economic Contribution of Children in Rural India: An Econometric Analysis, Econometrica 45 (July 1977): pg.1065-1080.

Rosenzweig M. R. and Wolping K.I.(1980): Testing the Quantity-Quality Fertility Model-The Use of Twins as a Natural Experiment, Econometrica, Vol. 10 No. 2.

Schultz, T.P. 1984, `Studying the Impact of household economic and community variables on child mortality, in W.Henry Mosley and Lincoln C. Chen, eds.,Child Survival: Strategies for Research; Population and Development Review. Supplement to Vol.10.

Thomas D. , Strauss J. and Henriques M. (1990) Child Survival, Height for Age and Household Characteristics in Brazil, Journal of Development Economics. Vol. 33.

Trussel J. and Preston S.H.,`Estimating the Covariants of Child Mortality from Retrospective Reports of Women' (Paper delivered at International Union of Scientific Study for Population Seminar on Methodology for Mortality Analysis, Dakar, Senegal, 1981).

United Nations, (1982) `Indirect Techniques for Demographic Estimation' (Manual X), Population Studies No.105, New York.

Walter A. (1970) An Introduction to Econometric. New York:Norton

Ware H., 1984, `Effects of Maternal Education, Women's Roles, and Child Care on Child Morbidity, in: W.H. Mosley and L.C.

Wolfe B.L. and Behrman J.R. (1982) Determinants of Child Mortality, Health and Nutrition in a Developing Country, Journal of Development Economics. Vol. 11 no.2 pg 163-193.

Wolpin K. I. and Rosenzweig M. R. (1982) Government Interventions and Household Behaviour in a Developing Country, Journal of Development Economics Vol. 10

# APPENDICES

APPENDIX I

NATURAL FERTILITY SCHEDULE

| AGE(YRS) | FERTILITY | AGE(YRS) | FERTILITY |
|---|---|---|---|
| 12 | 0.087 | 31 | 7.912 |
| 13 | 0.287 | 32 | 8.317 |
| 14 | 0.537 | 33 | 8.711 |
| 15 | 0.837 | 34 | 9.093 |
| 16 | 1.187 | 35 | 9.461 |
| 17 | 1.585 | 36 | 9.812 |
| 18 | 2.026 | 37 | 10.146 |
| 19 | 2.493 | 38 | 10.461 |
| 20 | 2.969 | 39 | 10.754 |
| 21 | 3.445 | 40 | 11.017 |
| 22 | 3.918 | 41 | 11.244 |
| 23 | 4.385 | 42 | 11.431 |
| 24 | 4.848 | 43 | 11.578 |
| 25 | 5.305 | 44 | 11.684 |
| 26 | 5.757 | 45 | 11.755 |
| 27 | 6.203 | 46 | 11.800 |
| 28 | 6.641 | 47 | 11.828 |
| 29 | 7.073 | 48 | 11.844 |
| 30 | 7.497 | 49 | 11.851 |

SOURCE: Kibua(1981), "The Impact of Economic Factors on Household Family Behaviour in Rural Kenya." Unpublished P.hD Thesis, University of Nairobi.

APPENDIX II

## CALCULATION OF MORTALITY INDEX[15]

Let the probability of a child dying before reaching age (a) be q(a), which is a linear transformation of the probability of dying before reaching that age in a standard mortality table $q_S(a)$, such that

$$q(a) - K\, q_S(a),$$

where K is a multiplying factor that depends on the average parities of mother in age groups of 15-19, 20-24 and 25-29 years. For a family (i), the actual number of dead children $D_i$ can be obtained via

$$D_i = C_i - C_i',$$

where $C_i$ = number of children ever born to a woman in family i, and $C_i'$= number of surviving children to that woman in family i. Moreover,

$$D_i = \sum_a C_i(a)\, q_i(a),$$

where $C_i(a)$ is the number of children ever born aged (a) to the woman in family i. The expected number of child deaths in family i can be calculated as

$$EXP(D_i) = \sum_a C_i(a)\, q_S(a)$$

---

15 Adopted with modification from Hossain (1990)

$$= \sum_{a} \{C_i(a)\ q_i(a)\}/K_i$$

$$= (1/K) \sum_{a=0}^{n} C_i(a)\ q_i(a)$$

$$= (1/K)D_i$$

$$D_i/EXP(D_i) = B_{i0} + \sum_{i=0}^{n} B_{ij}\ X_{ij} = M_i$$

The $X_{ij}$'s represent a set of family characteristics like mother's years of schooling and age and other characteristics like sewerage availability, nature of water source, and type of housing. $B_{ij}$'s represent a set of weights attached to them. Hence,

$$D_i/\{1/K_i)(D_i)\} = B_{i0} + \sum_{i=0}^{n} B_{ij}\ X_{ij}$$

$$Ki = B_{i0} + \sum_{j=1}^{n} B_{ij}\ X_{ij}$$

The estimates of the right hand side of the above equation yield the K's which are interpreted as indices providing information about whether the family has above or below national average mortality. The dependable variable[16] representing child mortality is

$$M_i = D_i/EXP(D_i)$$

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16 This measure has been used in many studies due to its flexibility and also has several advantages over the simple mortality rate measure. For instance the method is able to control the exposure factor ( e.g. time elapse since birth), normalize the distribution of ratios and provide an index as to whether a mother is doing better or worse than the general average mortality.

The $EXP(D_i)$ in this case is based on the relationship between proportion dead $D_i$ at a certain age and the probability of dying before a certain age according to the Brass procedure.[17] The standard $q_s(a)$ has been translated into $EXP(D_i)$, which is the Coale-Demeny North model at the level equivalent to $e_o = 57$.

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17 See Brass W. (1971)

Also see Trusell J. and Preston (1981)

Several references were made to United Nations, Manual X (1982).

APPENDIX III CRITICAL VALUES FOR STATISTICAL TESTS

| | | F STATISTICS TWO STAGE LEAST SQUARES | | | | | | T STATISTICS INDIRECT LEAST SQ. | | ONE TAILED TEST | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EDUC | | MORT2 | | FERT1 | | | | | |
| LEVEL OF SIGNIFICANCE | | 0.05 | 0.01 | 0.05 | 0.01 | 0.05 | 0.01 | 0.05 | 0.01 | 0.05 | 0.01 |
| SAMPLE | N | | | | | | | | | | |
| 1) POTENTIAL | | | | | | | | | | | |
| a) H.POT | 220 | 2.72 | 4.33 | 2.55 | 3.93 | 2.31 | 3.38 | 2.22 | 3.18 | 2.326 | 2.576 |
| b) L.POT | 137 | 2.73 | 4.36 | 2.56 | 3.96 | 2.32 | 3.41 | 2.24 | 3.21 | 2.326 | 2.576 |
| 2) FAMILY | | | | | | | | | | | |
| a) <6 CHILD | 173 | 2.73 | 4.36 | 2.56 | 3.96 | 2.32 | 3.41 | 2.24 | 3.21 | 2.326 | 2.576 |
| b) >5 CHILD | 184 | 2.73 | 4.36 | 2.56 | 3.96 | 2.32 | 3.41 | 2.24 | 3.21 | 2.326 | 2.576 |
| 3) INC(MEAN) | | | | | | | | | | | |
| a) < 35000 | 285 | 2.72 | 4.33 | 2.55 | 3.93 | 2.31 | 3.38 | 2.22 | 3.18 | 2.326 | 2.576 |
| b) > 35000 | 72 | 2.77 | 4.45 | 2.61 | 4.05 | 2.36 | 3.49 | 2.28 | 3.3 | 2.358 | 2.617 |
| 4) ACRES(MEAN) | | | | | | | | | | | |
| a) < 10.6 | 268 | 2.72 | 4.33 | 2.55 | 3.93 | 2.31 | 3.38 | 2.22 | 3.18 | 2.326 | 2.576 |
| b) > 10.6 | 89 | 2.76 | 4.41 | 2.59 | 4.01 | 2.35 | 3.46 | 2.28 | 3 3 | 2.358 | 2.617 |
| 5) ACRES(MED) | | | | | | | | | | | |
| a) <5 | 178 | 2.73 | 4.36 | 2.56 | 3.93 | 2.32 | 3.41 | 2.24 | 3.21 | 2.326 | 2.576 |
| b) >4 | 179 | 2.73 | 4.36 | 2.56 | 3.93 | 2.32 | 3.41 | 2.24 | 3.21 | 2.326 | 2.576 |
| 6) INC(MED) | | | | | | | | | | | |
| a) <13428 | 178 | 2.73 | 4.36 | 2.56 | 3.93 | 2.32 | 3.41 | 2.24 | 3.21 | 2.326 | 2.576 |
| b) >13428 | 179 | 2.73 | 4.36 | 2.56 | 3.93 | 2.32 | 3.41 | 2.24 | 3.21 | 2.326 | 2.576 |
| 7) AGES | | | | | | | | | | | |
| a) 20-34 | 200 | 2.73 | 4.36 | 2.56 | 3.93 | 2.32 | 3.41 | 2.24 | 3.21 | 2.326 | 2.576 |
| b) 35-49 | 157 | 2.73 | 4.36 | 2.56 | 3.93 | 2.32 | 3.41 | 2.24 | 3.21 | 2.326 | 2.576 |
| 8) GENERAL | 357 | 2.72 | 4.33 | 2.55 | 3.93 | 2.31 | 3.38 | 2.22 | 3.18 | 2.326 | 2.576 |