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Abstract

Kenyan women have more children, especially in rural areas, than in most developing nations. This is widely believed to be an impediment to Kenya's economic development. Thus, factors influencing family size in the Kenyan context are important for its future. A brief review of economic theories of fertility leads to the conclusion that both economics and social/cultural factors must be considered simultaneously when examining factors that determine the number of children in a family. The need to do this is borne out in Kenya's situation by utilising responses from a random sample of rural households in the Nyeri district of Kenya. Economic and social/cultural factors intertwine to influence family sizes in this district. After providing a summary of the main statistical results from the survey, we use multiple regression analysis to explore the influences of a woman's age, level of education, whether she has outside employment, whether the family keeps livestock, whether she expresses a preference for more boys than girls, whether the family uses only family labour (including child labour) and the size of the farm, which is used as a proxy for family income.

It was found that preference for male children has an important positive influence on family size in this district. Women were found to have greater preference for male children than their male counterparts possibly because of their fear of being disinherited if they do not produce an heir for their husbands. Preference for sons was also found in allocation of human capital resources at the household level in that the female respondents were found to have lower levels of education than their male counterparts. Various long-term policies are outlined that may help to reduce the number of offspring of women in Kenya.

Keywords: family size, fertility, child gender preference, human capital formation, costs, benefits, free child labour, marital status, and age.

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1.   Introduction

The Population Reference Bureau, World Data Sheet (2002) gives the population of Kenya as 29.8 million, a crude birth rate of 34 per 1000 population and a crude death rate of 14 per 1000 population. The annual estimated number of deaths in thousands is 408,000 while the population growth per annum is 2.9 percent. The excess of births over deaths at current rate per year is 607,000 and the doubling time of Kenya's population at the current rate is 34 years. The average family size for Kenya is 4.4 compared with the average for less developed countries of 2.17 while for Sub-Saharan Africa, it is 5.6 based on average number of surviving children per woman (female over 15 years). Average family size in Kenya declined by –2.64 percent in urban areas but by only –1.62 percent in rural areas between 1960 and 1970. A high fertility rate may translate into low per capita income.

The World Bank (1996) ranks Kenya as the 17th poorest nation in the world with a per capita income of US$250. The population growth of Kenya is still high by international standards if 1.5 percent is taken as the dividing line between high and low growth (Leete and Alam, 1993). Even with the current average fertility rates, the population in Kenya will at least double in 34 years. With a declining GDP, as has been the Kenyan trend over the last couple of years, and declining contributions of the agricultural sector to GDP, this may translate into much lower standards of living for the future generations. High population levels now, because of their resource-depleting effects, may be at the expense of future generations (Tisdell, 1998, pp. 100). The Republic of Kenya (1998) reports that the official incidence of rural absolute poverty is around 47 percent and this may worsen if the current population trend continues without sufficient technological progress and other measures to counter the effects of population growth.

Economic theories of the family and family size predict that variations in (fertility) family size depend on the benefits that households derive from having children and the costs that they incur in bringing up the children. Gender composition is important in many societies. Males are needed culturally to continue the family lineage in patriarchal societies. Furthermore, a woman with no males is considered to be inadequate in Kenya and a Kenyan

husband can marry other women in the hope of getting a son. This male-gender preference may influence the number of children born in a family. A strong preference for sons may be a major contributory factor in elevating fertility. This is because parents need to plan a larger number of births in order to ensure one or more of their surviving children is a male. Male children in Africa carry with them certain benefits valued by parents such as taking care of them in old age while girls are expected to marry and move to their husband's compound. Apart from preference for boys, other factors can also influence family size. Education of the woman has been identified in the literature as being a factor influencing family size. Others such as urbanisation, employment of the woman outside the farm, income levels and so on may also influence family size.

This study employs economic theories of the family to consider factors that influence the number of children born in a family and their gender composition using a sample from the Nyeri district in Kenya as a case study. The study is based on data obtained by direct structured interviews with 137 females and 98 males in Nyeri district in the Central Province of Kenya. Central Province is a very small province (13173 sq. km) but it has a population of 3,705,000 people, which is 15 percent of the total population in Kenya. Nyeri district's population rose from 167,560 in 1963 to 452,770 in 2002. Therefore, it has displayed rapid population growth. The economy of Nyeri district has been on the decline, just like in the rest of the Kenyan economy, especially since it relies on agriculture as the mainstay of its economy.

In this article, we try to identify the socio-economic factors that influence family size; and consider gender preference in relation to children in the Nyeri district and the reasons for it. The article starts with review of literature relevant to demand for children and child gender preference. This is followed by a description of the study site and nature of the survey. Then there is a summary of statistical findings of demand for children in Nyeri district. A multiple regression model (OLS) and Tobit models is subsequently used to identify the possible determinants of the demand for children in the Nyeri district.

2.   Economic Theories of Demand for Children and Gender Preference

The conventional theory of consumer behaviour as outlined by Becker (1960, 1981) and Becker and Lewis (1973) contends that couples behave in a rational way when they decide on their number of children and they view children more or less as consumption goods. They

argue that there is a negative relationship between fertility and income caused by the level of information on methods of birth control. Lower income groups can be assumed in their view, to be less well informed on contraceptive methods, and therefore have more children than they want. In the absence in differences of knowledge on birth control, all couples behave and calculate in the same way as households do when they plan their purchases of consumer durables. These authors show that households face trade-offs between the number of children, investment in these children, and current consumption goods. In deciding on the number of children they would like to have, couples take into consideration the cost or price of the goods and of the children, as well as their disposable income.

Apart from Becker (1960, 1981) and Becker and Lewis (1973) many other authors have applied cost-benefit analysis to choice of family size, allocation of human capital to children (for example by gender) and decisions about quality of children versus number of children. Relevant contributions include those by Repetto (1979); Leibenstein (1957, 1974); Mincer (1963); Simon (1969); Smolinski (1965); De Tray (1973); Schultz (1973); Willis (1994); Todaro (1997); and Tisdell (1998, 2002). However, the economics of fertility is complex, partly because social or cultural settings influence the economics involved. In addition, children are complex economic goods, if one considers them as such goods. Some writers in fact, such as Blake (1968), consider that it is inappropriate to consider children as economic goods.

One reason why children are complex goods is that they can both be durable consumer goods as well as investment goods. The latter is especially important in rural settings in developing countries because children assist with agricultural production and care of younger children and sons, in particular, provide economic support to their parents in their old age. However, in more developed countries the contribution of children to family income and to social security of parents is hardly of any importance. Therefore, children in developed countries may merely be viewed by parents as durable consumption goods. Consequently the economic theory of fertility may be more appropriately based on consumer demand theory (for example, using indifference curve analysis), in higher income countries than in less developed countries.

There is some evidence that at low levels of income and development, the demand for children behaves like a normal economic good but at higher levels of income and stages of

development, larger size families become an inferior good. Thus, family sizes (and desired family sizes) are a reversed–U function of levels of income and the degree of economic development of a country. This is not merely a function of income levels but also reinforced by several socio-economic changes associated with economic development.

The reversed U-shaped relationship is implied by the theories of Leibenstein (1957, 1974) and the research work of Smolinski (1965, 1969). Apart from the actual reduction in family size as development proceeds, great investment in the human capital embodied in children tends to occur. The hypothetical reversed U-shaped relationship is illustrated in Figure 1. It is actually based on the aggregate relationships.

Average size of family (number of surviving children

Level of per capita income/Degree of economic development
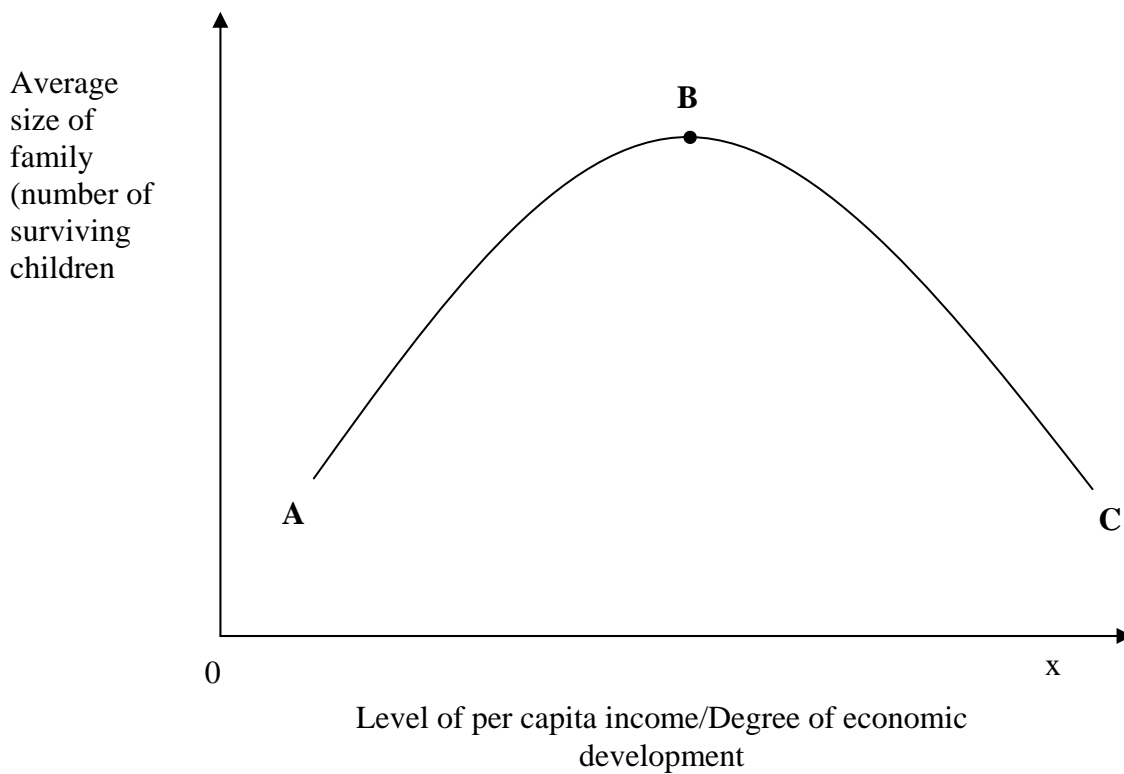
Figure 1:   Average family size (number of surviving children), shows an inverted U-shaped relationship with the average level of income and development in a region. A variety of economic factors contribute to this result.

Although the relationship shown in Figure 1 is based on aggregate relationships, one would expect that in poor areas of developing countries that cross sectional analysis might reveal that family size is a normal good. This will be tested in this article for a random sample of families from the Nyeri district of Kenya. According to the economic theory of fertility, the expected monetary and non-monetary benefits to the family or gains from children are balanced against their perceived costs and disadvantages, and a target family size results.

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Socio-economic factors affect family size by affecting the perceptions of the benefits and costs of various family sizes.

A number of additional factors have been put forward as possible influences of family size. For example, Tisdell (1998, 2002) contends that urbanisation tends to raise the cost of having larger families and lowers the value placed on large families. This is because the costs of raising children in urban households are generally higher than in rural households. Also the opportunities for productive employment of children are lower in towns than in rural areas. In addition, extended family support and kinship networks are often limited in urban areas and this can have a negative influence on family size. For instance, Turke (1989) and Bledsoe (1994) argue that demand for children is largely determined by the presence or absence of a supportive kinship network. In traditional societies, extended kinship networks function to disperse the costs of childbearing among an array of relatives allowing the parents to bear many children at low additional costs to themselves. Modernisation leads to the breakdown of these kinship networks increasing the incidence of childbearing costs on the parents, hence, reducing the number of children born. There may also be more opportunities for wives to obtain outside employment in urban settings and the opportunity cost of child minding or paying others to mind children in these circumstances can be high.

The economic theory of fertility was criticised by Blake (1968) who considers that children cannot be considered analogous to consumer durables because parents are not as free to choose the number of their children, as they are to decide to buy or not to buy consumer durables. Where parents are not satisfied with the number and quality of their children, they are not free to change these as they may change consumer durables if they are not satisfied with these. Parents are socially and legally required to care adequately for their children. According to Blake, instead of economic considerations, families are influenced in their decisions on fertility by the norms and values of society. Therefore, it is unlikely that poorer families will abstain from having children. Thus, according to Blake, fertility is determined by the characteristics of family and the general norms and values attributed to the concept of family in the given society, and fundamental changes in fertility are caused by changes of the institution of the family.

Emereuwaonu (1984) attributes the large family size in many African societies to factors such as early marriage, a high proportion of those married, high infant mortality, preference

for children of one sex or the other by parents, social security provided by children to their parents in their old age, and the social prestige and special privileges which family and the kin-group confer on a woman of high fertility. However, Brown and Fellows (1974) observed that in a society where the consequences of childlessness are destitution and poverty in old age, the effects of a decrease in infant mortality rates on family size are greatly reduced. Fear of the unknown, such as calamities, accidents, natural disasters and so on, will make parents desire a family of sufficient size to guarantee their security against possible eventualities.

Frank and McNicoll (1987) contend that in many developing countries, subsistence production is mainly the responsibility of women who are granted use rights by their husbands or her male relatives if she is not married. Women frequently recruit their children for farming, petty trade, fetching wood fuel and water and other housekeeping activities. Although children are an important source of farm labour, women do not have entitlement to this labour but enjoy use rights to it.

Payment of dowry entitles the husband to the children born by the wife. Childlessness can be grounds for divorce and full repayment of the dowry in Kenya. According to the terms of most Kenyan marriages, it is the children that a woman bears that guarantee her access to the land she needs in order to meet the family subsistence. Children are also a major source of old-age support to their parents. By continuing to bear children a woman confirms her status in the marriage, helps secure her continued access to land, and serves the family and lineage interests of her husband as well as ensuring that her own family can keep the dowry that was given for her. Thus economically and culturally defined and socially enforced obligations on African wives motivate them to have a family of a very large size.

Mhloyi (1986) argues that in a society that values large families, paternity confers status and prestige, which a man enjoys, and so men would be more inclined to support large families. Conformity to traditional customs that place a high value on children, and the need to guard one's cultural heritage and to perpetuate the family line, transcend national efforts to curb family size in most African countries and other developing countries.

From the reviewed literature, it has emerged that a social/psychological atmosphere plays a very important role in determining the desired and acceptable number of children in a family. Family size tends to decline when newly born children are not positively accepted and widely

valued by society. A negative valuation is manifested in such a phenomenon as contempt for and ridicule of large families. While the view of Blake (1968) and others is accepted that demand for children depends on the cultural norms and values of a society, it also depends on the cost of bringing up children and the economic benefits derived from them by couples. In our view, both economic and social/cultural factors play important roles in determining the number of children demanded by a household, investment in their human capital (especially according to their gender), and in some societies the gender composition of surviving offspring. The combined influence of such factors will be examined for a sample of Kikuyu households from Kenya.

## 3.	Study Site and Nature of the Survey

This study is based on cross-sectional data collected in December 2000 and January 2001 in Nyeri district in Central Kenya. The Nyeri district has a very high population density with some areas of high agricultural potential, such as Tetu division, having more than 400 persons per km^2, whereas new settlement areas such as Kieni West have 100 persons per km^2. The principal town is Nyeri with a population of about 50,000 persons and it is also the provincial headquarters.

Six divisions were selected for the study: Nyeri, Othaya, Tetu, Mukurweini, Mathira and Kieni. The Kenya Central Bureau of Statistics Welfare Monitoring Sampling Frame was used to select our sample. A random sample of 330 Kikuyu households was drawn but due to death, migration, absentees and non-responses we ended up with a sample of 185 households. Of these 11 were households headed by single males. These are not considered in this article because we want to concentrate on the responses of women interviewed. Thus this sample consists of 63 wives staying with their husbands, 26 wives staying alone as their husbands were working in urban areas, and 48 unmarried women (never married, divorced, separated or widows) who were heads of their households. Thus the sample consists of the responses of 137 women from 137 households.

The survey was conducted in Swahili by direct interview using a structured questionnaire. Of the 185 households in which either women or men were present, 48 refused to participate. The reasons for this included the following: (1) the women were too busy as it was during the short rains and there were food crops in the fields and coffee, tea, pyrethrum and other cash crops were being harvested; (2) the husbands refused to give permission in a number of cases

as they were suspicious that their wives were being incited to divorce or disobey them; (3) the households thought that we had been sent by the government and since Nyeri district was then an opposition zone, they would not respond kindly to any government functionaries; and (4) the households did not perceive any direct personal benefit from answering the questions. In the next section we provide summary statistics on family size and gender preference in Nyeri district.

4.   Summary Statistics: Family Size and Gender Preference

Table 1 shows the number of surviving children and their gender by marital status in our Nyeri sample.

Table 1

Number of Surviving Children and their Gender by Marital Status

	All women	Married women living with husbands	Married women living alone	Unmarried women
Size	137	63	26	48
Average number of children	4.82	4.54	4.31	5.48
Maximum	11	11	9	11
Sons	7	5	7	6
Daughters	8	6	6	8

As Table 1 shows the average number of surviving children in our Nyeri sample was 4.82, which is above the national family size of 4.4 children per woman. The maximum number of surviving children was 11 with a maximum of 7 boys and 8 girls. Given the low standard of living of the majority of Kenyans, a family of seven or eight children is difficult to provide for.

In our study, it was found that in jointly managed households, the average number of children was 4.54 compared to 4.31 for married women living alone and 5.48 for unmarried women. Unmarried women had more children on average. It is important to note that there was a significant age difference between the married women and the unmarried ones. The average age of the married women living with their husbands was 38.8 years while for those living alone the mean age was 38.1 years. It is also most likely that on average the unmarried women have had several years for child bearing. The sub-sample of unmarried women included widows (21.2 percent) with an average age of 61 years and an average of 6.8 children. Our results are similar to those of Emereuwaonu (1984) who found in his study that,

the highest cohort of wives who had seven or more children belonged to the oldest cohort. Our results are also similar to those of Brass and Jolly (1993) who found that in Kenya, in both the 1979 census data and the 1989 Kenya Demographic and Health Survey (KDHS) data, family size increased with age.

Table 2 shows the relationship between age and family size in our Nyeri sample.

Table 2

Relationship between Age and Family Size in Nyeri District

Age of woman (Years)	Mean number of surviving children	Number of women
20-34	1.55	11
25-34	3.26	35
35-44	5.04	27
45-49	5.33	18
50-80	6.46	46
Total		137

From Table 2, it can be seen that family size in Nyeri district increases with age and that women of age 45 and over reared six children on average against the desired mean of 4.8 indicating that they over achieved their desired family size. Our results therefore accord with those of Emereuwaonu (1984).

Table 3

Relationship between Level of Education and Family Size in Nyeri District

Level of education	Mean number of surviving children	Number of women
Never gone to school	6.13	31
1-4 years primary education	6.29	21
5-8 years primary education	4.44	59
Form 1-4	3.60	25
Form 5-6	na	na
College	1.0	1
Total		137

Table 3 shows the relationship between education and family size in our Nyeri sample. From Table 3, it can be seen that women who have acquired only four years of primary education have the largest family size. Those who never went to school follow these closely. Both of these categories have on average a family size of six children. However, an increase of education to eight years of primary education lowers the family size by 29.4 percent. On the

other hand, the family size falls by 18.9 percent when women acquire secondary education. This indicates that education of women up to secondary school and beyond has negative effect on family size. Appiah and McMahon (2002) also found that females who had higher primary or secondary education consistently had lower fertility rates. Increased education for females alone is associated with reduced fertility rates at all education levels, but this effect is reinforced by family planing efforts where presumably, more educated females are better able to comprehend and utilise contraception techniques. Our results also accord with those of Emereuwaonu (1984) who found that, wives with post primary education had the least number of children.

Preferences for large families are inherent in the Kenyan cultural and social-structural fabrics and the individual economic interests it gives rise to. The high fertility in our sample may be attributed to, among other factors, the need for child labour as 78.8 percent of all female respondents had access to free labour from their children. The children help mainly in harvesting and delivering cash crops to the factory for processing, doing housework, babysitting, fetching water and firewood (especially girls), looking after livestock, hoeing and so on. Hewlett (1991) contends that boys may be valued more because boys contribute through their substantially more calories to the family diet than do daughters. Bradley (1993) argues that women benefit from children's labour because of the fact that children are more likely to perform women's work than men's work under the control of women. However, we argue that there could be other factors apart from the benefit from boys' work that make women prefer male children.

In our sample, there were more girls born than boys. When asked whether they would have preferred more boys than girls, 21.3 percent of the female respondents answered in the affirmative compared to 12.6 percent of the male respondents. From these findings, it seems likely that women have greater preference for male children than men. A possible reason might be that a married woman with no boys runs the risk of losing her husband's property to his relatives upon his death as sons only are supposed to inherit their parent's property. It may also be that these women may fear for their future security in old age as daughters are expected to marry and move to their husband's compound leaving their aged parents behind and so girls may not be an attractive long-term investment. Tisdell (2000) observed a similar situation in India. These findings accord with Becker's theory and human capital theory in general.

For those who would have preferred to have more boys than girls, 72.4 percent of the female respondents said that boys remain at home and help their parents in old age; 10.3 percent said that boys would inherit their property since girls get married and move away from home and 17.2 percent claimed that boys are easier and cheaper to bring up than girls. They claimed that the cost of rearing a girl up to marriageable age is prohibitive. This means that those parents who gave this as their reason for the preference for male children are rational and weigh up the costs and benefits of each child. Since girls will eventually get married and move to their husband's compound, the respondents do not see why they should incur huge costs in rearing girls whose benefits they will not enjoy. In this case, the cost-benefit analysis is effective in explaining the preference for male children. However, the cultural aspect or societal values of having male children are also important as seen by the high percentage of female respondents who said that boys remain at home and help them in old age and also are important in relation to their inheritance.

This preference for male children may translate into gender inequality especially in human capital formation. It was found that 22.6 percent of the female respondents had never gone to school compared to only 9.2 percent of the male respondents and could not, therefore, read or write. From our analysis, we found that very few women reach secondary school (18.3 percent compared to 28.6 percent of males) and there were none at the university level. In Kenya as a whole, males have greater access to education than females (UNDP, 1995). This indicates that households would rather educate males rather than females.

Considering the competitiveness of the education system in Kenya and its costs, we would assume that households would educate those children with the highest academic potential and who have better prospects of getting employment in the formal sector to not only help themselves but also extend financial help to the parents in their old age. Old age security is non-existent in Kenya. However, in Kenya, women have much lower prospects than men of procuring employment in the formal sector. In 1986, unemployment for women was 24.1 percent, double that for men, which was 11.7 percent (Republic of Kenya, 1998). In this study, we found that only 8 percent of the female respondents had outside employment compared to 22.4 percent of the male respondents. Even in terms of earnings, women are started off on a lower scale than men and earn less on average.

The majority of the female respondents (62.2 percent) did not go further in their education, as there was no money to pay for their fees and their parents wanted to educate their brothers instead. This implies that these women have low or no education due to their parent's preference for their brothers who according to the human capital theory would be more likely repay parents the investment. This finding supports Becker (1981) who argues that investment in children will rise with parental income and decline with children's expected endowment. In this case, females are the unlucky ones since the parents consider them not as well endowed as males or as having fewer income prospects. So with low income, parents would rather educate males rather than females. The results suggest that parents are not altruistic towards their children since they only invest human capital in them because they expect to reap benefits from the success of the sons. Limited resources, (due to family size or income), constrains parents' abilities to pursue altruistic goals for their children (Buchmann, 2000).

Additional reasons given by the respondents for wanting sons just strengthen the argument that females are risky investments and cannot be relied upon to repay the human capital invested in them by their parents. For example, 8.1 percent of the respondents said that they dropped out of school to get married while 4.5 percent became pregnant and were expelled from school. Parents who calculate the costs and benefits of investing in their children would consider women in this sample a risky investment as investing in them would be a waste of resources since the benefits would go to another household. However, 18 percent of the respondents decided out of their own choice not to go to school supporting Mincer and Polacheck (1974) in their argument that since on average women will obtain a lower return from eduction than males, it is not profitable for them to invest in education and, therefore, women are liable on average to want less education than males.

Women are expected to become mothers at a relatively early age in Kenya; 19 is the median age for first birth in Kenya (National Council for Population and Development, 1994). These results also strengthen the gender theories that from a cultural point of view, women are destined for marriage and will eventually move to another homestead and so investing in them is of no benefit to their parents. Thus, child socialisation, governed by tradition imparts negative attitudes towards female education, even among females themselves. This inequality in the provision of education to women may have negative consequences on family size since as the literature shows, fertility of women declines as they receive more education. Apart

from this, women in Kenya are most often responsible for most of agricultural production and so it is important and necessary to keep women informed of new farming techniques the use of which is environmentally beneficial (Tisdell, 2001).

In the next section, we try to identify the possible determinants of the demand for children in Nyeri district using regression analysis.

5.   Determinants of the Demand for Children: Multiple Regression Analysis

The estimates are based on data drawn from a cross-section of households in Nyeri district of Central Province in Kenya. The regression sample consists of all the 137 female respondents. The dependent variable is the number of children born and surviving in the family. From the literature review, the following can be said to be the possible determinants of family size; age of the woman, household income, mortality rate, availability of kin to share the cost of bringing up children, preference for boys, the education level of the woman, her marital status, a woman's earnings from outside employment, demand for labour, demand for security in old age, cost of bringing up children, desire to propagate the family name, and so on. To identify the determinants of fertility and family size, one needs a great understanding of the societal process, society values, marital decisions, frequency of copulations, usage of contraceptives and so on which requires enormous resources, which due to limited time, and lack of enough resources could not be undertaken for this study. Some of the variables identified in the literature as possible determinants of family size were therefore not easily available.

However, the independent variables considered in this analysis as possible determinants of the family size are the age of the woman, her education level, employment outside the household, ownership of livestock, preference for boys, farm size, use of free labour, and log of earnings. We first determined the correlation between the independent variables and those having a correlation coefficient of 0.5 and over could not be used together. Thus, earnings were found to be highly correlated with education of the women and was dropped from the analysis. The correlation coefficient between education and employment was only 0.217 and so the two variables were retained in the analysis. We estimate an equation for determining the factors influencing family size. In summary, the following variables are used in the model: The dependent variable was Nochild = number of children surviving while the explanatory variables were:

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Age = age of woman in years; Edu = educational level of the women, 0 if never went to school, 1 primary school, 2 secondary school and beyond; Employed = employed outside the farm, 1 if employed, 0 if not; Livestck = whether a household has livestock, 1 if has, 0 otherwise; Prefboy = preference for boys, 1 if yes, 0 otherwise; Frelabor = household use of free labour from children and no labour is hired, 1 if yes, 0 if it does not; Totfmsz = size of family land in acres.

Typically a linear model would be specified as follows:

$$Y_i = \alpha_0 + \beta'X_i + U_i \qquad i = 1, \ldots..n.$$

Where Y_i is the dependent variable and X_i is a vector of exogenous variables, α_0 is a constant, β_1 is a vector of unknown regression coefficients and U_i is the error term. The parameters can be estimated by ordinary least squares. However, in the analysis of numbers of surviving children, we may have a problem with a censored regression model. That is, we will have zero values of the dependent variable for some families as not all families may have any children at all, while the independent variables are known. In that case OLS will produce biased estimates of β since $E(U_i) \neq 0$. We can overcome this problem by using a Tobit model to analyse our problem (Wilson and Tisdell, 2002; Gujarati, 1995; Amemiya, 1984). The Tobit model can be described as follows:

$$Y_i = \alpha_0 + \beta'X_i + U_i \qquad \text{if RHS} \geq 0$$
$$Y_i = 0 \text{ otherwise.}$$

Y_i is the dependent variable, X_i is a K*1 vector of known variables. β is a K*1 vector of unknown parameters. U_i are the residuals with $E(U_i) = 0$ and a common variance, σ^2. We also assume $U \sim N(0, \sigma^2)$.

However, Wilson and Tisdell (2002) found that if the number of zeros in the dependent variable is not large, OLS estimates could be substituted for Tobit, as the numbers of zeros in the dependent variable have to be significantly large for differences in estimates between OLS and Tobit analysis to emerge. The results of the OLS and Tobit analysis are shown in Table 4.

5.1. *The Results with Discussion*

As Table 4 shows, the two models, OLS and Tobit are not significantly different in that the estimates in both are not significantly different. This therefore concurs with Wilson and Tisdell (2002) in that where the zeros in the dependent variable are very few OLS may be operationally acceptable.

We had hypothesised that age would be positively related to family size as we assume that older people have had more years of giving birth and therefore would tend to have more children on average. Emereuwaonu (1984) and Mhloyi (1986) found fertility to be positively associated age. Our results accord to their findings in that not only was age positively related to family size but it was also highly statistically significant at the 1 percent level in explaining variations in family size in Nyeri district.

Table 4

Factors Influencing Family Size in the Nyeri Sample

Variable	Tobit model β- Coefficient	Ordinary least squares β- Coefficient
Constant	1.149	1.407
	(0.531)	(0.650)
Age	0.087	0.086
	(5.245***)	(5.173***)
Edu	-0.187	-0.205
	(-0.791)	(-0.862)
Employed	-0.041	-0.034
	(-0.069)	(-0.050)
Livestck	0.163	0.161
	(1.648*)	(1.619*)
Prefboy	0.918	0.927
	(2.225***)	(2.242***)
Frelabor	1.611	1.620
	(3.608***)	(3.619***)
Totfmsz	0.122	0.120
	(2.518***)	(2.466**)
Log likelihood	-291.9085	-
R^2	-	0.419
F-stat	-	13.28
N	137	137

Figures in parenthesis at t- values
*** Statistically significant at the 1 percent level.
** Statistically significant at the 5 percent level.
*Statistically significant at the 10 percent level.

Education of the woman was expected to be negatively associated with the numbers of children as we assume that more educated women will desire to have less children. They may also be expected to have and use the knowledge on contraceptives to control both the numbers and the spacing of their children (Appiah and McMahon, 2002). Education could also be used as a proxy for price of female time. Numbers of children and looking after children in general are assumed to be female-time intensive and therefore, an increase in the price of female time would cause households to substitute away from numbers of children to quality of children (Becker, 1981; Cochrane, 1979; Shultz, 1993). From the analysis, education of the woman was found to be negatively associated with the size of family in both OLS and the Tobit as we had earlier hypothesized. This result is consistent with the contention that increasing female education reduces the size of the family. It may also be that as women get more educated, they desire to improve quality of their children (desire to invest human capital in their children) rather than increase the numbers of their children. These findings accord with those of De Tray (1973); Rosenzweig (1990); Barro (1991); Appiah and McMahon (2002); Cochrane, et al. (1980); and Schultz (1993) who found that female education had a negative effect on the number of children born.

However, although the education variable had the expected sign, it was surprisingly not statistically significant in explaining variations in the size of family. This lack of statistical significance in education could be as a result of sampling bias. Table 3 shows that there is an over-sampling of women with primary education showing that women in this study are fairly homogenous in terms of educational attainment and this implies less variation in their family size responses.

Also, looking at the OLS results, it can be seen that the total explained variation in family size of these households resulting from the combined effects of variables in the model is 41.9 percent leaving 58.1 percent to other factors not in our model. These other factors could be the proximate or biological determinants of family size, which we could not capture in our analysis. It may also be that use of contraceptives in Nyeri district may be a very important variable leading to reduction in family size and may therefore have reduced the significance of education as an independent variable. Emereuwaonu (1984) and Brass and Jolly (1993), in their studies on Kenya found very weak relations between fertility and education. They also found that education in Kenya did not have a statistically significant impact on fertility although it was negatively correlated with fertility.

Employment outside the farm had also been hypothesised to have a negative influence on the family size. Employed people generally earn salaries and wages and De Tray (1973) found that an increase in female earnings had a strong negative effect on family size. The same argument as in female education could be applied in that numbers of children, as well as child services in general are assumed to be female-time intensive. Therefore, an increase in the price of female time causes households to reduce both numbers of children and child services. Brass and Jolly (1993), in their study on Kenya found that employment in the modern sector was the only development indicator that was related to the fertility declines in a significant way. From our analyses, we found that outside employment had a negative influence on the numbers of children. Our results accord with those of Mincer (1963); De Tray (1973); Emereuwaonu (1984); Heisel (1968) and Willis (1994) and are at odds with those of Conception (1973) and Olusanya (1969) for Nigeria. However, employment was not statistically significant in explaining variations in family size. This lack of significance in employment may be due to the very few women who were employed outside the household in our sample.

Ownership of livestock and rearing of livestock are labour intensive and this task is usually left to women and children. To be able to perform other household and agricultural activities, most women usually leave the task of looking after livestock to children, especially boys and we had therefore hypothesised that ownership of livestock would have a positive association with family size. As expected ownership of livestock was found to be positively associated with numbers of children supporting the hypothesis that rural and agricultural households would desire to have more children to help in agricultural and household tasks (Bergstrom, 1996) and this variable was found to be statistically significant at the 10 percent level (using a one tailed test of significance) in both the OLS and the Tobit in explaining variations in family size.

Gender composition is important in many societies. In Kenya, males are supposed to continue the family lineage and a woman with no males is considered disadvantaged and her husband can marry other women in the hope that they will give him a son. It is through their sons that women have access to land in the event of their husband's death as land is passed on to male heirs. We would have expected that preference for boys would have a positive association with numbers of children with those families having more girls preferring to go on giving birth until they get a boy. Our hypothesis was supported and the variable was also statistically

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significant at the 1 percent level in both OLS and the Tobit in explaining variations in family size. Furthermore, the coefficient (impact) of this variable is relatively large. This accords with Tisdell (2002) who found in India that parents believe that there are more benefits to be derived from having more male children than females especially because boys are expected to look after their parents in old age while girls get married and move to their husband's homestead.

According to Muellar (1976), having more children frees parents to perform other tasks and she contends that adult men may gain leisure by having large families or the women may be freed from the household to work in the market place. In this case, work by children may be merely a substitute for work by others in the household. We would assume that in agricultural households, the opportunity cost to the mother for having more children is higher when she has no older children because once she has older children they become free baby sitters. As such, having many children would provide the mother with more time to do other chores as the older children look after the younger ones. Children provide a woman some relief from the volume of work by their own labour contribution. We had hypothesised that use of free child labour would have a positive influence on family size. The variable for free child labour was positively related to family size and was also statistically significant at the 1 percent level in explaining variations in family size in both OLS and in the Tobit model. The coefficient of this variable in the multiple regression analysis is very large. Therefore, free child labour seems to be the major influence on family size.

The availability of ample land for cultivation was expected to be positively associated with family size as more land (holding other things constant) means more subsistence output and cash income from cash crops which is hypothesised to vary positively with fertility. Economic theory of the fertility predicts that under ordinary conditions the demand for children is related positively to income changes in developing countries (Todaro, 1997); Mincer (1963); Simon (1969) and Smolinski (1965, 1969). We therefore use farm size as a proxy for income. This in essence means that households that have less land should have fewer children if children are like normal goods. From our analysis, it was found that farm size has a positive association with family size and it is also statistically significant at the 1 percent level in explaining variations in family size. This indicates that demand for children in Nyeri district is a normal good because demand for them increases with increased in income. Our results accord with those of Mincer (1963); Simon (1969) and Smolinski (1965,

1969). However, the income effect may be relatively small since farm sizes are mostly quite small in Nyeri. The coefficient of this variable is small, and children are partly supported by the whole local community (cf. Bledsoe, 1994).

6.   Concluding Comments

From our regression analysis, the variables found to be significant in explaining the variation in family size in the Kenyan case study were age, ownership of livestock, preference for male children, use of free child labour and by farm size (used as a proxy for income). Age was positively related to family size (as would be expected) and was also statistically significant. Ownership of livestock was found to be positively associated with numbers of children indicating that rural and agricultural households would desire to have more children to help with animal husbandry. The use of free child labour was also positively associated with family size implying that families that are rely on child labour tend to have more children. This is especially true for women who use older children as baby-sitters as they perform other chores both inside and outside the household.

Our study shows that the demand for children is quite high in our sample for parents preferring to have more boys than girls. This gender preference may lead parents to have many children in search of boys. Preference for boys was found to be positively associated with numbers of children and was statistically significant. Women were found to have greater preference for male children than their male counterparts. This is mainly because of the fear in Kenya of their being disinherited if they do not produce an heir for their husbands plus the fact that it is only through male children that women have access to land when they become widows. This preference may result in inequality in the provision of human capital in terms of education and even in terms of earnings. Education and employment were found to be negatively associated with family size. It is therefore important for the government to embark on widespread education especially of women as our study has indicated that educated women have fewer children than the less educated. However, the lack of significance of education and employment outside the household shows that other social factors not captured in our model are very important in explaining variations in family size in this district. It may also be attributed to the relatively lack of access to education for many women and very few employed women in this sample.

Many empirical studies have found that fertility eventually decreases with development and higher per capita incomes. It is therefore important for the Kenya government to embark on creating an enabling environment for investment, both by locals and by foreign investors. This would lead to an increase in GDP and a rise in per capita incomes leading to a decrease in fertility and in the long run, a decrease in population. In Kenya this is only likely to happen if people's attitude towards the value of children is changed because they do not have to depend on their children for old-age support. However, in the process of trying to increase per capita incomes, it is important to ensure economically and environmentally sustainable use of natural resources to avoid environmental degradation with the possible consequences of reduced per capita incomes for future generations (Tisdell, 1998).

Introducing a welfare system or old age insurance benefits to help support the elderly and infirm would reduce the need in Kenya of women having many children as security for old age. So a desirable path for the Kenya government to take is to upgrade Kenyan living standards through investments in education and try to create employment opportunities for both men and women. In the long run, the National Social Security Fund and the National Hospital Insurance Fund should desirably be extended to everyone, even those in the agricultural and in the informal sectors and not just for those in formal employment. This would reduce the motivation of parents to have many children as a form of financial security investment for their old age or for circumstances where they are unable to fend for themselves (cf. Tisdell, 2002). However, Kenya is a poor country and most rural households are very poor so such a scheme is financially difficult to institute and may need to be subsidised by those in formal employment. Nevertheless, such a scheme is capable of providing long-term economic development benefits.

Results from our analysis show that education of women, up to secondary school and beyond has negative effect on fertility. Kenyan women, like most African women, end their education at the primary school level. Emphasis should, therefore, shift to providing higher education for girls if any significant progress is to be made in lowering family size in the Nyeri district and generally in the whole of Kenya.

Widespread sex education and contraceptives should be made easily available to young people especially to teenagers, and this will remove the stigma attached to family planning.

The Kenyan government should give individuals more freedom to decide on the number of children that they would like to have.

There should be legislative and administrative efforts to regulate dowry payments. In Kenya, these translate into a contractual agreement for the wife's labour as well as for her reproduction. Its regulation would serve not only to lessen the reproductive obligation of women, but also to reduce enforceability of the labour commitment to the husband's lineage. Women should also be granted land registration and the right of wives to inherit land should be recognised so that they do not have to depend on their children, especially boys, for access to land in the event of the death of their husband. This would not only curb preference for male children, but it should also lead to a reduction in family size, as can be inferred from our empirical results.

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