THE INFLUENCE OF SOCIO-ECONOMIC AND DEMOGRAPHIC FACTORS ON FERTILITY LEVELS IN NAIROBI

BY

JOSEPH MOINDI OMAGWA

A THESIS SUBMITTED IN PARTIAL FULFILMENT FOR THE DEGREE OF MASTER OF SCIENCE IN POPULATION STUDIES AT THE POPULATION STUDIES AND RESEARCH INSTITUTE, UNIVERSITY OF NAIROBI

1985

D E D I C A T I O N

TO MY PARENTS

D E C L A R A T I O N

This Thesis is my original work and has not been presented for a degree in any other University.

JOSEPH MOINDI OMAGWA

This Thesis has been submitted for examination with our approval as the University Supervisors.

DR. TIMOTHY H. GATARA

DR. CALEB OYUKE

ACKNOWLEDGEMENTS

Many people contributed to the completion of this thesis. It may not be possible to thank them all, however, I will thank a few.

First and foremost, I am particularly grateful to Kenyatta University for funding me through my two year Course at the Institute of Population Studies, University of Nairobi. I also wish to thank Professor Celia K. Nyamweru, Head Geography Department, Kenyatta University for her contribution and advice during this Course.

My special thanks go to my two supervisors Dr. Timothy H. Gatara and Dr. Caleb Oyuke both of the Institute of Population Studies for their patience, technical advice and encouragement during their supervision of this thesis.

Further, I would like to sincerely thank Professor S.H. Ominde, Director of the Institute of Population Studies for his fatherly advice, Dr. M. Otieno, Dr. John Oucho, Dr. Wariara Mbugua, Dr. S. Khasiani, Dr. Ocholla-Ayayo and Mr. C. Oyieng, all of the Institute of Population Studies for their lectures and advice during this Course.

I also wish to thank my colleagues at the Institute of Population Studies during the 1983/85 academic year for creating a conducive atmosphere.

I also single out Mr. S.K. Mwaniki for his Library services at the Institute Library and Mr. Okumu of Geography Department, University of Nairobi for drawing the maps used in this Thesis.

Last but not least, I thank Rachael N. Mbango for typing this Thesis.

ABSTRACT

Nairobi which is the study area, is the largest urban centre and capital of Kenya. It acquired its urban status in 1950. It is located almost at the centre of the country. From North to South, it stretches from 2^{o} 10'S to 2^{o} 50'S and from East to West, it stretches from 37^{o} 10'E to 36^{o} 40'E, thus covering an area of 684 square kilometres. According to the 1979 Kenya population census statistics, Nairobi had a total population of 827,775 people. This was 5.4 per cent of the total annual population of Kenya which was 15,327,061 people.

The main objectives of this study were to examine fertility levels between wards in Nairobi in order to establish how low they are, and if fertility differentials exist between wards. The study also attempts to identify the various socio-economic and demographic factors that influence fertility and in what direction. Motivation for this study stemmed from the fact that fertility is the major contributor to the population in the early years of life. This youthful population needs care in terms of provision of the essential services like education, health, food, shelter and transport especially in an urban centre where children depend directly on their parents for these services. There is need to understand the level of total fertility rates in Nairobi so as to assess the contribution of fertility to this youthful population.

To achieve these objectives, the 1979 Kenya population census forms the basis of the data used in this study. It was found to be rather detailed unlike the other previous censuses of 1962, 1948 and 1969. Thus, data on fertility and other related socio-economic and demographic factors used in this study were obtained.

The demographic techniques used for fertility estimation are: current fertility, life-time fertility, $(P_3)^2/P_2$ fertility and the Brass P/F ratio fertility methods. The multiple regression analysis is the statistical technique used in this analysis. This technique is suitable in that it can enter many variables into the analysis and it can establish their absolute and relative effects upon the dependent variable (fertility in this case). The F-statistic test has been used to test the levels of significance and thus confirm the stated hypotheses.

This study has revealed that fertility differentials exist between wards in Nairobi. A total fertility rate of 5.47 births was estimated for Nairobi. At ward level, births ranging from 3.62 to 8.29 was observed in Kilimani and Maisha-Makongeni wards respectively. These differentials are quite high in an urban setting of this kind. Some wards are experiencing very high total fertility rates and this may be associatedwiththe differentials in socio-economic and demographic factors.

The analysis of the data revealed that the selected socio-economic and demographic variables are found to influence and account for 84.4 per cent (R^2) of the variation in total fertility rates in Nairobi. The corresponding F-statistic at (df. 8,31) was 20.9 which is found significant at .05, .01 and .001 levels. Female education proved to be the major determinant of total fertility rates in Nairobi. It was found to be negatively related to total fertility rates. A computed correlation coefficient (r) of -0.630 was obtained and this confirms the stated hypothesis. It explains 39.7 per cent of the total variation in total fertility rates between wards in Nairobi. Male education was also found to be negatively related to total fertility rates. A computed correlation coefficient (r) of -0.585 confirms the stated hypothesis. Illiteracy of both adults (Male and female) was found to be positively related to total fertility rates in Nairobi. A computed correlation coefficient (r) of 0.376 confirms stated hypothesis that illiteracy is positively related to fertility.

Child mortality levels are also found to be inversely related to total fertility rates in Nairobi. A computed correlation coefficient (r) of -0.306 confirms the stated hypothesis. All the ethnic groups (Kikuyu, Luo, Luhyia and Kamba) considered in this study are found to have a positive influence on total fertility rates. Computed correlation coefficients (r) 0.346, 0.444, 0.274 and 0.119 respectively confirm the stated hypothesis that ethnicity is positively related to fertility rates.

Some recommendations that emerge from this study for both city and national policy planners are:-

In order to reduce fertility rates both in Nairobi and in Kenya at large, the educational levels of both males and females should be increased. This will help wipe out illiteracy which is found to be positively related to fertility. It will also increase the knowledge and awareness about contraception and it will also change attitudes on family size desires. It will also help create employment opportunities. Secondly, child mortality rates should be reduced by providing better health and nutritional services to both mothers and children. This will increase the survival rates of children thus increase the confidence in parents that the children they have will survive, thus desired family sizes will be achieved. Ethnic groups should also be given more formal education in order to change their attitudes on family size and their life-styles.

TABLE OF CONTENTS

PAGE

CHAPTER TWO: DATA AND TECHNIQUES OF DATA ANALYSIS 50

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

LIST OF APPENDICES

CHAPTER ONE

INTRODUCTION

1:0 BACKGROUND

In 1962, the population of Kenya was 8.6 million people with an annual rate of growth of 3.3 per cent. In 1969, the Kenya population had risen to 10.9 million and by 1979, the population had increased to about 15.3 million with an annual growth rate of 3.8 per cent (Central Bureau of Statistics (CBS) 1979). The main contributing factor to this growth is fertility because Kenya is experiencing sustained high fertility and continued mortality decline. This growth rate shows that Kenya's population is among the fastest growing in the world. The rate places considerable constraints on the social and economic development goals of the country. This has resulted into social problems like high dependency burden, unemployment, increasing demand for basic services such as health, education, nutrition and shelter. These problems have become the key concern of the Kenya Government and they are felt more in the urban than in the rural areas. A study on fertility is therefore necessary so as to understand those factors that influence it.

"There is no event in personal history more significant for the future than becoming a parent, and there is no societal survival than adequate fertility .... The individual and social importance of proper knowledge on this vital activity cannot be overstated."[1]

Demographers see fertility as the positive force in the vital process of continuously replenishing the population to combat the attrition of mortality. If the replenishment is either seriously insufficient or excessive, social problems result. It has been found that fertility levels in any society are influenced by environmental, social, economic, biological and demographic factors. These factors have either a positive or negative influence on fertility depending on the nature of the population under which they are operating. Most studies which have been carried out have shown that there are strong relationships between these factors and fertility levels both in developed and developing nations (Easterline, 1963; Andorka, 1978; Cochrane, 1979; Schultz, 1981).

Most developing nations are out to curb their population problems. They are therefore interested to know those factors which have a depressing effect on fertility. Most Researchers, have found that urban areas experience lower total fertility rates than the rural areas. This is because the urban residents are better placed in these socio-economic and demographic factors than the rural residents. Most of these factors tend to have a depressing effect on fertility in the urban areas, whereas in the rural areas, they play a reverse role. It is therefore assumed that if a country's population is concentrated in the urban areas, then fertility is bound to decline due to the influence of modernization.

Modernization is associated with factors which can reduce fertility such as adoption of birth control methods, late marriage, reduction of both infant and child mortality rates, separation of couples, better educational levels, increased incomes and also a change of attitudes of family size desires.

1:1 PROBLEM STATEMENT

Fertility levels in Kenya are generally lower in the urban areas as compared to the rural areas. However, for Nairobi, no researcher has examined in detail these fertility levels. The present study is an attempt to examine these fertility levels between wards in Nairobi. The levels of fertility and the factors that account for their differentials are important for policy planners.

1:1:1 JUSTIFICATION FOR THE STUDY

A number of fertility studies have been carried out in Kenya but no empirical study has examined fertility levels between the wards in Nairobi. This shows that a study on fertility within an urban centre like Nairobi has received inadequate attention from fertility researchers in Kenya.

Most fertility researches in Kenya are either centred on national level, or at provincial and district fertility differentials. Rural/urban fertility differential studies have found urban areas to be experiencing low total fertility rates than the rural areas (ILO/University of Nairobi Survey, 1974; Anker and Knowles, 1977; Kangi, 1973; World Bank, 1980).

Other fertility studies either on provincial or district fertility differentials (Van de Walle 1968; Henin, 1979; Anker and Knowles, 1980; Mwobobia, 1982) have also found Nairobi to be experienoing the lowest total fertility rates in the Country when compared to the other provinces and districts.

The low levels of total fertility rates experienced in Nairobi is largely explained by the differentials in the socio-economic, socio-cultural and demographic factors existing between Nairobi and other provinces and districts in Kenya.

Despite these findings, Nairobi is presenting a modern front to the world yet its youthful population is gradually increasing despite its modernization process. The 1962, 1969 and 1979 Kenya population censuses show crude birth rates (CBR) of 37.3, 40.8 and 40.8 respectively for Nairobi. Inspite of these rates falling substantially below that of the country of 52 births per thousand population (CBS, 1979), these rates are still high if compared to those of developed and other developing countries. This is an indication that fertility is contributing alot to the youthful population in Nairobi.

Further, child-woman ratios of 629 and 649 computed from 1969 and 1979 Kenya population censuses respectively reflect high fertility rates in Nairobi. Such fertility rates contribute significantly to the age structure of Nairobi's population as reflected in the population pyramid (see figure 1) overleaf. The pyramid constructed from 1979 population census reflects a high proportion of the youthful population in Nairobi since 35.45 per cent of the population is below 15 years of age.

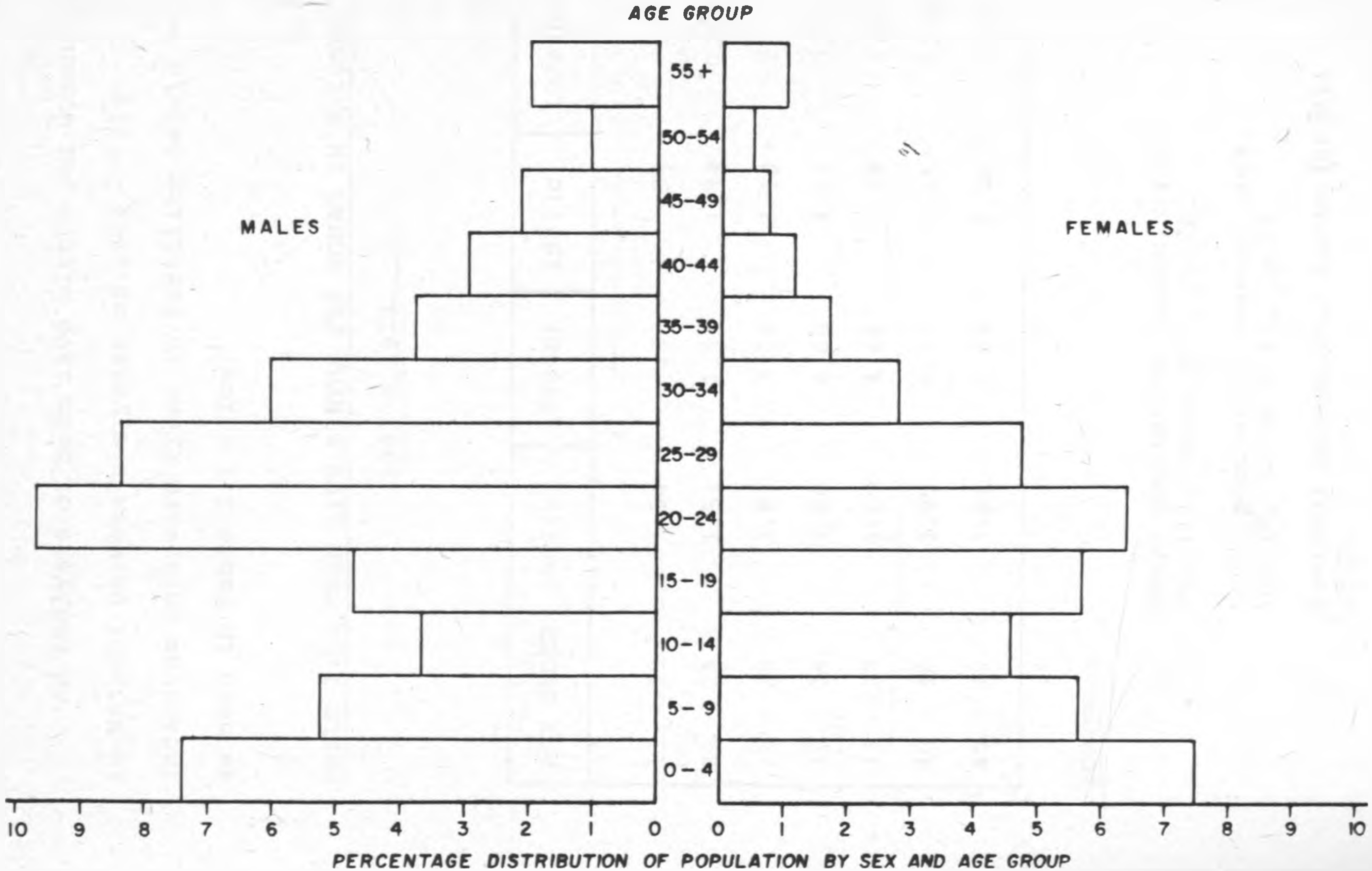


Fig. 1 POPULATION PYRAMID – NAIROBI 1979

An analysis of mean live births per woman in Nairobi between the years of 1962 - 1979 indicates an upward trend in fertility levels as seen in Table 1:1 below.

TABLE 1:1: MEAN LIVE BIRTHS PER WOMAN IN NAIROBI 1962 - 1979

AGE GROUP	1962(a)	1969(b)	1977(c)	1979(d)
15 - 19	.54	.32	.34	.29
20 - 24	1.54	1.51	1.74	1.34
25 - 29	2.83	3.05	3.10	2.77
30 - 34	3.66	4.00	4.51	3.99
35 - 39	4.09	4.64	5.28	4.81
40 - 44	3.95	4.83	5.61	5.11
45 - 49	3.61	4.64	6.15	5.16

Source

a Kenya population census, 1962, Vol.III, Table x12, pp.70.

b Kenya population census, 1969 Vol.IV, Table 4.12, pp.31.

c National Demographic Survey (NDS)(1) 1977.

d Kenya population census, 1979.

This youthful population is not only becoming a concern to the parents but also to the urban planners (health, education, transport etc.), as they have to plan in order to cater for the needs of these youth. This youthful population is also potential future parents who will contribute to fertility levels in Nairobi in the future.

A study on fertility in Nairobi is necessary since it will highlight on the distribution of total fertility rates in the city's various wards. This distribution will show the contribution of fertility to the youthful population in these various wards in the city.

Second, the study will help provide a basis for understanding those factors which influence fertility in Nairobi. Those factors found to be having a depressing effect on fertility in the urban area can be emphasized in the rural areas to help curb the population problem.

The study will help city planners in various fields (education, health, transport etc.) in the establishment and distribution of these essential services e.g. provision of health facilities and services, schools, transport and other recreational facilities needed within the city. Preference to be given to those wards experiencing high total fertility rates.

1:1:2 OBJECTIVES OF THE STUDY

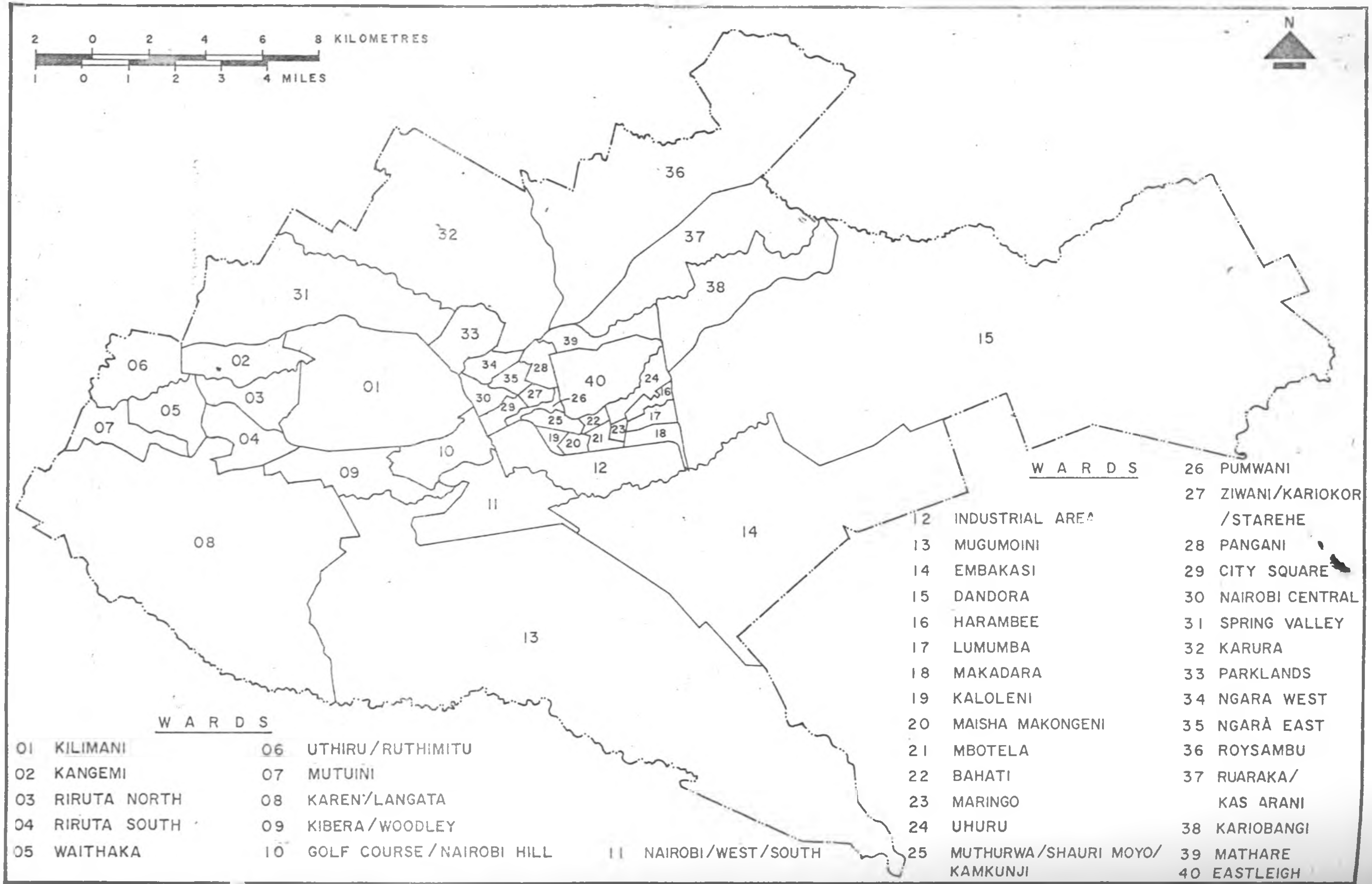
1. This study intends to estimate and analyse total fertility rates by ward in Nairobi.

2. If fertility differentials are found to exist between the wards, then the selected independent variables (socio-economic and demographic) will attempt to explain the differentials.

3. To show the direction and strength of the relationship between each selected independent variable and the estimated total fertility rates (TFR).

1.2 NATURE AND SCOPE OF THE STUDY

According to the 1979 Kenya population census, Nairobi was divided into 40 different enumeration wards (see Map 1) overleaf. This study covers all these wards in Nairobi. The ward is the unit of analysis in this macro-level study. The ward is the smallest enumerated unit from where the selected socio-economic and demographic factors used in this study are obtained. The selected dependent variable is total fertility rate (TFR). To estimate this variable by ward, data are obtained from women respondents (married or single) between the reproductive ages (15 - 49) years from all the wards of Nairobi.



MAP I NAIROBI WARDS

1:3 BACKGROUND TO THE STUDY AREA

Nairobi is chosen as an area of study because it is by far the largest and most important urban area in Kenya. It is the capital city and it stands almost at the heart of the country. From North to South, it stretches from 2° 10'S and from East to West, it stretches from 37° 10'E to 36° 40'E, thus covering an area of 684 square kilometres.

Nairobi is not only the principal urban centre of the country, but is also the centre for most social-economic and administrative functions of the country. It is a major receiving area of most migrants from the rural areas (Ominde, 1972).[2] It is inevitable that the movement of people into this urban centre will continue. These migrants are mainly composed of people in the reproductive ages (20-49) years. They are therefore likely to add more children through births to the already high numbers of children in the city.

In terms of urbanization,[3] Nairobi acquired its urban status in 1950. Statistics shown below on Table 1.2 indicate that in 1969, Kenya had 47 urban centres with a total urban population of 1,079,908 persons. This figure represented 9.86 per cent of the country's total population. Nairobi in 1969 had 47.2 per cent of this total urban population of the country. In 1979, the number of urban centres had risen to 91 with a total urban population of 2,308,194. This represented 15.05 per cent of the country's total population. Nairobi in 1979 had 35.9 per cent of this urban population, the largest proportion as compared to other urban centres.

TABLE 1:2 DISTRIBUTION OF URBAN CENTRES WITH POPULATIONS OF OVER 2,000 BY PROVINCE: 1969 AND 1979

P R O V I N C E	Number of Urban Centres		1969		1979	
	1969	1979	Total Population	Percent	Total Populaiton	Percent
NAIROBI	1	1	509,286	47.2	827,775	35.9
CENTRAL	6	13	45,955	4.3	128,932	5.6
COAST	8	11	283,652	26.3	406,991	17.6
EASTERN	7	15	37,975	3.5	233,316	10.1
NORTH EASTERN	-	7	-	-	60,139	2.6
NYANZA	4	7	43,829	4.1	207,757	9.0
RIFT VALLEY	19	31	148,576	13.8	338,141	14.6
WESTERN	2	6	10,645	1.0	105.743	4.6
KENYA	47	91	1,079,908	100.0	2,308,194	100.0

SOURCE: 1979 Kenya Population Census, Vol.II Analytical Report, Central Bureau of Statistics, Ministry of Economic Planning and Development.

In terms of population size and distribution, the population censuses 1948, 1962, 1969 and 1979 show that Nairobi's population has been increasing from 118,976, to 343,500, 509,268 and 827,775 people respectively. According to population projections by Henin (1979), the city of Nairobi is expected to be one million in the year 1984 and 2.8 million in the year 2000.[4]

Table 1:3 below shows these population statistics in respective years, percentage increase and annual growth rates within the Inter-Censal periods. It can be seen from the table that both the percentage increase and annual growth rates are decreasing as the years increase. However, the percentage annual growth rate within the Inter-Censal periods has been on average about 5 per cent and above which is quite substantial, an indication that population increase in Nairobi is very high indeed.

Computation formula:

$$P(t) = P(o)e^{rt}$$

where P(t) = Present Population

P(o) = Initial Population

r = rate of growth

t = time

TABLE 1:3 : POPULATION OF NAIROBI, PER CENT INCREASE AND ANNUAL GROWTH RATES: 1948-1979

YEAR	POPULATION	PERIOD	% INCREASE	% ANNUAL GROWTH RATE
1948	118,976	1948-62	65.4	7.6
1962	343,500	1962-69	32.6	5.6
1969	509,286	1969-79	38.5	4.9
1979	827,775			

SOURCE : Computed from the Kenya Population Censuses, 1948, 1962, 1969 and 1979.

The analysis of 1979 population census figures at ward level, shows that there are great inequalities in the distribution of population to various wards (see Table 1:4) below. Five wards stand out in terms of population size. Mathare Valley with a total population of 68,456 is the largest. It is followed by Kibera/Woodley ward with 63,353 people. Eastleigh with 53,562, Kilimani with 45,111 and Kariobangi ward with 43,349. These are among the major sections of Nairobi which are overcrowded with people. In the second category are medium sized wards like Roysambu/Kahawa, Ruaraka/Kasarani, Nairobi/South/West, Kawangware/Riruta North, Parklands, Uhuru and

CITY OF NAIROBI

TABLE 1:4 : POPULATION SIZE, AREA AND POPULATION DENSITY - 1979 CENSUS

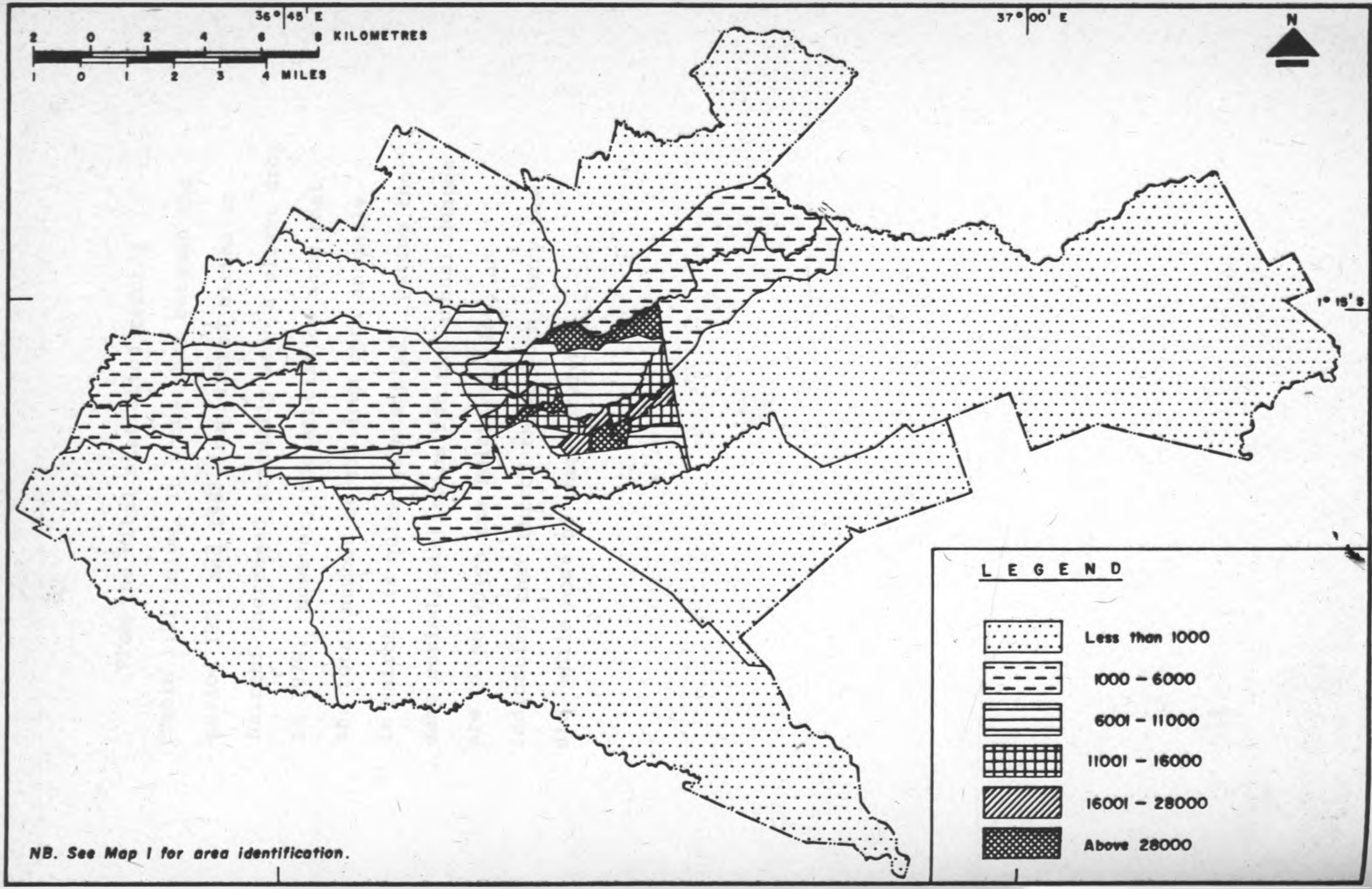
WARD	POPULATION	AREA SQ.KM	POPULATION DENSITY/ (SQ.KM)
KANGEMI	21081	5	3933
KAWANGWARE/RIRUTA NORTH	24413	4	5261
RIRUTA S. SATELLITE	17165	5	3433
WAITHAKA	7365	4	1521
UTHIRU	8140	6	1218
MUTUINI	7627	4	1588
KILIMANI	45111	24	1805
KAREN/LANGATA	13112	74	176
KIBERA/WOODLEY	63353	7	8515
GOLF COURSE	16670	5	2835
NAIROBI/SOUTH/WEST	28997	11	2432
INDUSTRIAL AREA	9314	10	849
MUGUMUINI	11750	124	94
EMBAKASI	13502	62	217
DANDORA	22672	162	139
HARAMBEE	16257	0	20321
LUMUMBA	13544	1	11286
MAKADARA	11931	1	10285
KALOLENI	5120	0	8000
MAISHA-MAKONGENI	16606	0	27676
MBOTELA	14073	0	43978
BAHATI	10670	0	20519
MARINGO	13083	0	32707
UHURU	23813	1	12149
SHAURI MOYO	18858	1	14286
PUMWANI	14403	0	36007
ZIWANI-KARIOKOR	8521	0	12530
PANGANI	17223	1	10251
CITY CENTRE	18402	1	15683
NAIROBI CENTRAL	8859	1	7382
SPRING VALLEY	18559	23	788
KARURA	11031	36	298
PARKLANDS	23965	3	6886
NGARA WEST	10044	1	8100
NGARA EAST	16335	1	13173
ROYSAMBU/KAHAWA	30958	46	663
RUARAKA/KASARANI	29881	16	1829
KARIOBANGI	43349	12	3437
MATHARE	68456	2	29006
EASTLEIGH	53562	7	7439
NAIROBI	827775	684	1210

SOURCE: KENYA 1979 POPULATION CENSUS.

Dandora. The third category are wards like Waithaka, Uthiru, Mutuini and Kaloleni.

Table 1:4 has also population densities per square kilometre in each ward. The most densely peopled wards are Mbotela with 43,978 persons per square kilometre, followed by Pumwani with 36,007 persons per square kilometre, Maringo with 32,707 persons per square kilometre, Mathare with 29,006 and Maisha-Makongeni with 27,676.

The other most overcrowded areas are mainly the wards in the East, usually called the Eastlands wards and those around the City Centre. Here is where majority of the Nairobi African residents live. These wards are Harambee, Lumumba, Kaloleni, Maisha-Makongeni, Mbotela, Bahati, Uhuru, Shauri-Moyo/Muthurwa/Kamukunji, Ziwani/Kariokor/Starehe and the adjacent wards of Pangani, City Centre and Ngara East. These wards have population densities of between 10,000 - 20,000 persons per square kilometre. To the West and South of the City Centre are less density wards. Map 2 overleaf gives a summary of these population densities by ward in Nairobi in 1979.



MAP 2 POPULATION DENSITY BY WARD IN NAIROBI – 1979

From the vital statistics records (Table 1:5) below, it shows that between the period 1971 and 1982, registered births in Nairobi increased gradually with a slight drop in 1979. However, the statistics show that the total number of children born annually in Nairobi is quite substantial. During the same period, statistics for the annual deaths are given which are relatively low, an indication that out of those born, very few die, while most of them survive.

TABLE 1:5

REGISTERED BIRTHS AND DEATHS OF NAIROBI RES[illegible]

	1971	1972	1973	1974	1975				1979	1980	1981	1982
BIRTHS												
MALE	12952	14520	14533	15406	14681	16557	156[illegible]	[illegible]	14543	16418	18183	22224
FEMALE	12437	13923	14817	14580	13926	15901	15097	1585[illegible]	15397	16480	17583	21329
TOTAL	25389	28443	29350	29986	28607	32458	30768	32179	28940	32898	35766	43553
DEATHS												
MALE	2213	2142	2014	2267	2045	2118	2035	2155	3847	2198	1965	2292
FEMALE	1652	1450	1489	1541	1254	1534	1431	1487	2319	1529	1493	1522
TOTAL	3865	3592	3503	3808	3299	3652	3486	3642	6129	3727	3458	3814

SOURCE: Nairobi City Council.

1:4 THEORETICAL FRAMEWORK

Socio-economic, socio-cultural and demographic factors are likely to affect either directly, indirectily, independently or jointly the fertility levels in any given society. This postulate will be the basis of this study and in this postulate, the key concepts are: socio-economic, socio-cultural and demography.

The socio-economic factors are those factors which reflect the social and economic status of individuals within a given society. These factors reflect the level of living of individuals in that society. These factors are like education, employment, income , housing, health, food and nutrition, sanitation, clothing and social security, just to mention a few among others. In this study, we have considered education, as this can also be used as a proxy for income, employment, consumption and health standards of the people in a society.

Socio-cultural factors are those factors which reflect the social behaviours, beliefs, practices and attitudes towards fertility in a given society. These differ from one society to the other depending on ethnic differentials. Ethnicity is therefore used as a socio-cultural variable in this study.

Demography can be defined as a modern field of study which examines the structure of human populations (their distribution by age, sex, marital status etc), and their dynamic aspects (births, deaths and migration).[5]

Bogue defined demography as a study by statistical methods of human populations, involving primarily the measurement of the size and growth of numbers of people, the proportions living, being born and dying within an area and the related functions of fertility, mortality, marriage and migration. In this study, the demographic variables considered are fertility and mortality.

These variables considered,fertility, education, ethnicity and mortality are defined at the end of this chapter.

1:5 THEORIES OF FERTILITY

Research evidence has shown that a few theoretical approaches have incorporated some or part of the variables considered in this study. Some of these theories are cited below.

The Economic Theory of fertility by Becker (1960, 1965) states that fertility is related to socio-economic conditions, family size preferences and conscious decisions of limiting childbearing.[6] In this theory, Becker found that household income is a major determining factor on the number of children a couple should have. He viewed reproduction as an economic behaviour. Parents (households) are seen as rational entities maximizing their utility or well-being subject to various constraints. Children are seen as commodities and the households attempt to obtain the "optimal" combination of the children and other goods. Thus the number of children depends on constraints faced by the parents (household) - basically income and time, its relative preference for children as compared to other goods, and the costs and benefits of children as compared to other goods. The theory applies best to urban residents who find children costly relative to other goods.

Children contribute very little or nothing to the family income in the urban areas unlike they do in the rural areas, where they help in looking after animals, picking coffee, tea, pyrethrum e.t.c.

Becker's theory has been criticized by other scholars because the theory does not account for the biological and socio-cultural factors.

Judith Blake (1956) came up with an analytical framework of fertility to show how social structural factors may relate to fertility levels in different societies through the influence of intermediate variables. In this theory, the intermediate variables emphasized are sexual intercourse, conception and gestation. Sexual intercourse is influenced by age of entry into sexual unions, permanent celibacy, duration of marriage, voluntary and involuntary abstinence and coital frequency. Exposure to conception depends on the use or non-use of contraception methods, while gestation depends on foetal mortality from voluntary and involuntary causes. Freedman and Davis (1963) emphasized the importance of these intermediate variables in influencing fertility.

Bongaarts (1978)[7] emphasized more on these intermediate variables which directly influence fertility through socio-economic and cultural factors. These socio-economic factors like level of education of women is found to be negatively related to fertility. Bongaarts classified these intermediate variables into three distinct categories as shown below:

I Exposure factors
- Proportion married.

II Deliberate marital fertility control factors
- Contraception
- Induced abortion.

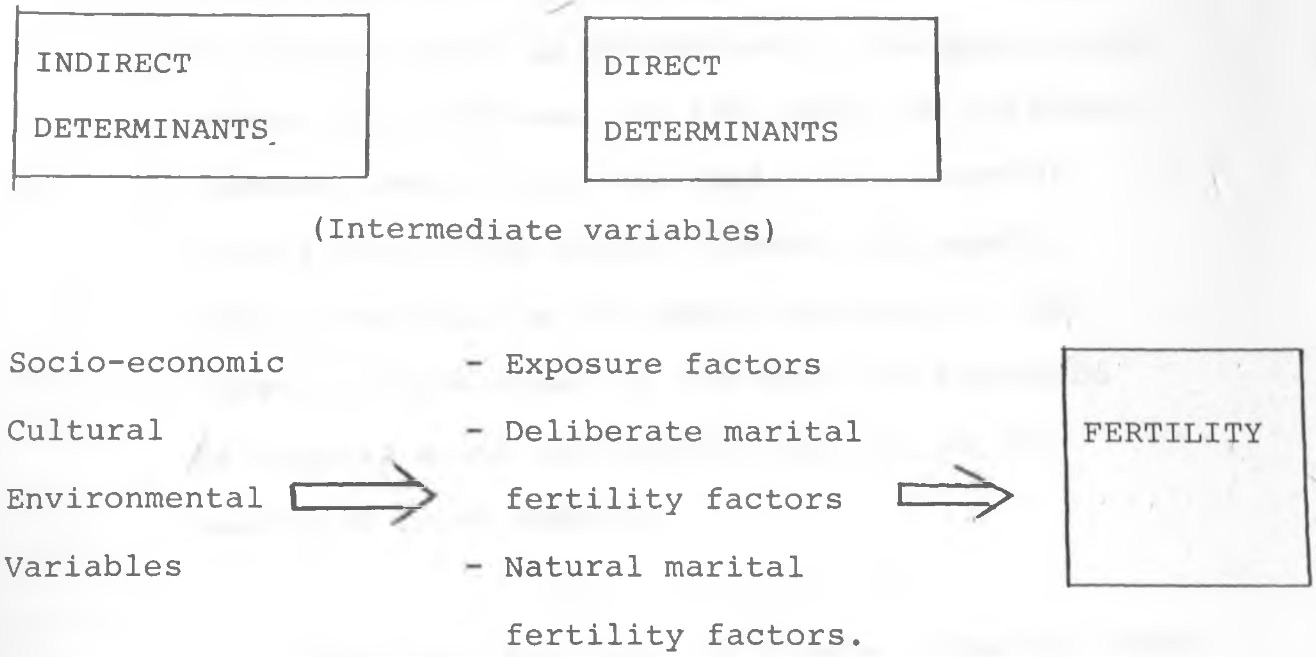
III Natural marital fertility factors
- Lactational infecundity
- Frequency of intercourse
- Sterility
- Spontaneous intra-uterine mortality
- Duration of fertile period.

This classification is presented in Bongaart's model shown below . Bongaarts found that intermediate variables such as prevalence for contraception, induced abortion, proportion married, frequency of intercourse, period of lactation etc. do influence fertility directly.

Marriage is a principal intermediate determinant of fertility (Bongaarts, 1978). Marriage affects fertility through the numbers who marry, proportion of those who stay in stable unions and the age at which they marry. Total fertility rate is found to be high in early marriages and is low in late marriages. This is because in the latter, the reproductive period is shorter while it is longer in the early marriages.

Prolonged lactation is associated with longer periods of post-partum amenorrhea (a period of infertility following birth). In developing countries, lactation is found to be longer and therefore the period is longer thus conception is delayed longer in such periods. Contraception also influences fertility because the higher the contraception, the lower the fertility.

BONGAARTS' MODEL ON DETERMINANTS OF FERTILITY



Susan Cochrane (1943) developed an economic model of fertility which determines how education affects fertility. In this model, she found that education affects fertility indirectly through other intervening variables.

In her model, she hypothesized that fertility is determined by biological or natural supply of children which depends on the proportion married, age at marriage and health e.g. that of infants and children. Fertility is also determined by demand factors e.g. perceived costs and benefits of children and family size preference. Fertility also depends on fertility regulation or control which is determined by the supply and demand for children. If the supply of children exceeds demand, then the family will control births but if the demand exceeds the supply, then there will be no control of births. All these are determined by the level of education of couples which influences their decision making on birth control.

Cochrane emphasized on female education which is of paramount importance in decision making. Focussing on the relationship between education and fertility, particularly in third world countries, Cochrane (1979) concluded that policies geared toward increasing educational levels in developing countries would probably lead to fertility declines.

1:6 LITERATURE REVIEW

1:6:1 EDUCATION

Evidence from studies done by Western scholars has shown that developed nations have achieved fertility reduction through an improvement in their formal education. It is through these findings that most developing nations are trying to adopt the educational policy as a means to the reduction of population.

Caldwell (1980) found that the impact of education on fertility is not direct but acts through other mechanisms e.g.:-

First, it reduces the child's potential for work both in and outside the home since most hours are taken by school attendance and homework. This makes a child loose contact with traditional work at home.

Second , education increases the cost of children in terms of costs incurred in fees, uniforms, stationery and food.

Third , schooling creates dependency both within the family and the society. With schooling, it becomes clear that the society regards the child as a future rather than a present producer, and that it expects the family to protect the society's investment in the child for that future. Families tend to adjust to this expectation.

Fourth , schooling speeds up cultural change and creates new cultures. In the west, values of the school were middle class values and the schools were expected to propagate these values. In the developing countries, schools propagate values of the western middle class. Caldwell (1980) advocated for mass education both for males and females if a demographic change is to be realised. In 1972 Charles Grant wrote that education should be used "to improve native morals."

Formal education prepares women for roles outside the home thus removing them from the traditional roles of the mothers at home (Westoff, 1966; Goldstein, 1972; Cochrane, 1979). Kasarda (1973:314) found that formal education is important because of its influence on the quantity and quality of women's work.

Caldwell and Cochrane (1981) both found that education makes women and men to change attitudes about family size desires. In the western countries, research has shown that educational attainment for women is one of the most important factors accompanying modernization. This leads to the achievement of small family sizes and desires (Westoff et. al., 1955 and 1960;

Freedman, 1965; Bongaarts, 1980 and Jain, 1981).

Most authors believe that modern cities have provided a particularly favourable environment for the development of attitudes motivating family limitation. Increased costs of children in the cities and their decreased economic usefulness have been mentioned by some researchers as factors leading to lower fertility rates in the cities.

Studies of Olusanya in Western Nigeria in 1971 found that for women who never attended school, they said that fertility is "Up to God."

In most countries, the more educated generally perceive that the utility of children has been declining to a greater extent than the less educated do. The more educated expect less from their children than the less educated. The less educated bear more children with an expectation to gain more from their children later at old age.

The World Fertility Survey (WFS) in Thailand found that the more educated expect less economic benefits from children and also showed that the more educated felt better able to afford children than the least educated. In West Africa, Olusanya (1971) found that in Nigeria, the more educated were less likely to believe that having more children raised their standard of living as the less educated believed.

Bogue (1969) concluding from his surveys in United States found that "throughout the world, there seems to be a strong inverse relationship between the amount of educational attainment and the level of fertility (1969:693)." In his studies, Bogue found that rising educational levels, school attendance and elimination of early marriages are much more powerful in promoting fertility reduction than simple urbanization and rising levels of income.

Hiesel using 1962 Kenyan census data found that women with higher levels of formal education in any given age group have lower fertility.

Mott (1980) found that in developing nations, women who have little education have higher fertility levels than women with no formal education. This confirms Henin's (1979) findings in Kenya and in other African studies that women with few years of education (Primary education) have higher fertility than women with zero years of education. However, fertility reduces as women's education increases to secondary and above.

Mandelbaum (1974) using data from various sources on Indian women, observed that "a year or two of schooling results in little or no reduction in fertility but a high school education regularly has a significant effect" (Mandelbaum 1974: 53). These studies confirm other studies which have found that education is inversely related to fertility Anker (1975) and Freedman (1977).

In urban areas, Zarate (1967) and Caldwell (1978) found inverse relationships between education and fertility for Mexico and Ghana respectively. Stycos (1968) found the same inverse relationships in Latin America. Schultz (1972) found that both male and female education was inversely related to fertility in his studies in Taiwan and Israel. Ben-Porath (1973) observed the same results for male and female education in Israel. He found female education to be significantly inversely related to fertility but male education was not very significant though inversely related to fertility.

Some other fertility studies done by Heer (1966) and Janowitz (1971) have found negative relationships between education and fertility.

Cochrane (1978), in her studies of Thailand used female literacy to see its influence on fertility. She found that there was a fall in fertility as women literacy increased. She also found that education can affect fertility either directly or indirectly.

Evidence has shown that education has an indirect effect on fertility depending on the age at marriage. The study by Coale and Tye (1961) suggests that postponement of marriage can be an important component of population control. Mott and Amani (1971) showed that literate women in the city of Isfaham marry on average a year later than illiterate women. In Turkey (Stycos and Weller, 1967) found that the educated always marry later than the uneducated. Mott's study of Western Nigeria (1976) found that a lower proportion of women (15-19 ages) with some education were married than those with no education. Harmon's study of the Philliphines (1970), Kogut's study of Brazil (1974), and Anker and Knowle's study of Kenya (1975) found a positive relation between educational level of women and age at marriage.

Education is also found to influence fertility indirectly. It increases the efficiency of fertility control by increasing a woman's knowledge about contraception (Janowitz, 1979). Robert Michael (1973) stressed the role of schooling in creating greater access to fertility control information and more intensive use and approval of contraceptive technology.

1:6:2 CHILD MORTALITY RATE

Various studies have shown that child mortality rates are positively related to fertility. Evidence is from countries of Bangladesh (1951-61), Puerto Rico (1950-60), Taiwan (1954-59), Chile (1960), and the Philliphines (1968).

Child and infant mortality rates affect fertility through the number of surviving children desired. Thus, in high mortality areas, more children would need to be born to achieve the desired number. It has been found that each child who dies must be "replaced" by another if the family is to attain its desired family size.[8] The response to replace a male child is greater than that of a female child (Dan Vanco, 1970; Schultz, 1972). This is because most societies value male babies than the female ones. Bogue (1967) found that the fear for mortality among infants and children is a motive that promotes high fertility desires. May and Heer (1968) argued that the decline in mortality implies that fewer children are needed in order for parents to reach their desired family size, to take care of them in their old age and to continue the family line. Mortality decline in industrialized nations consequently influenced the eventual lowering of fertility.

Freedman (1963:164) argued that "known low mortality is one of the necessary conditions for an effective social policy for reducing fertility."

According to the U.N. Department of Economic and Social Affairs (1972:84), "evidence accumulates that the reduction of both infant and child mortality rates may be a necessary prerequisite to the acceptance of family planning. Couples will not wish to prevent pregnancies until they have some assurance that the children they already have will survive."

Mandelbaum (1974) in his studies in India found that the fear for mortality among infants and children motivated fertility in most of the Indian societies. This shows that societies with high child mortality rates tend to have high fertility rates.

1:6:3 ETHNICITY

In this study, four dominant ethnic groups in the city of Nairobi have been considered. These are the Kikuyu, Luo, Luhyia and Kamba local ethnic groups. This study is to examine the influence of these ethnic groups on fertility levels in Nairobi wards.

Most studies have shown that ethnicity acts through culture to directly influence fertility. Sociologists like Lorimer, Davis and Blake maintain in their theoretical considerations that the extended family is a major cause of high fertility in developing countries. Couples are motivated to have many children to strengthen their family line or their own status in the household. The idea is that being parents of many children is seen as a matter of prestige. This may not be the case in developed countries.

High fertility levels experienced in India are attributed to their traditional beliefs and practices. In India, a woman's status in the society can be enhanced only when she has many children. In India, sons are highly preferred as they are not only regarded to be of an economic advantage to parents but that they can keep the family line. The verdic blessing for a woman who is married in India is, "may she bear ten sons and make of her husband the eleventh" (Lahiri, 1975).

Lahiri (1974) in his studies in the urban cities of India found that an average of two sons and one daughter was considered ideal. If a family never achieved this, women would continue to higher parities.

The same argument used in India has been found to apply to Kenya. The high fertility experienced in Kenya has been associated with cultural beliefs and practices. The World Bank report (1980) found that most Kenyans desire seven to eight children because of old age support and to keep the family line. Most Kenyan women and even men have a very high expectation from their children's education. However, urban and better educated mothers have less expectations from their children than the rural and less educated mothers.

Molnos' (1973) study on the cultural practices of the East African tribes, found that for most ethnic groups, family size desires were very high, for reasons of prestige and old age support in case some died. Children also help to keep the family line. The age at marriage was found to be very early (around 16 years) and the women continued to bear up to the end of their reproductive period. Birth control practices were only those of lactation and abstinence during certian periods of ceremonies only. Molnos found that sex preference for sons was practised by all tribes, a factor which can influence fertility.

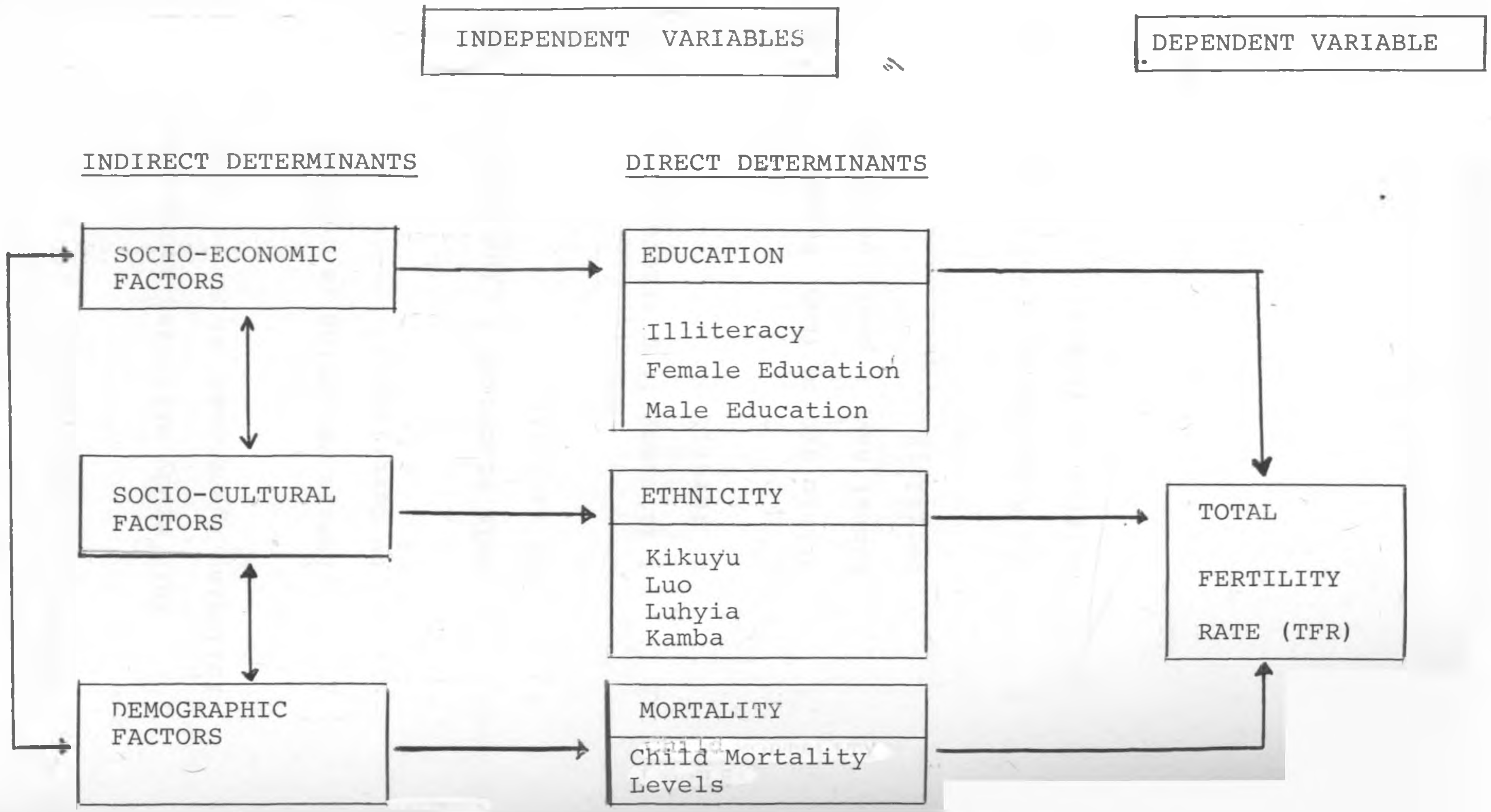
Some other studies have shown that urbanization makes people drop or loose contact with their cultural beliefs and practices.

However, this is a gradual process as other researchers have found. Rural-urban migrants have relatively traditional values which change slowly over time.[9] These migrants retain some of their fertility behaviours of their original environment until they make adjustments at their new environment.

Goldberg (1957), in his studies based on several American cities hypothesized that urban fertility differentials by social class (status) were only caused by farm in-migrants who had moved into the cities and these were majority among the lower social strata.[10]

From the above theories of fertility and literature on this subject, this study will be guided by the general contention that total fertility rates are a function of socio-economic and demographic factors. These factors either act directly or indirectly through the intermediate variables. Given below in figure 2 is an hypothesized fertility model which is elaborated in examining the relationships between these fertility related factors and total fertility rates.

FIGURE 2: THEORETICAL FERTILITY MODEL RELATING THE SOCIO-ECONOMIC AND DEMOGRAPHIC FACTORS TO TOTAL FERTILITY RATES IN NAIROBI



1:6:4 OPERATIONAL HYPOTHESES

This study will test among others the following hypotheses at macro-level.

1 Female education is inversely related to fertility.

2 Male education is inversely related to fertility.

3 Illiteracy is positively related to fertility.

4 Ethnic groups (Luo, Kikuyu, Luhyia, Kamba) have a positive effect on fertility.

5 Child mortality levels are inversely related to fertility.

1:7 SOME DEFINITIONS OF THE KEY CONCEPTS USED

DEPENDENT VARIABLE

1. TOTAL FERTILITY RATE (TFR), which is the dependent variable used in this study is a refined measure of fertility. It is defined as the total number of live births that a woman reaching the end of her reproductive life (44-49) years has given birth to.

INDEPENDENT VARIABLES

2. EDUCATION

Education is a socio-economic variable which has been used in this study. Education by definition is the transmission of ideas, knowledge or values either through the formal or informal system. Formal education has been used here which is the highest standard or form one has attained through the school system.

3. ETHNICITY

Ethnicity is a socio-cultural factor which has been used. Ethnicity by definition refers to being a member of a particular ethnic group. An ethnic group is a distinct category of the population in a larger society. Members of such a group are tied together by common beliefs, practices and norms which make their culture.

4. <u>CHILD MORTALITY RATE</u>. Is the demographic variable used. This variable refers to those children who die before they attain the age of five years after birth. This rate is determined by the life expectancy at birth (e_o) in that society. The higher the life expectancy (e_o) the lower the rate and vice versa.

<u>OTHER CONCEPTS</u>

5. <u>CRUDE BIRTH RATE (CBR)</u>. This is the number of live births that occur in the population in one year per 1000 population.

It is computed as:-

$$CBR = \frac{B}{P} \cdot k$$

Where,

B is the total number of live births in a year.

P is the total mid-year population.

k is a constant, normally 1000.

6. CHILD - WOMAN RATIO (CWR)

This is the ratio of the number of children (0-4) years to the number of women aged (15-49) years per 1000 women.

It is computed by the formula.

$$\text{Child-Woman Ratio} = \frac{\text{Number of children (0-4) Years}}{\text{Number of Women (15-49) years}} \times 1000$$

7. "DE FACTO" POPULATION CENSUS

This is that census which counts the population according to where it happens to be on the census night or day, as opposed to the "de-jure" census which counts people by their usual place of residence.

1.8 OUTLINE OF CHAPTERS

This study is presented in four chapters. The breakdown of these chapters is briefly given in this subsection.

Chapter One presents the introduction to this study. It talks about the problem statement and justification for the study. It also specifies the objectives and significance of the study. It provides a brief background of the study area. It also looks at the theoretical framework of the study, and the literature review related to this study. It ends by specifying a theoretical fertility model, the hypotheses tested and definitions of some of the concepts used.

Chapter Two is devoted to the data sources and the methodology used in this study. In this chapter, data sources, quality of the data and the data collected are presented. The chapter further presents a detailed discussion on each of the demographic techniques used for both fertility and mortality estimation. It also discusses on the statistical techniques used in data analysis i.e. the multiple linear regression analysis and the F-statistic test.

Chapter Three presents the major findings of the estimated total fertility rate results from the four demographic fertility techniques discussed in chapter two. The results of the multiple linear regression analysis and the F-statistic test based on the findings of the factors considered to influence fertility in Nairobi are also presented.

Chapter Four presents a summary and conclusion of the major findings of this study. It also outlines some policy recommendations based on the results of the findings and also highlights on a few areas recommended for further research.

CHAPTER TWO

DATA AND TECHNIQUES OF DATA ANALYSIS

2:0 The present chapter is based on data collection and various demographic and statistical techniques of data analysis. The chapter is divided into two sections. In the first section, data sourse, data collected, quality and limitations of the data are presented. The second section presents a detailed discussion on the demographic and statistical techniques for data analysis applied in this study.

2:1 DATA: SOURCE, DATA COLLECTION, QUALITY AND LIMITATIONS

2:1:1 DATA SOURCE

The 1979 Kenya population census forms the basis for the data used in this study. The Kenya population census held in August 1979 was the fourth general population census for Kenya. Previous censuses were taken in 1948, 1962 and 1969. The 1979 population census was taken on a "de facto" basis with reference to midnight 24th August, 1979. Legal provision for the 1979 population census was under the Authority of Section 5 of the Statistics Act (Cap 112) and the statistics (census of population) Order, 1979.

The 1979 Kenya population census was taken in order to determine the number and distribution of population, to determine the nature and rate of internal migration and to obtain basic data on population characteristics such as on their education, age-sex composition, marital status and household composition.

Details of enumeration procedures and the questionnaire are discussed in Vol.I of the 1979 Kenya population census. It is therefore not necessary to discuss the same here since reference can be made to the same. It was a detailed census unlike the other previous censuses. To achieve the above objectives, detailed questionnaire was designed to collect information from respondents in terms of age, sex, marital status, children ever born, those children living and those who have died, children born 12 months before the census, household numbers, date and place of birth, ethnic group, educational attainment and present and previous place of residence. Enumerators were given thorough training on the questionnaire and how to code down the informations from respective questions asked. It is from the final results of this census that the data used in this study have been drawn from.

2:2 DATA COLLECTION

2:2:1 FERTILITY DATA

To obtain data on fertility, two sets of questions were asked in the 1979 Kenya population census.

I. Females aged 12 years and above were asked to state the number of children they had ever born alive, specifying how many were still living in the same household and how many were living elsewhere. Appendix Table A presents data on the number of children ever born by ward in Nairobi.

II. Secondly,a question on births 12 months before the census was asked and these were recorded from the same women respondents as above. Appendix Table B presents current age-specific fertility rates by ward in Nairobi.

To estimate total fertility rates by ward in Nairobi, the above data from women respondents aged (15-49) years were used. Demographic fertility techniques used for this estimations are discussed below.

2:2:2 MORTALITY DATA

Childhood mortality statistics are useful as a sensitive index for a country's health conditions and this acts as a guide to structuring the country's public health programmes. Child mortality rates can also influence family size desires of couples. Most studies have shown that populations that experience high infant and child mortality rates tend to compensate for the dead children by replacing them through bearing more children.

In Kenya like in most developing nations, data on mortality are least reliable. Reluctance to answer questions about the death is a common case in the African culture. To avoid questions on the dead children, the 1979 Kenya population census asked questions on the total number of children ever born alive and those who are still alive by the age of the mother. Using these data from the 1979 census, child mortality estimates were computed using the Brass mortality technique. These child mortality estimates by ward in Nairobi were converted to child mortality levels (e_o) by ward (see Appendix Table C) using Coale and Demeny Model life-tables (Nyamwange,1982) This study used these estimated child mortality levels by ward in order to assess their influence on total fertility rates by ward in Nairobi.

2:2:3 EDUCATION DATA

Education is one of the socio-economic variables considered in this study. Various studies have revealed that education is a strong determinant of fertility. Education is found to have an inverse relationship to fertility (Anker and Knowles, 1977; Cochrane, 1979).

To assess the influence of education on total fertility rates in Nairobi, data on educational attainment were obtained from the 1979 Kenya population census. Two questions on education were asked in the 1979 census.

I. Question on whether the respondent had ever been to school.

II. The highest class or form reached for those who had been to school or were at school.

Three categories of educational levels were considered in this study, and data on these levels was obtained from the 1979 Kenya population census for each respective ward. The first category consists of adult respondents who have never attended school and these are considered illiterate. The second category consists of women respondents aged (15-49) years with 7+ years of education. The third category consists of male respondents aged (15-49) years with 9+ years of education. Appendix Table D presents the percentage distribution of these respondents in terms of their educational levels between wards in Nairobi.

Rising educational attainment increases the income potential of individuals. Since from the 1979 Kenya population census, data on income were not available, male education has been used as a proxy for income status. Nairobi is therefore divided into two social classes i.e. middle and above income wards and low income wards (see Table 2:1) below.

TABLE 2:1: CLASSIFICATION OF NAIROBI WARDS BY SOCIAL CLASS: 1979

LOW INCOME WARDS	MIDDLE AND ABOVE INCOME WARDS
Kangemi	Kilimani
Kawangware	Golf-Course
Riruta-Satellite	Nairobi South/West
Waithaka	Industrial Area
Uthiru	Mugumuini
Mutuini	Embakasi
Karen-Langata	Harambee
Kibera-Woodley	Lumumba
Makadara	Uhuru
Kaloleni	Pangani
Maisha-Makongeni	City Centre
Mbotela	Nairobi Central
Bahati	Spring Valley
Maringo	Parklands
Shauri-Moyo	Ngara West
Pumwani	Ngara East
Ziwani-Kariokor	Eastleigh
Karura	
Roysambu/Kahawa	
Ruaraka/Kasarani	
Mathare	
Kariobangi	
Mathare	

2:2:4 ETHNICITY DATA

Ethnicity is a social-cultural variable which has been used in this study. Data on this variable were obtained from the 1979 Kenya population census. In the census, each respondent was asked to state his/her ethnic group. It was necessary to consider this variable since ethnicity is one of those strong determinants of fertility in any society. Fertility behaviours are very much determined by the ethnic background of an individual, through beliefs, practices, and norms of a society where one belongs.

At the time of 1979 Kenya population census, the census statistics for Nairobi show that the Kikuyu with 33.41 per cent were the majority, the Luo were next with 18.16 per cent followed by the Luhyia with 16.22 per cent and the Kamba with 12.46 per cent were the fourth largest tribe. These four ethnic groups constituted 80.25 per cent of the total population of Nairobi leaving only 19.75 per cent represented by other ethnic groups.

The distribution of these ethnic groups between wards in Nairobi (see Appendix Table E) is very important in that it may account for the distribution of total fertility rates between these wards in Nairobi. This can be due to the influence of their cultural beliefs and practices (Sydner, 1975).

2:2:5 DATA QUALITY

Kenya's 1979 population census was found to have some errors like many other African censuses. The published analytical report of 1979 Kenya population census volume II has identified two errors in the 1979 population census. There was under-enumeration of children below 5 years throughout the country and there was also mis-reporting of ages by the respondents. Characteristics of age mis-reporting were identified as follows:-

a A marked heaping of ages on round numbers ending in 0 or 5.

b An over-statement of ages of young children.

c A general exaggeration of ages among middle aged and elderly, more pronounced for men than for women, giving high sex ratios for older age groups.

d An over-statement of ages among adolescent girls and young children giving low sex ratios between ages of 16 and 30.

Some of these errors may have come up because of high illiteracy levels among respondents (Brass, 1968) or due to lack of interest about one's age, digital preference, failure to record ages and erroneous estimations of ages by enumerators (United Nations, 1975) or due to transfer of women across age boundaries (Gaisie, 1976).

Some of these identified errors may have been committed by the respondents from whom the data used in this study have been obtained. A good example is that where data on children ever born and those born 12 months before the census were subject to a few identified errors, though not very serious. The numbers of children ever born by older women were subject to omissions. Symptoms of such omissions are seen in Appendix Table A where average parities fail to increase with age increase. In some cases parity increases up to age 40-44, drops at ages 45-49 or it increases up to ages 45-49 and drops at ages 50+. This kind of sudden drop in parity is a clear indication of omission of children ever born. This was evidenced in a few wards as seen in Appendix Table A. For the current births presented in Appendix Table B, some features also appeared. In 26 wards, current births were recorded for women over the age of 50 years, but women of these ages (50+) years except in rare cases are incapable of bearing children. These figures must be attributed to some errors in the data although they are not very much pronounced. This may be due to mis-reporting of ages of women respondents or gross mis-dating of births (due to the error in the reference period), or by attributing to the women respondents, children born by other women e.g. their daughters.

To reduce the effects of age heaping and other forms of age mis-reporting, data from respondents have been classified into either five year age groups or particular age brackets have been considered e.g. respondents between ages (15-49) years. Secondly, demographic techniques applied in this study consider some of these errors in the data and they do some adjustments in order to avoid any errors in the data.

2:2:6 LIMITATIONS OF THE 1979 KENYA POPULATION CENSUS

Data on occupation, income, contraceptive use and family size desires would not be obtained from the 1979 census. This is because the questionnaire designed did not include questions on these variables. These were some of the intended variables to be used in this study in order to assess their influence on fertility in Nairobi.

2:3 DEMOGRAPHIC TECHNIQUES FOR FERTILITY ESTIMATION

2:3:1 CURRENT FERTILITY METHOD

This method can be used to estimate current fertility rates using data on the most recent live births (i.e. births 12 months before the census), tabulated by five year age groups. Data on current fertility (births) are of some demographic value in that they give information on the shape of the age specific fertility distribution.

This method is given by the formula:-

$$\text{Current age-specific fertility rates (TFR)} = 5 \sum_{i=1}^{7} fi$$

Where fi are current births per woman in five year age groups i=1 to 7.

However, depending on results of this method may be unreliable because the data obtained are often incomplete and inaccurate in some cases. The major source of error arises from the inaccuracy in the placement of the time for the last birth or in the reference period. Births may be reported for a period on average greater or less than one previous year. Results of this method are in chapter 3 (Table 3:1)

2:3:2 LIFE-TIME FERTILITY METHOD

This method uses data on children ever born alive only. The total number of children ever born by a group of women of a given age is a record of their total childbearing experience from the beginning of their reproductive life to their current age. Such a record of children ever born by women of ages 45-49 years is the average completed family size and is therefore an estimate of their life-time fertility.

This method does not suffer from the reference period as the current fertility method. It assumes that average parities increase with age increase up to the end of the reproductive period (45-49), and that older women have higher parities than the younger women. But these older women are more prone to recall errors. There may be some omission or under-statement of the number of children ever born by older women e.g. children who have died early in infancy life or those who have left home.

Secondly, data for women over the age of 50 cannot be used as a valid index of the current level of fertility as the mean number of births may decrease with increasing age. This fall may be attributed to the general level of fertility which may have been lower at a time in the past when these women were of childbearing age. There may be also a selective survival of women who had born fewer children, or due to the inability of some illiterate respondents to report large numbers accurately.

2:3:3 TOTAL FERTILITY RATE (TFR) = $(P_3)^2/P_2$ TECHNIQUE

This method was developed by Coale and Demeny (1966). It uses parity information only and it therefore does not suffer from the reference period as the current fertility method does.

It has been found that the decline of fertility with age when birth control is not practised is generally governed by declining fecundability than by customs and institutions. The method considers that the ratio of the average parity of women at the end of childbearing (45-49) to the average parity of younger women (25-29) is closely related to the relative parity of women early and late in their twenties. Ratios of TFR/P_3 and P_3/P_2 are relatively close and are represented by a simple equality formula (U.N. manual IV, 1967:33).

$$TFR = (P_3)^2/P_2$$

Where:-

TFR = Total fertility rate

P_2 = Parity at 20-24

P_3 = Parity at 25-29

This formula provides a possible method of estimating total fertility rates when older women tend to under-report number of children ever born while the younger women report parity accurately. If total fertility rates from this method are substantially higher than average parities reported by women at 45-49 or 50+, then there is a likely omission of children ever born by older women. If $(P_3)^2/P_2$ exceeds parity at ages 45-49 (P_7), then the method gains credibility and is to be preferred to the numbers supplied by older women, but if they are equal, then any figure can be an acceptable estimate of total fertility rates.

ASSUMPTIONS OF THIS METHOD

1. It assumes that fertility at ages (15-29) has been constant in the recent past (Arriaga et.al.,1978).

2. The age pattern of fertility conforms to the typical age relationship found in populations practising little or no birth control, implying that:

   i. the age pattern of declining fecundability is typical,

   ii. widowhood, divorce and other forms of sexual dissolutions do not have an unusual age incidence from age 30 to forty five in the population in question (U.N. Manual IV, 1967).

2:3:4 BRASS P/F RATIO TECHNIQUE FOR FERTILITY ESTIMATION

Brass (1968) developed a method for fertility estimation which is found applicable in countries with defective data, like in most of the African countries. The mathematical derivation of this technique is presented in Appendix F. This method unlike the other techniques has an added advantage. The method unlike the others uses both "current" fertility (i.e. births 12 months before the census) and "retrospective" fertility (children ever born) data recorded from the same age group of women respondents. These data help derive more reliable fertility estimates. This is because using both information reduces any errors that may be either in the data on current births or children ever born.

The Brass P/F ratio technique basically combines the responses on the total number of children ever born with information on current births. The essence is to determine a ratio which is then used as an adjustment factor of the age pattern of fertility rates derived from the current births. This is done by multiplying them with either P_2/F_2, P_3/F_3 or an average of the two ratios depending on the nature of the computed P/F ratios. Brass (1968) recommended P_i/F_i ratios for younger age groups for a number of reasons as given in the assumptions below.

BEHAVIOUR OF P_i/F_i RATIOS

The P_i/F_i ratios are generally calculated for the entire age range from (15-49) years, even though not all the ratios are used for adjustment purposes (Manual X, 1983). However, the pattern of the ratios with age may reveal data errors in fertility trends.

In general, the P_i/F_i ratios calculated should be fairly similar i.e. are expected to be around unity or equal to 1.00 (the value for perfect agreement) indicating that the two sets of information are consistent. The P_i/F_i ratios declining systematically with age increase (especially those above ages 30 or 35) imply a general forgetting pattern of the older women in the reported number of children ever born. Due to illiteracy levels, these women tend to forget some of their children who either died early in life or have left home. If the P_i/F_i ratios are under unity, then it suggests that current fertility reports have been over-estimated for a period longer than 12 months (i.e. reported births are too high). If the P_i/F_i ratios are greater than unity, then there is an indication that the recent fertility births have been under-estimated for a period less than 12 months. A sequence of P_i/F_i ratios that increase with age indicate that fertility may have been declining in the recent past.

In practice, the P_i/F_i ratios are far from being constant, even below age 35. One can be satisfied if P_2/F_2 and P_3/F_3 ratios are reasonably consistent. If this can be the case, one of these ratios can be used as an adjustment factor or if they are not very similar, a weighted average of the two can be used.

Some researchers have found that P_i/F_i ratios may be affected by fluctuations (Van de Walle, 1968). These fluctuations are common due to transfer of women from one age group to the next. A rise or fall of these ratios with age can be due to extensive migration, a fall or rise in fertility, past trends in fertility or due to selective survival of women who have reported their parities (Kpekdepo et al, 1976; Van de Walle, 1968).

ASSUMPTIONS OF BRASS FERTILITY TECHNIQUE

The technique rests on these main assumptions:

1. that the reports on births in the previous twelve months usually give approximately the correct shape of the distribution of current fertilities (i.e. the age pattern of fertility) although the level may not be correct because of imprecision in the reference period.

2. that the number of children ever born and the current births are usually reported with reasonable accuracy by younger women under 30 because,

   i. the events which they are asked to recall are fairly recent.

   ii. the total births to each of them are usually not more than two or three and therefore difficulties of counting large numbers do not arise and

iii. most of the living children would still be at home and present.

3. the method assumes that fertility has been constant over the past 10-15 years (Arriaga et al., 1978) for if it has changed, the life-time fertility from children ever born cannot be expected to be consistent with cumulated current fertility rates.

2:4 DEMOGRAPHIC TECHNIQUES FOR CHILD MORTALITY ESTIMATION

2:4:1 BRASS TECHNIQUE FOR ESTIMATING CHILD MORTALITY

As already mentioned above, in the 1979 Kenya population census, women were asked to report the total number of children ever born to them and those still alive. The survival of children depends on infant and child mortality rates experienced in a population. From the 1979 census, mortality data were obtained at ward level.

Brass (1964); Brass et al.,(1968), devised a method that converts the proportions of dead children D(i) born to women in particular age groups (15-49) into life-table q(i) values which reflect child mortality rates of that population.

Estimates of q(2), q(3) and q(5) converted from D(2), D(3) and D(5) respectively indicate the recent child mortality rates. To convert DI's (proportions of children dead in each age group i) to q(i) (probability of dying before attaining age i) depends on the fertility pattern, which is also dependent on the age at which childbearing starts. Brass used this analytic function:

$$f(x) = k(x - s)(s + 33 - x)^2, \quad S \leq x \leq S + 33$$

$$k = \text{constant}$$

Where:

S is the starting age of childbearing to represent fertility. The earlier the age (S), the older the children, and the longer their exposure to the force of mortality unlike when children are born relatively late in women's lives.

To convert D(i)'s to q(i)'s Brass used multipliers which were developed using these indices:

a P_1/P_2 - parity (15-19) and (20-24) years respectively.

b $\bar{m}'$ - the median of fertility schedule.

c $\bar{m}$ - the mean age of childbearing.

The first (P_1/P_2) is used to calculate multipliers for the earlier three age groups and the rest of the multipliers are calculated using $\bar{m}$ or $\bar{m}'$. It must be noted here that q(i) can be converted to survival rates l(x).

ASSUMPTIONS OF BRASS'S MORTALITY TECHNIQUE

The reliability of Brass technique depends on:-

1. He assumed that age specific fertility schedule has been approximately constant in the recent past (at least for the younger women).

2. He also assumed that infant and child mortality rates have been constant in recent years.

3. He assumed uniform age distribution of women within each five year age group.

4. Age pattern of fertility among infants and children conforms approximately to the model life-tables.

5. Omission rates of dead children and of surviving children are about the same in the reported numbers of children ever born.

2:4:2 COALE AND DEMENY MODEL LIFE-TABLE SERIES

Coale and Demeny (1966) distinguished and published four different mortality patterns which they named the East, South, West and North families. These four families were found to differ in infant and child mortality patterns.

Coale and Demeny derived mortality levels for these four families which range from level 1 to level 24 with life-expectancy at birth (e_o) for females ranging from 20 years to 77.5 years respectively. High mortality levels lead to high life-expectancy at birth (e_o) and low child mortality rates. The reverse is true for low mortality levels. Child mortality rates and life-expectancy at birth (e_o) are some of the actual characteristics of a population which can be used to locate a stable population having approximately similar demographic indices.

The North model life-table which appears to conform to the Kenyan data (Blacker, 1970) has been used to derive mortality levels used in this study (Nyamwange, 1982:50-55). Having tried all the possible techniques to arrive at more realistic mortality rates for Nairobi, as a last resort, mortality levels were obtained from the Coale and Demeny, North Model Series.
This study is to examine the influence of these mortality levels on the estimated total fertility rates by ward in Nairobi. The simple procedure used to obtain these mortality levels is given below.

The Brass probabilities of dying Xq(i) were converted to probabilities of survival l(x) using this simple procedure.

1. l(x) the survivorship rate was calculated by subtracting xq(i) of the Brass estimated results from 1000. i.e
   $l(x) = 1000 - xq(i) \cdot 1000$
   From here observed l_2, l_3, l_5 were calculated,

where l_2, l_3 and l_5 are numbers of survivors to 1000 births.

2. Using the observed l_2, l_3 and l_5 and through interpolation between the corresponding rows of the Coale and Demeny North model life-tables, respective mortality levels were arrived at. The mean of these mortality levels was then calculated to obtain respective mortality levels for each ward. The derived mortality levels are presented in Appendix Table C.

2:5 STATISTICAL TECHNIQUES

2:5:1 SCATTERGRAM

A scattergram is obtained by plotting values of the dependent variable (fertility in this case) versus each independent variable on a graph. The dependent variable falls on the vertical axis and the independent variables on the horizontal axis. The scattergrams are intended to give a general impression of the relationships between these variables. These scattergrams help to test for linearity between the dependent and each independent variable (Blalock, 1972). They can also show the relevance of the hypotheses to be used. This was done for all the variables used before the decision to use the linear regression model was made.

2:5:2 THE LINEAR REGRESSION MODEL

The regression model is one of the most suitable techniques in a demographic fertility study of this kind where fertility is influenced by a number of factors. The regression model is the most common technique which can consider all these variables and analyse the relationships between fertility and the socio-economic and demographic variables considered. Both the simple and multiple linear regression analysis are the statistical tools considered in this study.

2:5:3 THE SIMPLE LINEAR REGRESSION MODEL

The simple linear regression model is used to measure the existence of a linear relationship between a dependent variable (fertility in this case) and a single independent variable. It assumes that the dependent variable is influenced partly by the error term which is as a result of the nature of the data or due to unselected variables.

The simple linear regression model is computed by the formula.

$$Y_i = a + bx_i + e_i$$

where

Y_i = dependent variable (fertility)

a = intercept

b = slope

x = independent variable

e_i = error term.

B is the slope of the least squares line termed as the regression coefficient. It shows an average amount of change in the dependent variable (Y) per unit change in the independent variable (x).
A is the intercept of this line with the y-axis and the random error (e_i) arises from variables other than x which have either been left out or are unobtainable.

In most demographic studies like this one, more than one variable is involved. The simple linear regression model considers one variable at a time. Therefore, the simple linear regression model is found insufficient to handle many variables considered to influence fertility. This then calls for the use of a multiple regression model which is much more suitable because of its flexibility.

2:5:4 THE MULTIPLE REGRESSION MODEL

This technique attempts to explain or predict a dependent variable from many independent variables. It measures the existence of a relationship linear in the coefficients between the dependent variable (fertility) and a number of independent variables (socio-economic and demographic).

Its computational formula is given by:

$$Y_i = A_i + B_1X_{1i} + B_2X_{2i} + \dots + B_kX_{ki} + e_i$$

where Y = dependent variable (fertility).

A = Intercept (constant).

b = Slope (regression coefficient).

$X_1, X_2, X_3 \dots X_k$ = independent variables considered (k=8 in this study).

ei = error or disturbance term.
Computation of these values is made possible by the use of facilities.

The formula for estimating the regression coefficients B is:-

$$B = (X^1X)^{-1} X^1Y$$

The computed regression coefficients B can also be used for testing multicollinearity. If the computer gives values for these regression coefficients (i.e. B exists) then $(X^1X)^{-1}$ exists which further implies that the determinant of X^1X is non-zero. Hence multicollinearity is negligible. If multicollinearity exists then B - the regression coefficient matrix cannot be obtained. Hence the computer cannot work out the problem. It will indicate some error.

MULTIPLE CORRELATION ANALYSIS

To measure the relationships between the dependent variable (TFR) and the independent variables, some statistical values are computed in the multiple regression analysis i.e.
B - regression coefficients, simple (r), R and R^2.

The regression coefficients - B if fitted in the multiple regression equation can predict the dependent variable (fertility in this case) from a knowledge of independent variables.

The coefficient of multiple correlation (R) represents a single index which measures the strength of relationships between the dependent variable (fertility) and the total number of independent

variables included in the model. It is easier to interprete R by squaring to get R^2, which is the proportion of the variation in the dependent variable explained by the variables entered in the regression model.
$1 - R^2$ is the proportion of the dependent variable which is unexplained by the selected independent variables. The computed simple correlation coefficient (r), shows the degree of association between the dependent variable and a single independent variable assuming the remaining independent variables are held constant.

PROBLEMS OF MULTIPLE REGRESSION ANALYSIS

Some of the multiple regression analysis problems the reseacher can expect are:

1. The problem of multicollinearity can arise when many independent variables are used. They tend to overlap between themselves. This can be tested by the use of regression coefficients B. If estimation of these regression coefficients is possible, then the problem of multicollinearity is negligible. Their individual influence and the effects on the dependent variable, as should be measured by the regression coefficients B, become unreliable. The greater the overlap of the independent variables, the lower the reliability of the regression coefficients B.

2. Another problem common in most statistical analysis is the reliability of the data. Data used to measure the dependent variable in this case fertility may be defective and this may make one to estimate fertility results which may not be very reliable. Independent variables selected may not be the exact explanatory variables which can explain the variation in the dependent variable. Important independent variables may be left out either by chance, deliberate or because they are unobtainable. A researcher must be cautious in selecting the correct data which can be used in estimating the dependent variable. Independent variables must also be carefully selected to avoid any errors.

2:5:5 ASSUMPTIONS OF LINEAR REGRESSION MODEL

The validity of the regression model rests on the satisfaction of all or some of the assumptions given below.

1. The dependent variable must have a linear relationship with the selected independent variables, (Goldberg, 1966 ; Blalock, 1972).

This can be tested with scatterplots of data points (dependent versus independent) to assess the goodness of fit of the regression line. If the trend is not linear, then the regression analysis will not be of better use. However, in some cases where it is not linear, it can be made linear by transforming the data by use of logarithms or any other method. In this study, scattergrams were used to test for linearity.

2. Both the dependent and independent variables should be normally and randomly distributed. This requires that the conditional distribution of the residuals to be normal, if they are normal then the distribution of dependent and independent variables are also normal.

3. i. The random error (e_i) is assumed to be uncorrelated with any of the independent variables selected. To test this, a plot of residuals versus each independent variable should not display any pattern. This was done in this study and the scatterplots are seen in chapter 3.

ii. that the random error (e_i) has mean zero and constant variance.

iii. that the random errors (e_i) are randomly distributed.

vi. that the random errors (e_i) are uncorrelated.

4. The dependent variable must not be dichotomous but the independent variables can be in interval or ratio scale. In this study, total fertility rates (TFR) used as the dependent variable is not a dichotomous variable and the independent variables considered are in either interval or ratio scales.

5. The independent variables should not be strongly intercorrelated as this will bring the problem of multicollinearity. In this study, the zero order correlation coefficients are used to test this condition. They do not indicate strong intercorrelationships between variables and therefore the problem of multicollinearity does not arise. Regression coefficients (B) were also computed which shows that multicollinearity is negligible.

6. The number of observations must be 20 or more in order to allow for a large number of degrees of freedom in testing the statistical significance of each independent variable. In this study, the number of observations are 40 wards.

7. Homoscedasticity, which means that for each independent variable, there is a conditional distribution for the values of the dependent variable and that this distribution is constant all over the linear relationship.

2:5:6 TESTING FOR GOODNESS OF FIT OF A LINEAR REGRESSION MODEL

The F-test which is a measure of the overall significance of the estimated regression model is used in this study.

The test statistics employed for the overall F-test is computed as:-

$$F = \frac{SSreg/k}{SSres/(N-k-1)} \quad \text{or}$$

$$= \frac{R^2/k}{(1-R^2)/(N-k-1)} = \frac{R^2(N-K-1)}{(1-R^2)K}$$

where

SSreg = Sum of squares explained by the regression equation.

SSres = the residual (unexplained) sum of squares.

K = Number of independent variables in the equation, k = 8 in this study.

N = Sample size, N = 40 in this study.

R = Multiple correlation coefficient.

If the computed F - value is equal to or exceeds the critical table value of F, at a specified level of significance and at the appropriate number of degrees of freedom, then the null hypothesis HO: $B_1 = B_2 = B_3 = \ldots = B_x = 0$ is rejected, and the alternative accepted. If the computed F - value falls short of the critical table value of F, the null hypothesis is accepted see (Blalock, 1972).

C H A P T E R   T H R E E

ESTIMATIONS AND ANALYSIS OF TOTAL FERTILITY RATES (TFR)

3:0 INTRODUCTION

This chapter is intended to bring out results and analysis of this study. In the first section of this chapter, results of the total fertility rates derived from each of the four demographic fertility techniques discussed in chapter 2 are presented. The second section justifies the selection of the demographic technique with the most plausible fertility results for Nairobi wards. The third section examines the analysis of the relationships between the estimated total fertility rates and the selected independent variables by use of the multiple linear regression model. This analysis is aimed at investigating the role of the socio-economic and demographic variables in influencing total fertility rates in Nairobi. This analysis is based on the variables obtained from the 1979 Kenya population census.

3:1 THE TOTAL FERTILITY ESTIMATES BY WARD IN NAIROBI 1979

Table 3:1 below shows the results of the estimated total fertility rates (TFR) obtained from the four demographic techniques for fertility estimation. These are the current fertility, life-time fertility, $(P_3)^2/P_2$ fertility and the Brass P/F ratio methods. These techniques are discussed in detail in chapter 2. The comparison of entries in columns 1 to 6 shows that the values in column 1 are the lowest followed by those in column 2, while those in column 3 are the highest and those in column 4, 5 and 6 fall in the middle. Discussion on each of these results is given below.

3:1:1 CURRENT TOTAL FERTILITY RATES (TFR)

These current fertility rates derived from current births (i.e. births 12 months before the census) are shown in column 1 of Table 3:1 below. They are the lowest as compared to the other results on the same table. When this method was applied to the data on current births (Appendix Table B), generally it was found that the general level of the current age specific-fertility rates are too low, a factor which may account for the low current total fertility rates estimated. This may be attributed to under-reporting of births for the prec eding 12 months. This is a common case of censuses in developing countries and may be because of:-

a non-response.

b mis-dating of births (error in reference period)

c may be failure of enumerators who didn't ask the question at all.

This method gives Nairobi a total fertility rate of 4.82 births. At ward level, the total fertility rates range from 2.82 to 6.43 births in Kilimani and Maisha-Makongeni wards respectively. Wards with the lowest observed current fertility rates are Kilimani, Nairobi Central, Parklands, Spring Valley, Nairobi South/West and Ngara West. The highest observed current births with this method are in Kaloleni, Kariobangi, Maisha-Makongeni, Riruta-Satellite, and Ruaraka/Kasarani wards. Majority of these wards have estimated births ranging between 4.00 - 6.00 births.

TABLE 3:1 ESTIMATES OF TOTAL FERTILITY RATES FOR NAIROBI WARDS: 1979

WARD	CURRENT TFR	LIFETIME TFR	$(P_3)^2/P_2$ TFR	BRASS P_2/F_2 TFR	BRASS P_3/F_3 TFR	BRASS $\frac{1}{2}(P_2/F_2+P_3/F_3)$ TFR
	1	2	3	4	5	6
KANGEMI	5.49	6.31	5.95	6.01	5.84	5.93
KAWANGWARE/RIRUTA	6.09	6.41	6.64	5.96	6.24	6.10
RIRURA S.SATELLITE	6.29	6.77	5.92	6.43	6.13	6.28
WAITHAKA	5.53	7.88	6.93	7.56	7.14	7.35
UTHIRU	5.44	7.29	7.32	6.17	6.74	6.46
MUTUINI	6.15	7.04	6.89	7.88	7.08	7.48
KILIMANI	2.82	3.25	4.32	3.58	3.67	3.62
KAREN/LANGATA	3.78	3.74	4.63	4.53	4.42	4.48
KIBERA/WOODLEY	5.51	5.36	5.32	5.38	5.34	5.36
GOLF COURSE	5.56	4.96	7.30	5.00	5.96	5.48
NAIROBI/SOUTH/WEST	3.54	5.03	5.93	4.83	4.95	4.89
INDUSTRIAL AREA	5.56	6.48	7.66	5.10	6.15	5.63
MUGUMUINI	4.87	5.32	6.12	5.91	5.99	5.95
EMBAKASI	4.96	3.49	5.16	5.09	5.26	5.18
DANDORA	5.59	6.38	5.89	5.69	5.38	5.54
HARAMBEE	4.96	5.46	8.37	6.56	7.10	6.83
LUMUMBA	5.10	6.88	7.25	5.87	6.24	6.06
MAKADARA	5.63	5.67	6.85	6.39	6.64	6.52
KALOLENI	5.98	8.82	8.97	6.64	8.47	7.56
MAISHA-MAKONGENI	6.43	6.67	8.09	8.38	8.19	8.29
MBOTELA	5.97	6.48	7.58	8.01	7.91	7.96
BAHATI	4.82	6.29	7.79	5.57	6.40	5.99
MARINGO	4.80	5.91	7.16	6.29	6.40	6.35
UHURU	6.64	6.61	7.97	5.24	5.95	5.60
SHAURI MOYO	5.35	6.42	6.54	6.97	6.94	6.96
PUMWANI	6.03	5.15	6.14	4.88	5.42	5.15
ZIWANI/KARIOKOR	5.19	6.22	8.06	6.28	7.31	6.79
PANGANI	3.82	4.54	5.59	4.06	4.38	4.22
CITY CENTRE	3.14	5.00	4.71	5.27	4.85	5.06
NAIROBI CENTRAL	2.85	4.26	4.25	3.75	3.67	3.71
SPRING VALLEY	3.68	3.72	5.55	4.46	4.31	4.39
KARURA	4.63	4.85	3.78	5.31	5.49	5.40
PARKLANDS	2.86	3.55	4.22	3.65	3.34	3.50
NGARA WEST	2.90	3.96	5.14	4.40	3.67	4.04
ROYSAMBU/KAHAWA	6.03	5.85	6.27	7.28	7.04	7.16
RUARAKA/KASARANI	6.17	5.80	6.26	6.65	6.63	6.64
KARIOBANGI	6.12	6.15	5.89	6.17	6.23	6.20
NGARA EAST	3.63	4.40	6.76	4.99	4.76	4.88
MATHARE	5.84	5.55	5.64	6.28	6.09	6.19
EASTLEIGH	4.18	5.55	7.66	5.57	5.33	5.45
NAIROBI	4.82	5.16	5.75	5.47	5.46	5.47

3:1:2 LIFE-TIME FERTILITY ESTIMATES

Fertility estimates derived from this method using data on children ever born (see Appendix Table A) are shown in column 2 of Table 3:1 above. These fertility rates are relatively higher than those derived from current fertility births. This is perhaps in this case, women respondents were asked to report (state) their parity without the reference period coming in. However, this does not mean that the results are the most reliable. This method is sometimes distorted and its results may sometimes be distorted and may not be very reliable. It assumes that parity increases with age increase but this trend may not follow in some cases. Some older women tend to omit some of their children due to memory failure.

Evidence of some omission is seen in some wards where there is a drop in parities at ages (45-49) or 50+ as seen in Appendix Table A. This was observed in a few wards, like Embakasi, Harambee, Lumumba, Maisha-Makongeni, Shauri-Moyo, Pumwani and Ziwani-Kariokor.

This method gives Nairobi a total fertility rate of 5.16 births. At ward level, fertility levels range from 3.25 to 8.82 births in Kilimani and Kaloleni wards respectively. The lowest observed life-time fertility births are in Kilimani, Parklands, Ngara West, Embakasi, Karen/Langata and Nairobi Central wards. Highest births are observed in Kaloleni, Waithaka, Uthiru, Mutuini, Maisha-Makongeni and Riruta-Satellite wards. Majority of these wards have the estimated births ranging from 5.00 - 7.00 births.

3:1:3 $(P_3)^2/P_2$ FERTILTIY ESTIMATES

To derive these fertility estimates, this method used data on children ever born (Appendix Table A).

This method takes care of the problem of the tendency of older women who omit some of their children. However, the method gave fertility rates which are rather high as compared to the others.

The derived fertility estimates are in column 3 of Table 3:1 above. This method gives Nairobi a total fertility rate of 5.75 births. At ward level the fertility rates according to this method range from 3.78 to 8.97 births in Karura and Kaloleni wards respectively. Majority of these wards have births ranging from 5.00 - 8.00. This method gives the lowest observed births in Karura, Parklands, Kilimani, Nairobi Central and Karen/Langata wards. The highest observed births are in Kaloleni, Uhuru, Maisha-Makongeni, Ziwani-Kariokor, Harambee and Bahati wards.

3:1:4 THE BRASS P/F RATIO FERTILITY ESTIMATES

The Brass P/F ratio technique unlike the other techniques uses a combination of both "current" (i.e. births 12 months before the census) and "retrospective" (i.e. children ever born) fertility data from the same women respondents aged (15-49) years to derive more realistic and reliable fertility estimates. The method uses adjustment factors (P/F ratios) to eliminate the elements of any errors in the data. The most reliable P/F ratios are either P_2/F_2, P_3/F_3 or an average of the two at ages (20-24) and (25-29) years respectively. These ratios are more reliable because at such ages, women are young and can recall recent births accurately since they have had few births by then.

The entries in column 4, 5 and 6 on Table 3:1 above give the Brass fertility estimates derived from P_2/F_2, P_3/F_3 and an average of the two ratios respectively. The reliability of these fertility estimates depends on the nature of the Pi/Fi (i = 1, 2, 3......n) ratios derived from the Brass technique. This study examined the derived Pi/Fi ratios for all the entire age groups (15-49) and these ratios are presented in Appendix Table G for each ward in Nairobi.

The derived Pi/Fi ratios presented in Appendix Table G show an indication that there are slight deviations from unity and that most of the ratios are slightly above unity. These deviations show an indication that the recent fertility births have been under-estimated or reported for a period less than 12 months. In 20 out of 40 wards a decline of these Pi/Fi ratios is seen between the ages 15-29. These ratios for the age range 20-29 are fairly consistent and are around unity. However, in some wards, fluctuations in these Pi/Fi ratios are seen and these are common due to transfer of women from one age group to the next (Van de Walle, 1968). Sometimes this can be attributed to extensive migration, a fall or rise in fertility or due to selective survival of women who have reported their parities (Kpekdepo et al, 1976; Van de Walle, 1968).

The total fertility rates derived from the Brass P_2/F_2, P_3/F_3 and an average of the two ratios are discussed below.

The Brass P_2/F_2 ratio for Nairobi is found to be 1.135 showing an under-reporting of current births by only 13.5 per cent. This is not a very substantial percentage, however, it shows that a few births have been under-reported. At ward level the P_2/F_2 ratio ranges from 0.8078 to 1.6787 in Pumwani and City Centre respectively. This shows that under-reporting of current births in the City Centre ward is very high indeed as a ratio of 1.6787 shows that 67.87 per cent of the current births have been under-reported.

However, the Brass P_2/F_2 estimates of the total fertility rates are presented in column 4 on Table 3:1 above. The Brass P_2/F_2 ratio gives Nairobi a total fertility rate of 5.47 births. At ward level, the P_2/F_2 ratio gives births which range from 3.58 to 8.38 in Kilimani and Maisha-Makongeni wards respectively. Wards with the lowest observed births from the P_2/F_2 ratio are Kilimani, Parklands and Nairobi Central. Some wards with the highest observed births from the P_2/F_2 ratio are in Ruaraka/Kasarani, Kaloleni, Maisha-Makongeni, Mutuini, Waithaka, Mbotela and Roysambu/Kahawa.

The Brass P_3/F_3 ratio for Nairobi is found to be 1.134 showing an under-reporting of current fertility births by a small per cent of only 13.4. At ward level, the P_3/F_3 ratios range from 0.898 to 1.546 in Pumwani and City Centre respectively. This shows that the deviations from unity at the City Centre ward are quite high and this indicates that under-reporting of current fertility births in the City Centre ward is high by 54.6 per cent.

The derived Brass P_3/F_3 ratio total fertility rates are in column 5 of Table 3:1 above. The P_3/F_3 ratio gives Nairobi a total fertility rate of 5.46 births. At ward level, births from P_3/F_3 ratio range from 3.34 to 8.47 in Parklands and Kaloleni wards respectively. Some wards with the lowest observed births from this P_3/F_3 ratio are Parklands, Kilimani, Nairobi Central, Spring Valley, and Ngara West. Some wards with the highest observed births with this ratio are Mbotela, Waithaka, Ziwani/Kariokor, Mutuini, Roysambu/Kahawa, Kaloleni and Maisha-Makongeni.

Since this study experienced slightly high P_i/F_i ratios in most wards, an average of the Brass P_2/F_2 and P_3/F_3 ratios for each ward has been used as an adjustment factor. This average ratio may reduce the fluctuations in the Brass P_2/F_2 and P_3/F_3 ratios so as to arrive at a better adjustment factor which can be used to derive more reliable fertility rates for Nairobi wards. The estimates from this average ratio are discussed below.

It can be mentioned by passing that researchers like Etiene Van de Walle (1968) used an average of P_3/F_3 and P_4/F_4 ratios to estimate total fertility rates for Kenya using the 1962 Kenya population census. Anker and Knowles (1980) used an average of P_4/F_4 and P_5/F_5 ratios to estimate Kenya's total fertility rates using 1969 Kenya population census. Mwobobia (1982) used an average of P_2/F_2 and P_3/F_3 ratios to estimate total fertility rates for each district in Kenya using 1979 Kenya population census. These researchers used the Brass P/F ratio fertility technique and they found high P_i/F_i ratios in their studies and that is why they used the above mentioned respective average P_i/F_i ratios.

Total fertility rates derived from an average of P_2/F_2 and P_3/F_3 ratios are presented in column 6 of Table 3:1 above. This ratio of 1.135 gives Nairobi a total fertility rate of 5.47 births.

At ward level, it is found that births derived from this average ratio range from 3.62 to 8.29 in Kilimani and Maisha-Makongeni wards respectively. Majority of these wards have total fertility rates which range from 5.00 - 7.00 births. Some wards with the lowest observed births with this average ratio are Kilimani, Nairobi South/ West, Nairobi Central, Parklands, Ngara West and Spring Valley. Some wards with the highest observed births with this average ratio are Waithaka, Mutuini, Kaloleni, Mbotela, Ziwani/ Kariokor, Maisha-Makongeni and Roysambu/Kahawa.

1:5 SELECTED TOTAL FERTILITY RATE RESULTS

The above sections have examined results of the total fertility rates derived from different techniques applied.

One thing which comes out clearly from the above results on Table 3:1 is that fertility differentials exist between wards in Nairobi. This is indicated clearly from the results of each technique applied.

The problem faced by the researcher was the basis of selecting the technique with the most reliable total fertility rate results for the Nairobi wards. This does not mean that other results are ruled out as being totally unreliable. In a study of this kind, some results must be adopted for further analysis. However, the criteria used might be a simple one and this was based on the advantage, disadvantage, strength or weakness of each technique applied.

The total fertility rates derived from the current fertility method are found to be too low and therefore may not be very accurate and reliable. This is due to the inaccuracy in the data on current births. These data sometimes suffer from some errors due to the reference period which tends to confuse women respondents. These women respondents can either report current births for a period more or less the reference period of 12 months. Brass (1968) found that current fertility rates are rather too low or too inflated due to illiteracy levels which brings a misperception in the reference period.

The life-time fertility estimates are found higher than the current births. However, these results may not be very reliable either because of the tendency of older women who report fewer children ever born by omitting some children due to memory failures. The presence of an apparent decrease in mean numbers of children ever born to women who have completed reproduction at ages (45-49) or 50+ years in some wards is an indication that there was some omission of children ever born in these wards.

The $(P_3)^2/F_2$ fertility method is not having reliable results either. The method uses data from a very limited age range as a basis for extrapolation to all other reproductive ages. Secondly, this method according to the United Nations (Manual IV,1967), gives reliable total fertility rates if the population in question does not apply birth control methods, but births are controlled by nature. This may not apply to the population under study in Nairobi who are exposed to and are aware of these modern birth control methods. These people are therefore likely to use these modern birth control methods.

The Brass P/F ratio technique is therefore considered to be the most reliable method among these other methods applied. This technique unlike the others uses both "current" and "retrospective" fertility data to derive more reliable fertility estimates. It also uses Pi/Fi ratios as adjustment factors to remove the effect of any errors in the data used. It is on this basis that the Brass P/F ratio technique has been considered superior to the other techniques. The total fertility rates derived from this technique are therefore considered to be the most reliable estimates for Nairobi wards.

The Brass total fertility rates based on an average of P_2/F_2 and P_3/F_3 ratios as an adjustment factor have been adopted in this analysis. These results are presented in column 6 of Table 3:1 above.

The second objective of this study was to find out if fertility differentials exist between wards in Nairobi. These findings presented in column 6 of Table 3:1 above show clearly that fertility differentials exist between wards in Nairobi, with total fertility rates ranging from 3.62 to 8.29 births in Kilimani and Maisha-Makongeni wards respectively. This is a very wide variation in an urban setting of this kind. Secondly, besides these differentials in fertility, some wards have relatively high total fertility rates as shown by the results on Table 3:1 above.

From these findings, Nairobi wards can be classified into three distinct categories: low, medium and high according to their total fertility rates. These categories show distinct fertility differentials between wards as presented on Table 3:2 below.

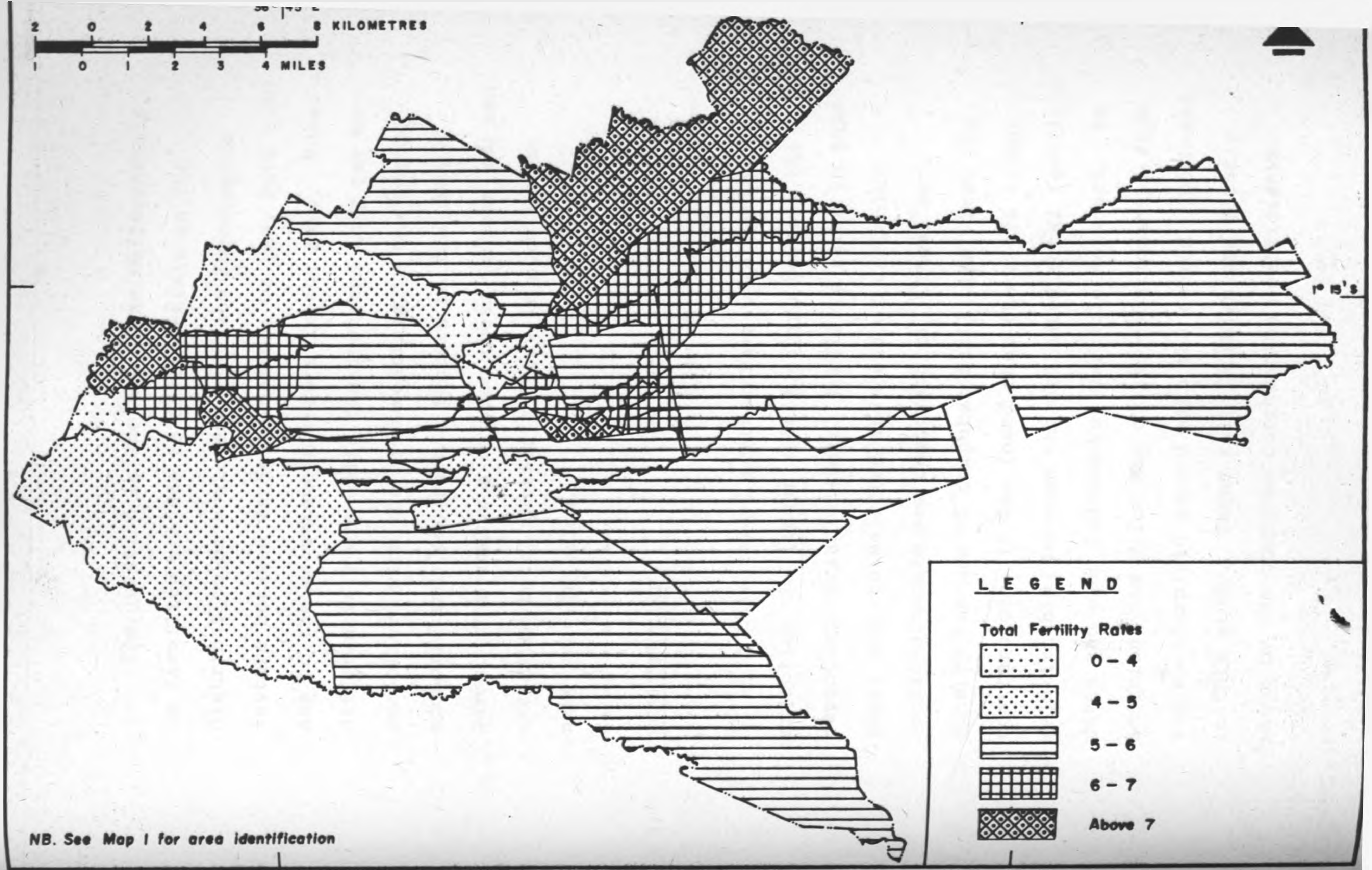
The wards that fall in the medium and high class category of total fertility rates are mainly those near the City Centre and these are mainly those wards towards the Eastlands and North of Nairobi.

The wards with the lowest total fertility rates are those slightly far from the City Centre and these are mainly those wards towards the Southern Zone and Westlands Zone of Nairobi.

The distribution of these total fertility rates by ward in Nairobi is clearly presented on map 3 below. For area (ward) identification reference can be made to map 1 in chapter one.

TABLE 3:2 CLASSIFICATION OF NAIROBI WARDS INTO LOW, MEDIUM AND HIGH TOTAL FERTILITY RATES (TFR) - 1979

LOW (TFR) WARDS 3-5	MEDIUM (TFR) WARDS 5-6.5	HIGH (TFR) WARDS 6.5 - 8.29
KILIMANI	KAWANGWARE/RIRUTA NORTH	WAITHAKA
KAREN/LANGATA	RIRUTA SATELLITE SOUTH	MUTUINI
NAIROBI/SOUTH/WEST	KIBERA/WOODLEY	KALOLENI
PANGANI	INDUSTRIAL AREA	MAISHA-MAKONGENI
NAIROBI CENTRAL	MUGUMUINI	MBOTELA
SPRING VALLEY	EMBAKASI	ROYSAMBU/KAHAWA
PARKLANDS	DANDORA	UTHIRU
NGARA WEST	LUMUMBA	HARAMBEE
NGARA EAST	BAHATI	MAKADARA
GOLF COURSE	MARINGO	SHAURI-MOYO
	UHURU	ZIWANI-KARIOKOR
	PUMWANI	RUARAKA-KASARANI
	KARURA	
	KARIOBANGI	
	MATHARE	
	EASTLEIGH	
	KANGEMI	
	CITY CENTRE	



MAP 3. DISTRIBUTION OF TOTAL FERTILITY RATES BY WARD IN NAIROBI — 1979

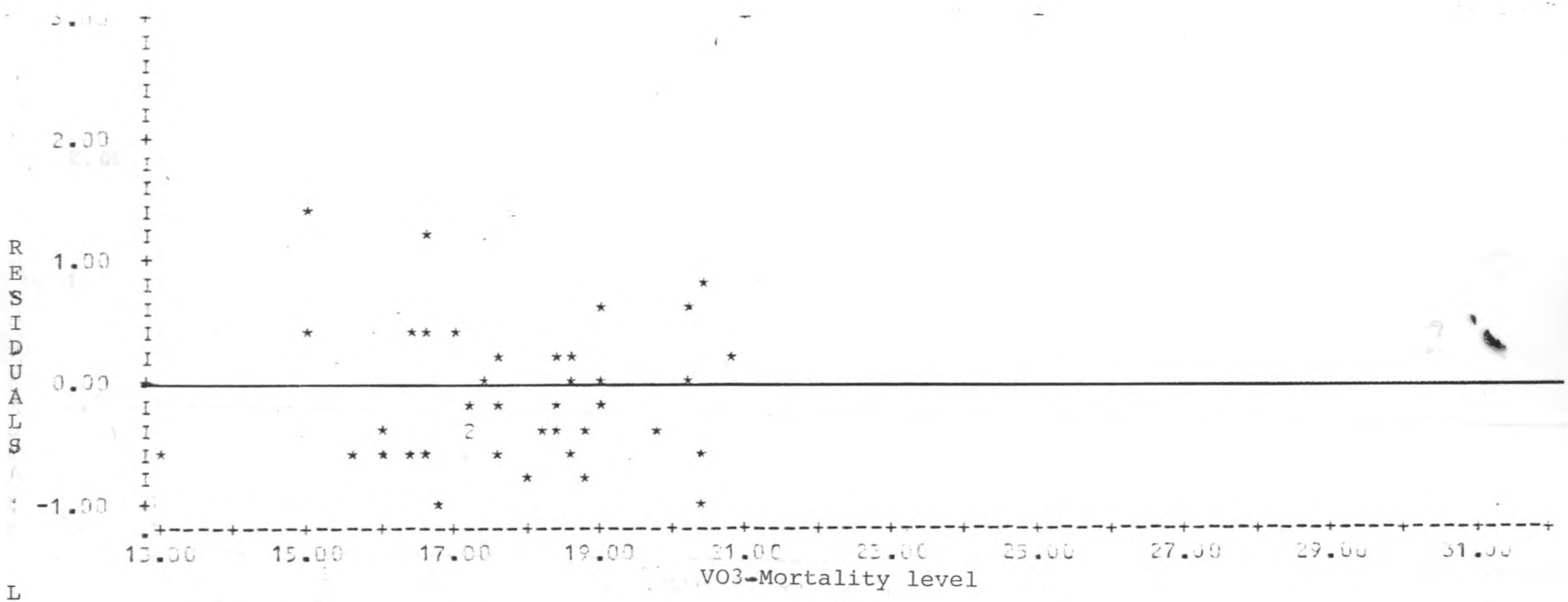
The question is whether these differentials in fertility are due to differentials in the distribution of socio-economic and demographic factors between wards in Nairobi or they have come due to the measurement errors in the data. These differentials are quite distinct and they may be associated with the differentials in the socio-economic and demographic factors between these wards. The analysis between these factors and the estimated total fertility rates is done in the next section below.

3:2 SCATTERGRAMS

In this study, scattergrams were used to establish the linear relationships between the dependent variable (total fertility rates in this case) and the selected independent variables (socio-economic and demographic). These were done by the use of computer facilities. From the scatterplots, it was found that there are linear relationships between the estimated total fertility rates and each independent variable selected. In addition, the direction of the relationships from the scatterplots agreed with the stated hypotheses in this study. These relationships are clearly shown by the computed correlation coefficients given below in the zero order correlation coefficients and also in the multiple linear regression results. These results satisfied one condition of the regression model and thus justified the use of the regression model in this study.

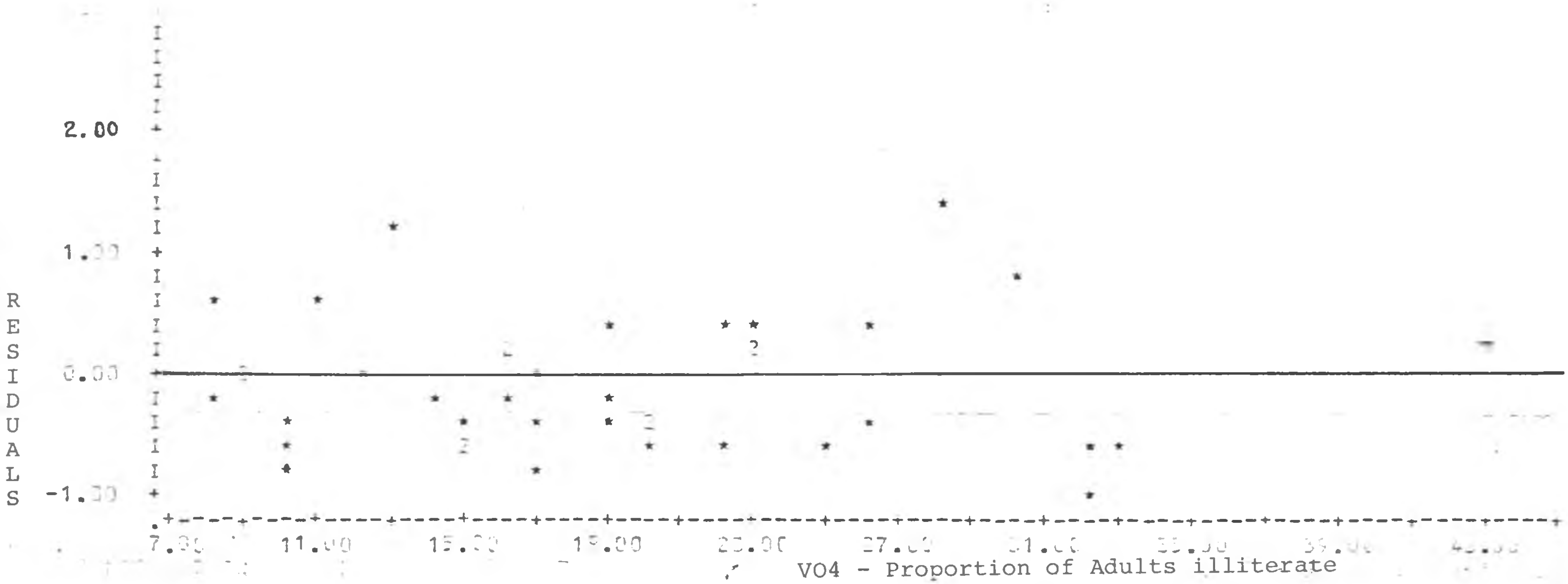
Secondly, an analysis of residuals (e_i) i.e. the difference between the observed and expected Y-values (dependent variable) was done in order to examine if any abnormalities exist in the data as one of the conditions of the regression model states. A plot of residual values (e_i) versus each independent variable (x) was done by use of the computer and these scatterplots are seen below in figures 3-10. It can be seen from these scatterplots that no clear pattern is displayed between these residual values and each independent variable. This shows that residual values are uncorrelated with the selected independent variables and this satisfies one of the conditions of the regression model.

FIGURE 3



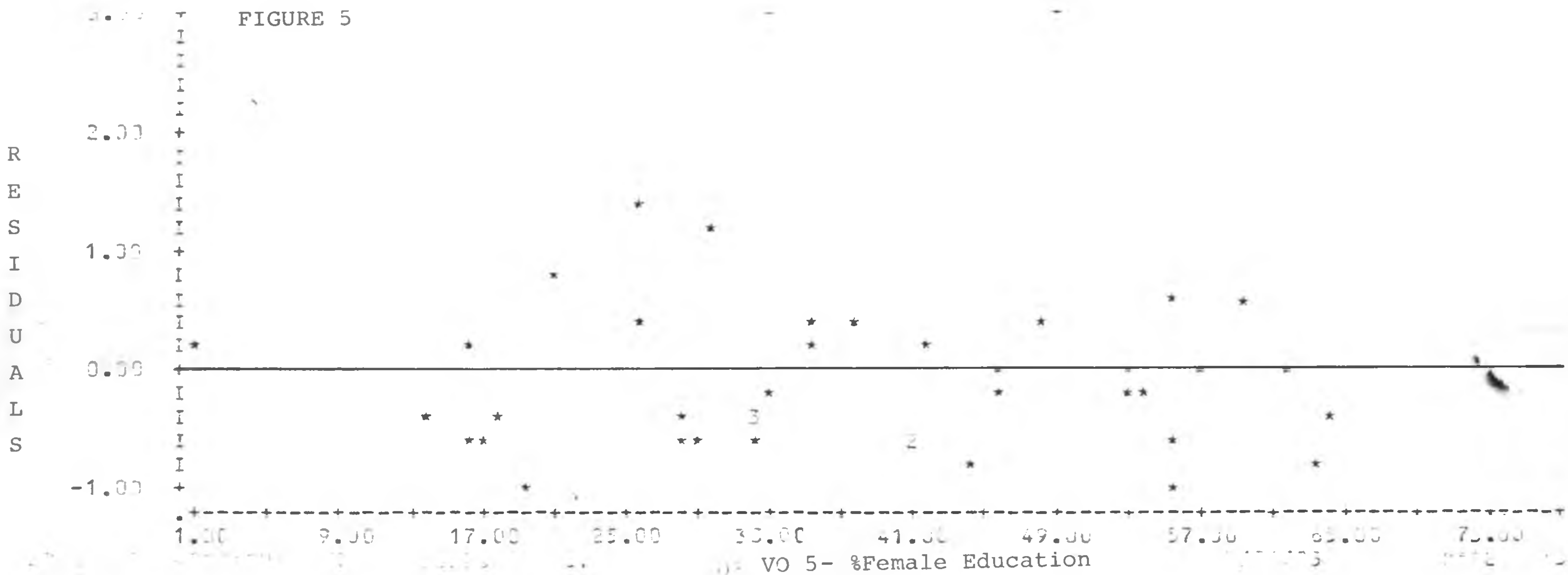
Scattergram: Residual values versus Mortality levels

FIGURE 4



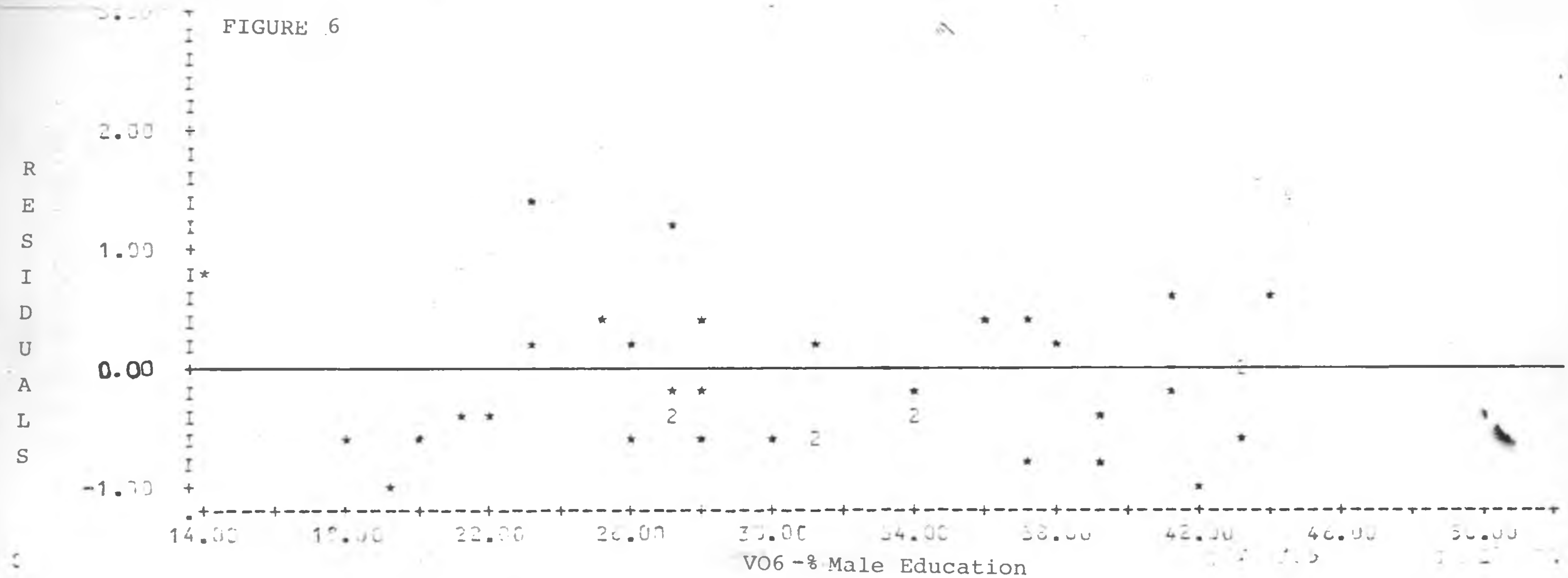
Scattergram: Residual values (e_i) versus proportion of Adults illiterate

FIGURE 5



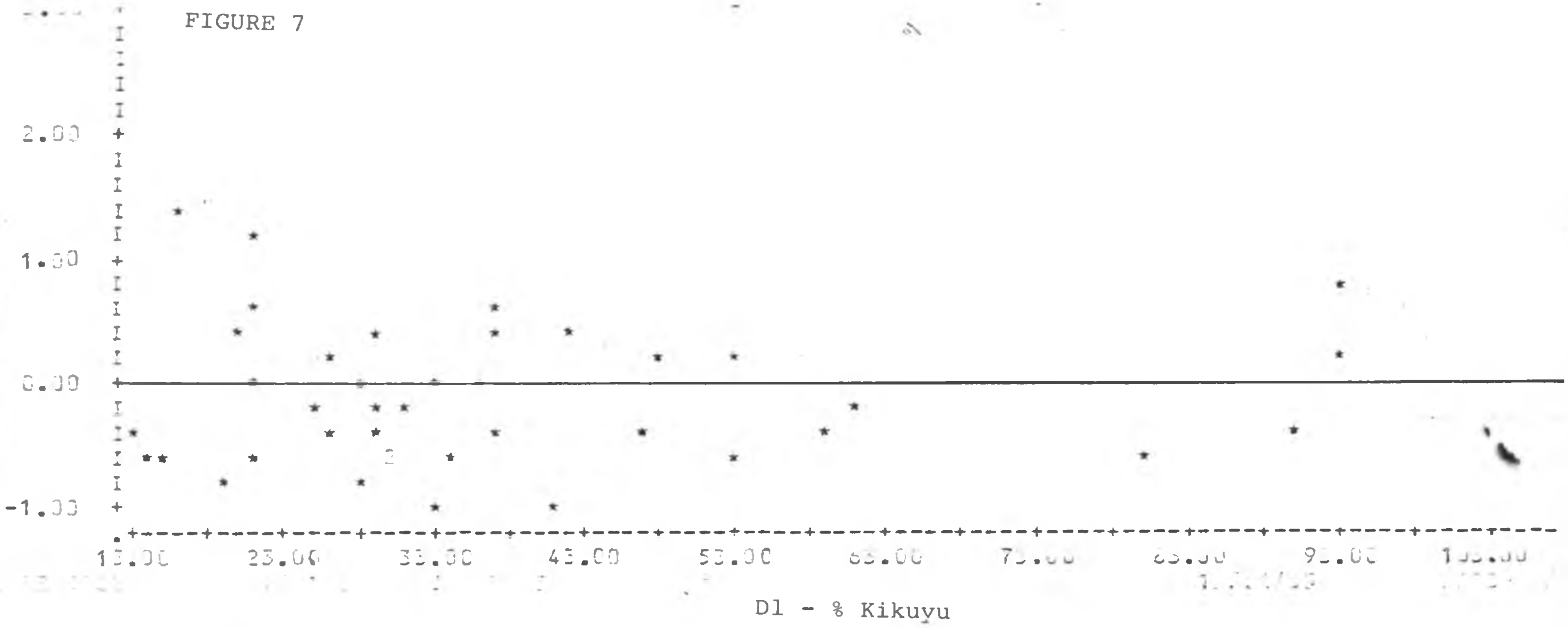
Scattergram: Residual Values (e_i) versus % Female Education

FIGURE 6



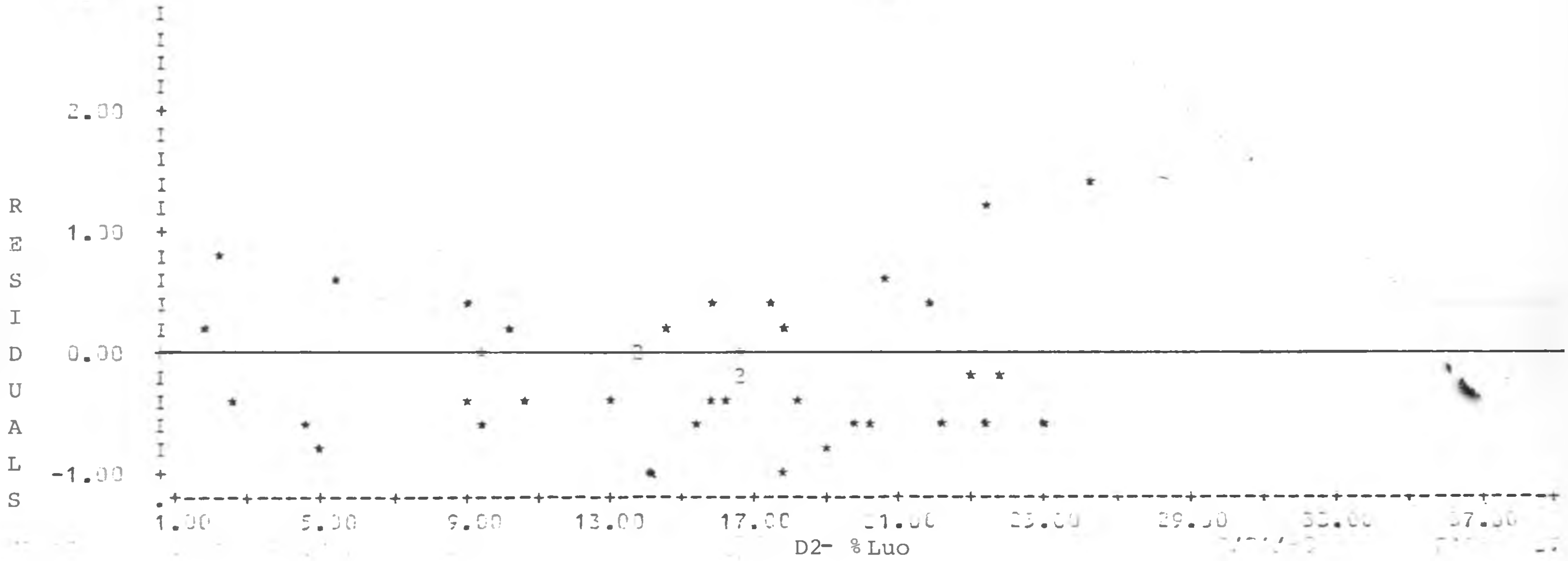
Scattergram: Residual values (e_i) versus % Male Education

FIGURE 7



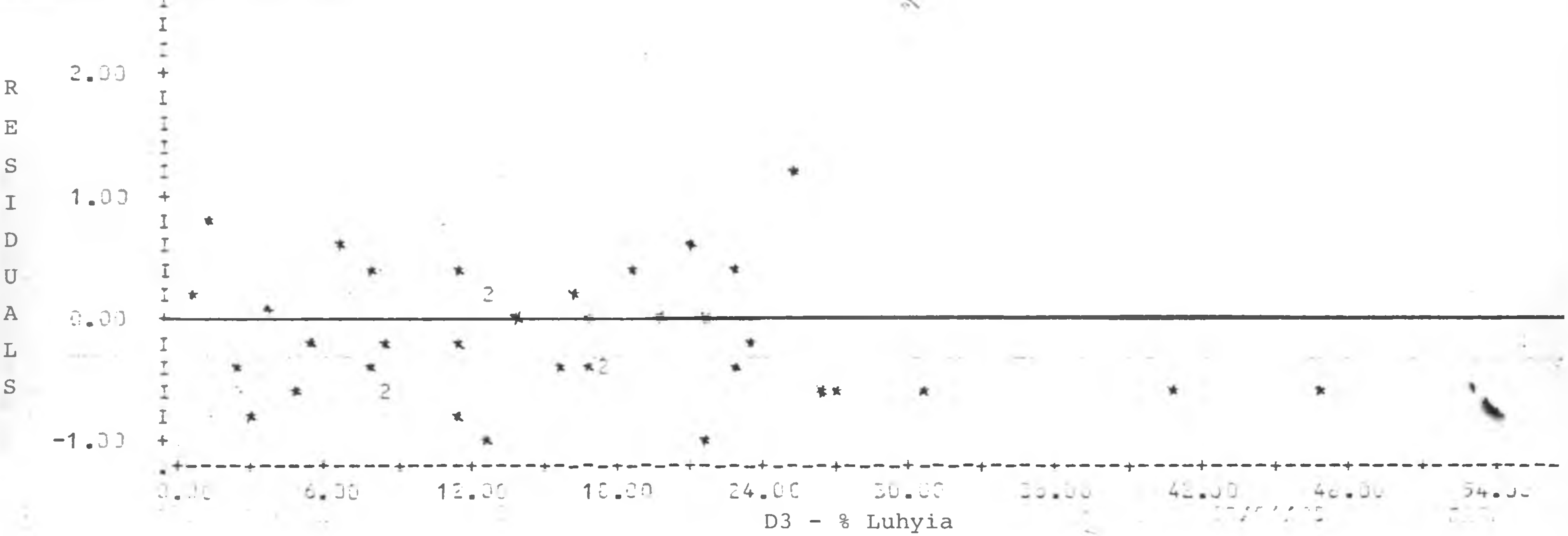
Scattergram: Residual Values (e_i) versus % Kikuyu

FIGURE 8



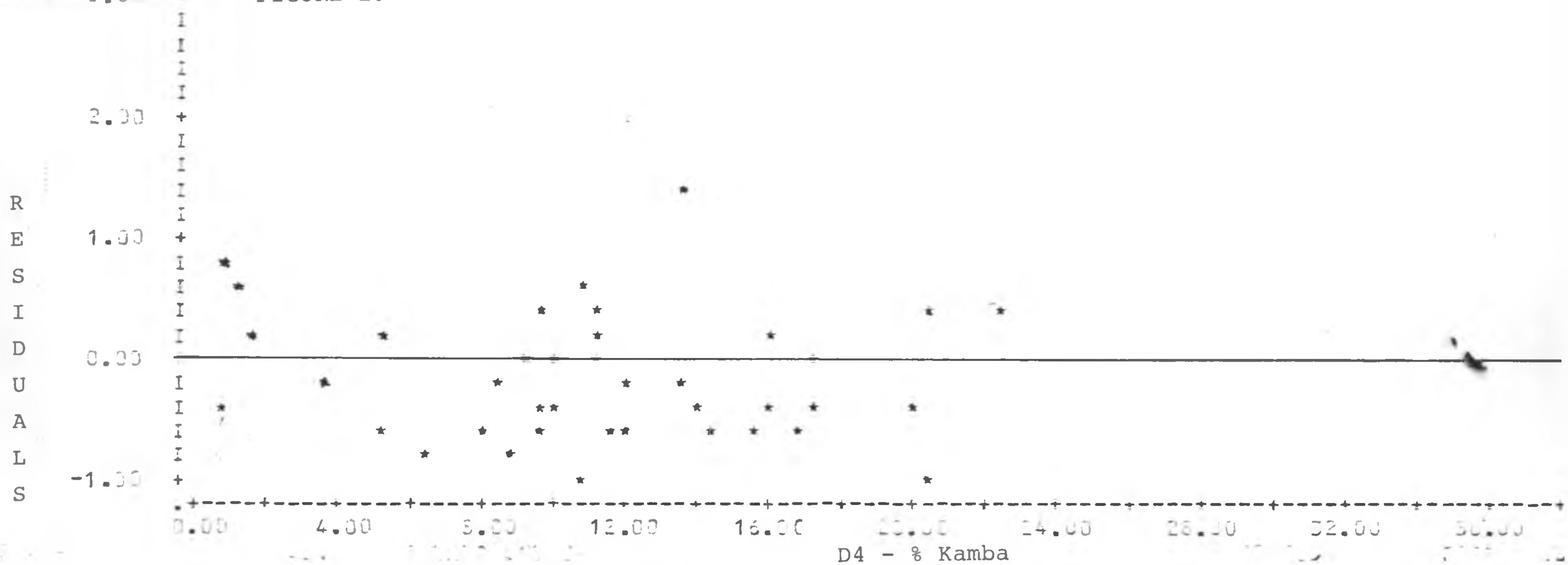
Scattergram: Residual values (e_i) versus % Luo

FIGURE 9



Scattergram: Residual values (e_i) versus % Luhyia

FIGURE 10



Scattergram: Residual values versus % Kamba

3:3 EMPIRICAL RESULTS OF THE REGRESSION MODEL

3:3:1 MATRIX OF ZERO-ORDER CORRELATION COEFFICIENTS (r)

On Table 3:3 below, are zero-order correlation coefficients (r) which show the interrelationships between the variables considered and also their relationships with the dependent variable (total fertility rates). These correlation coefficients do not show that the variables considered are highly intercorrelated. Therefore the problem of multicollinearity is not experienced between these selected variables. However, for the education variable, three categories were considered: female education (vo5), male education (vo6) and adults illiterate (vo4). These categories seem to be highly intercorrelated as reflected in the computed correlation coefficients between them.

Females (15-49) years with 7+ years of education (vo5) have a correlation coefficient of (r= -0.793) when correlated with percentage of adults illiterate by ward (vo4), males (15-49) years with 9+ years of education (vo6) have a correlation coefficient of (r= -0.859) when correlated with per cent of adults illiterate (vo4) by ward. When females (15-49) years with 7+ years of education (vo4) were correlated with males (15-49) years with

9+ years of education (vo6), a correlation coefficient of (r= 0.818) was computed. These high intercorrelations came about because education is one variable split into three categories and all these categories tend to influence each other positively or negatively.

TABLE 3:3 : MATRIX OF ZERO-ORDER CORRELATION COEFFICIENTS (r)

X	VO2	VO3	VO4	VO5	VO6	D1	D2	D3	D4
VO2	1.000								
VO3	-0.306	1.000							
VO4	0.376	-0.629	1.000						
VO5	-0.630	0.473	-0.793	1.000					
VO6	-0.585	0.504	-0.859	0.818	1.000				
D1	0.346	0.328	0.263	-0.403	-0.445	1.000			
D2	0.274	-0.514	0.012	0.019	0.074	-0.510	1.000		
D3	0.444	-0.594	0.074	-0.084	-0.064	0.569	0.644	1.000	
D4	0.119	-0.496	0.099	-0.113	-0.013	-0.581	0.469	0.535	1.000

Source : Computer print-out

3:3:2 MULTIPLE LINEAR REGRESSION RESULTS

In the above sections, it has been shown that fertility differentials exist between wards in Nairobi. These differentials in fertility are associated with differentials in demographic and socio-economic factors between these wards in Nairobi.

Fertility is influenced by a number of independent variables and it is the multiple linear regression analysis which can consider them jointly. This multiple regression analysis sheds some light on the relationships between the estimated total fertility rates and various socio-economic and demographic variables selected. This technique helps explain fertility differentials between these wards in Nairobi.

The order of inclusion of the variables in the regression equation is determined by the computer, and the choice of the order in which variables are entered into the regression model has an important bearing on the results. A variable which explains most of the variation in the total fertility rates is entered first and the variable which explains the greatest amount of variation when combined with the first, will be entered second followed by the others (Nie et al., 1975 : 345).

The results of the multivariate analysis between the estimated total fertility rates and the selected independent variables are presented in Table 3:4 below. This table shows simple (r), R-squared (R^2), R-squared change, B and A values. The simple (r) are the indices of association between the total fertility rates and each of the selected independent variables. The R-squared (R^2) values are the indices which show the total proportion of the variation in the total fertility rates explained by all the selected independent variables entered in the regression equation. The R-squared change show the proportion of variation explained by each variable. The regression coefficients, B denote the slope of the regression line while the A value is a constant which shows where the regression line intercepts with the Y-axis.

According to the multiple linear regression equation results (see Table 3:4) below, the 8 selected independent variables were entered in the equation at different steps. All these variables were found significant at .05, .01 and .001 levels and at different degrees of freedom (df).

TABLE 3:4 : SUMMARY OF MULTIPLE REGRESSION RESULTS

	INDEPENDENT VARIABLE	R-SQUARED (R^2)	RSQ-CHANGE	SIMPLE (r)	B
VO5	% females 15-49 yrs with 7+ years of School by ward	0.397	0.397	-0.630	-0.431
D3	% Luo by ward	0.551	0.154	0.444	0.738
D1	% Kikuyu by ward	0.781	0.229	0.346	0.654
VO4	% Adults (Female and Males) illiterate by ward	0.803	0.023	0.376	-0.211
D2	% Luhyia by ward	0.826	0.022	0.274	0.202
VO3	Mortality levels by ward	0.836	0.009	-0.306	0.223
VO6	% Males (15-49) yrs with 9+ years of School by ward	0.840	0.004	-0.585	-0.171
D4	% Kamba by ward	0.844	0.004	0.119	0.089
	(Constant)				2.203

SOURCE: Computer Printout
Dependent Variable=VO2 - Total Fertility Rate (TFR)
R^2= 84.4 Per Cent

From Table 3:4 above, it can be seen that the selected socio-economic and demographic factors are good predictors of fertility variation between wards in Nairobi. All the 8 independent variables entered in the regression equation explain 84.4 per cent (R^2) of the variation in the estimated total fertility rates between wards in Nairobi. The corresponding F-statistic at (df:8,31) was 20.9 which is found significant at .05, .01 and .001 levels. However, an unexplained variation of 15.6 per cent can be attributed to the data on certain variables not obtained from the 1979 Kenya population census. The data not obtained were on the income, contraceptive use and family size desires between the wards.

Table 3:4 further shows that females (15-49) years with 7+ years of education, proportions of the Luo, Kikuyu, adults who are illiterate and the Luhyia explain most of the variation of 82.6 per cent in total fertility rates between wards. Child mortality levels, proportion of males (15-49) years with 9+ years of education and proportion of the Kamba account for only 0.9 per cent, 0.4 per cent, and 0.4 per cent of the total variation in total fertility rates respectively. This shows that the latter variables are not very strong indicators of fertility variation in Nairobi. Each of these variables is now considered separately.

In each of the following subsections, an attempt is made to investigate the relationships between each independent variable selected and the estimated total fertility rates by ward in Nairobi.

3:3:3 EDUCATION AND ITS INFLUENCE ON TOTAL FERTILITY RATES (TFR)

Evidence from various studies has shown that education is inversely related to fertility (Heer, 1966; Zarate, 1967; Stycos, 1968; Bogue, 1969; Janowitz, 1971; Anker, 1975; Freedman, 1977; Caldwell, 1978; Cochrane, 1979).

In this study, three categories of educational levels were considered. These are females (15-49) years with 7+ years of education (VO5), males (15-49) years with 9+ years of education (VO6) and adults illiterate (VO4) by ward in Nairobi. This study was to assess the influence of each category on the estimated total fertility rates between wards.

Female education (VO5) was found to be the major determinant of the estimated total fertility rates in Nairobi wards. In the multiple regression equation results, this variable was entered first. It accounts for the greatest amount of variation of 39.7 per cent in the total fertility rates between wards. A strong computed negative correlation coefficient of (r= -0.630) shows that female education in Nairobi is inversely related to total fertility rates. This confirms the stated hypothesis that female education is inversely related to fertility and therefore it has a depressing effect on fertility. This implies that as women advance in their education, they tend to reduce their fertility. The results agree with those of other researchers who have found a similar association. Schultz (1972) found female education to be inversely related to fertility in Taiwan and Israel. Cochrane (1978) found the same inverse results in Thailand and Henin (1979) found the same for Kenyan women. This is perhaps the educated women tend to marry relatively late, thus reducing their reproductive period. Education also creates awareness in the use of modern contraception which has a direct inverse effect on fertility (Michael, 1973; Janowitz, 1979). Education also changes women's attitudes towards family size desires (Caldwell, 1981) and also increases accessibility to modern employment thus reducing time for child care.

Male education (VO6) is found to account for a small proportion of 0.9 per cent in the total variation in total fertility rates in Nairobi. This shows that it is not a very strong indicator of fertility variation in Nairobi.

A strong computed negative correlation coefficient of (r= -0.585) confirms the stated hypothesis that male education is inversely related to fertility. This implies that male education has also a depressing effect on fertility. The results agree with those of Schultz (1972) in Taiwan and Israel, Ben Porath (1973) in Israel, although the results were not significant as those of female education.

Proportion of adults illiterate (VO4) was found to explain only 2.3 per cent of the total variation in total fertility rates between wards in Nairobi. A computed positive correlation coefficient of (r= 0.376) confirms the stated hypothesis that illiteracy is positively related to fertility. This positive relationship between the two variables has been obtained elsewhere. Olusanya (1971) in his studies in Western Nigeria found that for women who never attended school, said that fertility is "up to God" and to them family size desires are determined by natural fertility factors. The less educated women bear more children with an expectation to gain more from their children later at their old ages. The illiterate mothers sometimes suffer more child losses than the literate ones and therefore they tend to compensate the dead children by replacing them (Schultz, 1972). This factor accounts for high fertility among the illiterate mothers.

3:3:4 ETHNICITY AND ITS INFLUENCE ON TOTAL FERTILITY RATES (TFR)

In this study, four major ethnic groups in Nairobi were considered. These are the Luo, Kikuyu, Luhyia and the Kamba. This study was to examine the influence of these ethnic groups on total fertility rates in Nairobi.

In a multiple regression equation, these ethnic groups Luo (D3), Kikuyu (D1), Luhyia (D2) and Kamba (D4) were entered in different steps in this order. The relationships between these ethnic groups and the estimated total fertility rates were found to be positive. This is shown by computed correlation coefficients of r= 0.444, 0.346, 0.274 and 0.119 respectively. These results confirm the hypothesis that ethnicity is positively related to fertility. These ethnic groups are found to explain 15.4 per cent, 22.9 per cent, 2.24 per cent and 0.4 per cent respectively of the total variation in total fertility rates between wards in Nairobi.

These findings imply that despite these ethnic groups living in the urban centre of Nairobi, they still tend to have a positive influence on fertility in the urban wards. This would be a factor accounting for the high total fertility rates in some wards as the results have shown. Molnos' (1973) study of the Eastern African tribes found that the traditional customs, beliefs and practices of these ethnic groups are geared to promoting and maintaining high overall fertility.

These findings can be supported with the arguments of the sociologists like Lorimer, Davis and Blake who maintain in their theoretical approach that the extended family is a major cause of high fertility in developing countries.

3:3:5 THE INFLUENCE OF CHILD MORTALITY LEVELS ON TOTAL FERTILITY RATES (TFR)

Evidence from various studies has shown that there is a positive relationship between child mortality rates and fertility. In this study, child mortality rates are measured using child mortality levels (Nyamwange, 1982). High child mortality levels are characterised by high life expectancy at birth (e_o) and low child mortality rates while low child mortality levels are characterised by low life expectancy at birth (e_o) and high child mortality rates.

Computed child mortality levels are shown in Appendix Table C. From this Appendix Table C, it can be seen that child mortality levels in Nairobi wards range from level 15 ($e_o \simeq$ 51.4 and 55.0 for males and females) respectively in Maisha-Makongeni to level 20.9 ($e_o \simeq$ 66.3 and 70.0 for males and females) respectively in Waithaka. These child mortality levels computed for Nairobi are quite high, an indication that child mortality rates are very low and that survival rates for children in Nairobi wards are relatively high. These low child mortality rates experienced in Nairobi can be attributed to better nutritional status, health facilities and services and water supplies enjoyed by majority of the urban residents.

Entering this variable on the regression equation, it was found to be inversely related to total fertility rates.

A computed negative correlation coefficient of (r= - 0.306) confirms the stated hypothesis that child mortality levels are inversely related to fertility. This variable accounts for 0.9 per cent of the total variation in total fertility rates between wards in Nairobi.

May and Heer (1968) found that a decline in mortality makes parents need fewer children in order to achieve their family size desires. This would be the factor which makes couples in some wards to have fewer children thus the low total fertility rates experienced in some of these wards of Nairobi.

CHAPTER FOUR

SUMMARY, CONCLUSION AND RECOMMENDATIONS

The purpose of this chapter is to give a summary and conclusion of the major findings of this study. In the first section of this chapter, summary and conclusion are presented. The second section presents some policy recommendations that emanate from the findings of this study. The last section highlights on a few areas recommended for further research.

4:1 SUMMARY AND CONCLUSION OF THE FINDINGS

What has been covered and the observations made in this study, adds considerably to the understanding of the total fertility rates by ward in Nairobi. The results may prove useful to city planners (health, education, transport etc) in the establishment and distribution of these essential services. Other national policy planners may also find it useful in trying to implement some policies geared to fertility reduction in Kenya and especially in Nairobi.

This study was aimed at achieving three main objectives.

I. To estimate and analyse total fertility rates between the wards in Nairobi.

II. To examine if differentials in fertility exist between the wards and those factors which explain the differentials.

III. To show the direction and strength of the relationships between each selected independent variable and the estimated total fertility rates.

To achieve these objectives, this study has been facilitated by the 1979 Kenya population census. Its enumeration started on the night of 24th August, 1979 and was complete by 15th September 1979. Unlike the other previous censuses taken in 1948, 1962 and 1969, this census was rather detailed, thus enabling data on fertility and the socio-economic and demograpnic factors used in this study to be obtained. However, this study was set by a few limitations on data from the census.

a Lack of data on income, occupation, contraceptive use and family size desires.

b Unreliability of the fertility data due to some omissions and misreporting of children ever born but these were minimal and the techniques employed have taken care of this problem.

The demographic techniques used to estimate total fertility rates are:- current fertility, life-time fertility, $(P_3)^2/P_2$ fertility and the Brass P/F ratio fertility methods. To estimate child mortality levels, Brass basic method and Coale and Demeny model life tables (series) have been used. The multiple linear regression analysis has been used to establish the relationships between total fertility rates and the independent variables considered. The F- test is the statistical technique used for testing the levels of significance. Details of these techniques are discussed in chapter two of this study.

Nairobi's 1979 "de facto" population census was found to be 827,775 persons living in an area of 684 square kilometres with a density of 1,210 persons per square kilometre. At ward level, population densities range from 94 to 43,978 persons per square kilometre (see Table 1:4 of chapter one). This table clearly shows that some wards are densely populated than the others.

Map 2 in Chapter One is a summary of the distribution of these population densities by ward in Nairobi. The map shows that high density wards are around the City Centre extending towards the Eastlands zone. This shows that majority of the people prefer to stay around the City Centre maybe due to some economic constraints involved in terms of transportation to and from the City Centre and other business and recreational facilities centred around the City Centre. Most employees walk to and from their working places thus to ease the costs involved in transport. They therefore prefer to stay around the City Centre since most working places are concentrated around the City Centre and Industrial area. Low density wards are far from the City Centre i.e. towards the Northern, Western and Southern zones. However, given time, population densities in Nairobi are likely to increase towards these zones because of shortages of housing facilities within and around the City Centre.

The general finding from this analysis has revealed clearly that fertility is relatively high in some wards and that a definite fertility differential exists between wards in Nairobi. This conclusion was arrived at following the estimated results of the four demographic fertility techniques used (see Table 3:1) in chapter three. The adopted Brass technique results obtained from an average of P_2/F_2 and P_3/F_3 ratios gave Nairobi a total fertility rate of 5.47 births. At ward level, clear differences in fertility are observed, where births range from 3.62 to 8.29 in Kilimani and Maisha-Makongeni wards respectively. This is a clear indication that fertility differentials exist between wards, which are quite substantial in such an urban centre. Such differentials are unlikely to result from measurement errors in the data, rather they suggest that fertility differentials are not random. These differentials may be systematically associated with the social, economic, health and cultural factors existing between these wards.

From the findings of this study, Nairobi wards have been classified into three distinct categories low, medium and high according to their total fertility rates (see Table 3:2) in chapter three. The distribution of these total fertility rates between wards is shown on map 3 of chapter three.

From Table 3:2, Chapter three, wards with low total fertility rates are mainly those far from the City Centre especially those towards the

Westlands and Southern zones. This is where majority of the residents are relatively of high educational levels. They are exposed to better employment. Very few adults are illiterate in these wards, and are therefore not employed either in the private or public sector unless self-employed. Most women in these wards are better educated (i.e. beyond 7+ years of education) and are therefore employed. They are likely to limit their family sizes. The survival rates of children in these wards is relatively high, a factor which may account for the low total fertility rates experienced in these wards.

The wards that fall in the medium and high class category of total fertility rates are mainly those in the Eastlands and North of Nairobi. The wards in these zones are like Pumwani, Shauri-Moyo, Maisha-Makongeni, Kaloleni, Mbotela, Bahati, Uhuru, Mathare, Maringo, Kariobangi, Ziwani-Kariokor and Ruaraka-Kasarani. Here is where majority of the local ethnic groups (Kikuyu, Luo, Luhyia, Kamba and others) live. Majority of these people are illiterate. However, there are few males and females with 9+ and 7+ years of education respectively. Most of these people are low income earners even if employed either in the private or public sector of the economy.

Most of them, more especially women, engage themselves in self employed income generating activities. These activities do not hinder them from taking care of their children. These women are therefore likely to have more children since they have the time unlike the employed females who attend office work and hence have very little time for their children. Some of these wards experience relatively low survival rates for their children, a factor which may also account for the high total fertility rates in these wards.

Too many children are being born in these wards and they do not have adequate facilities of education, health and housing. Some even lack adequate parental care. Due to lack of these essential social facilities, these children are likely to engage themselves in odd social activities in the City of Nairobi like prostitution, begging in the streets, stealing and working as parking boys etc. These are some of the social problems which are experienced in the streets of Nairobi. A solution to this problem needs to be found e.g. expanding educational facilities to cater for these children so that they do not enter into these criminal activities.

These social factors mentioned above would be among the several factors which have contributed to these fertility differentials within the City of Nairobi.

In this study, the analysis of data using the multiple regression model has revealed that the selected socio-economic and demographic factors are found to account for 84.4 per cent of the total variation in the total fertility rates between the wards in Nairobi. 15.6 per cent of the unexplained variation may be attributed to the data not obtained from the 1979 Kenya population census.

The results of the multiple regression model (see Table 3:4 chapter three) have shown that education both for males and females is found to correlate quite highly with the estimated total fertility rates. This shows that education is a strong determinant of fertility variation between the wards in Nairobi.

Female education is found to be inversely related to total fertility rates in Nairobi. A computed correlation coefficient of (-0.630) confirms the stated hypothesis. This variable explains 39.7 per cent of the total variation in total fertility rates between wards. This is quite substantial, thus female education has a depressing effect on fertility levels in Nairobi.

Male education is also found to be inversely related to total fertility rates in Nairobi. A computed correlation coefficient of (-0.585) confirms the stated hypothesis. This variable explains only 0.4 per cent of the variation in total fertility rates. Despite the small percentage of the variation, male education has also a depressing effect on fertility levels in Nairobi.

Illiteracy of both adults (male and female) is found to have a positive effect on fertility rates in Nairobi. A computed correlation coefficient of (0.376) confirms the hypothesis that illiteracy is positively related to total fertility rates. This variable explains 2.3 per cent of the variation in total fertility rates within Nairobi.

The socio-cultural variable considered in this study is ethnicity. The results reveal that all the ethnic groups considered:- the Luo, Kikuyu, Luhyia and Kamba have a positive influence on the total fertility rates estimated. Computed correlation coefficients of 0.444, 0.346, 0.274 and 0.119 for each tribe respectively, confirm the hypothesis that these ethnic groups are positively related to fertility rates. They explain 15.4 per cent, 22.9 per cent, 0.2 per cent and 0.4 per cent respectively of the total variations in total fertility rates in Nairobi. It can be seen from these results that both the Luo and Kikuyu explain most of the variation in fertility and hence have a stronger positive influence on fertility unlike the other ethnic groups. However, this shows that, despite their stay in the modern city of Nairobi, it does not necessarily isolate them from their traditional beliefs and practices. Most African tribes are known to maintain their traditional cultures regardless of where they are residing.

The demographic variable considered in this study is child mortality levels. This variable is found to be inversely related to fertility rates. A computed negative correlation coefficient of (-0.306) confirms the stated hypothesis that child mortality levels are inversely related to fertility rates. This variable explains 0.9 per cent of the variation in total fertility rates between wards in Nairobi. The estimated child mortality levels give a clear indication that most wards in Nairobi experience low child mortality rates, which means that most children survive. This may be attributed to the better nutritional status, health services and facilites and the educational status enjoyed by the majority of the residents in Nairobi unlike those people in the rural areas.

4:2 POLICY RECOMMENDATIONS

Some of the findings from this study may prove useful not only to policy makers but also to scholars interested in the field of population.

1. To enable a fertility study of this kind to analyse the relationships between total fertility rates and income, occupation, contraceptive use and family size desires, future population censuses in Kenya should design a questionnaire which can collect information from respondents on the above variables found missing in the 1979 census data and other previous censuses.

2. A measure that can enable fertility reduction in Kenya and especially in those wards with high total fertility rates in Nairobi is that of increasing the educational levels of both males and females. Education especially that of females influences the age at first marriage thus reduces the reproductive period.

Education will help in the increase of knowledge and awareness on contraceptive use, and will also wipe out illiteracy which in this study is found to have a positive influence on fertility in Nairobi.

3. There should also be an expansion of more educational facilities (schools) to cater for the high number of children born in the city of Nairobi especially in some wards of the Eastlands region.

4. A policy geared to reducing child mortality rates is necessary for future or present fertility reduction in Kenya, and especially in Nairobi. Reducing child mortality rates will increase the confidence of the parents in the survival of their existing children and this may help reduce population growth rates. Reduction of children mortality rates can be done through increasing educational levels of both females and males, expansion of health services and facilities, which should be intensified both in the rural and urban areas to eradicate killer diseases of infants and children.

5. Another policy measure is that of increasing the education of the local ethnic groups. This will make them become conscious of modern ways of life and it will also change their traditional values of large family sizes.

6. A policy geared to the establishment of a pension or welfare scheme(s) for the elderly and disabled can be a means of reducing fertility. These schemes can provide old age security, rather than parents expecting old age security from their children. These schemes can be established by the government and non-governmental organizations (NGOs).

4:3 RECOMMENDATIONS FOR FURTHER RESEARCH

Since this was a macro-level study, the results have revealed that fertility is relatively high in some wards in Nairobi. However, some wards have relatively low total fertility rates. This shows that fertility differentials exist between these wards. A micro-level study is therefore necessary to reveal some detailed information on fertility especially from these wards with high and low total fertility rates.

This research can be done to find out from the respondents their family size desires with respect to their education, occupation, income, age and ethnic group.

FOOTNOTES

1. Ryder, N. B. — "Fertility," chapter 18 in P.M. Hauser, and O.D. Duncan. The study of population (Chicago: University of Chicago press, 1959). p.400

2. Ominde, S. H. — Population Change and Socio-economic Development in E. Africa, 1980, pp.98-102

3. The 1948, 1962 and 1969 population censuses defined urban population as those towns with a population of 2000 people or more.

4. Henin, R. A. — Alternative population projections for Kenya and its provinces, Table 8, P.16. Population Studies and Research Institute, University of Nairobi, 1979.

5. Encyclopaedia. — Britannica, Vol. 5, Inc. William Benton, Publisher, 1943-1973; Hellen Henisway Benton, Publisher 1973-74.

6. Becker, G. — "An economic analysis of fertility," in National Bureau of Economic Research, Demographic Change in Developed Countries (Princeton, 1960), pp. 209-240.

7. Bongaarts, J. — "A framework of analysing proximate determinants of fertility." Population and Development Review, 1978, Vol. 4(1), pp. 105-132.

8. Schultz, T.P. — "Interrelationships between mortality and fertility," in Population and Development, ed. by Ronald Ridker (Baltimore, 1976).

9. Zarate, A and Alicia Unger de Zarate, "On the reconciliation of migrant-non migrant fertility differentials in urban areas," International Migration Review, Vol.9 No. 2, Summer 1975.

10. Goldberg, D. "Another Data" The Milbank Memorial Fund Quarterly, 41 (July, 1956), pp. 291-308 and Robert O. Carleston, Fertility trends and differentials in Latin America; Ibid; 43(October, 1956) pp. 15-31.

APPENDICES

APPENDIX
TABLE A

REPORTED PARITIES FOR WOMEN IN RESPECTIVE WARDS - NAIROBI 1979

WARD	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50+
KANGEMI	.318	1.553	3.041	4.401	5.354	6.518	6.310	6.440
KAWANGWARE/RIRUTA	.462	1.766	3.425	4.650	5.748	6.237	6.414	6.402
RIRUTA S.SATELLITE	.356	1.532	3.012	4.487	5.665	5.818	6.767	5.895
WAITHAKA	.197	1.574	3.302	4.676	6.213	7.190	7.884	7.412
UTHIRU	.231	1.489	3.302	5.077	6.328	6.486	7.293	6.968
MUTUINI	.286	1.849	3.568	5.047	6.619	6.646	7.039	7.161
KILIMANI	.138	.726	1.771	2.569	3.120	3.376	3.269	3.193
KAREN-LANGATA	.245	1.185	2.342	3.474	3.864	3.894	3.738	3.054
KIBERA-WOODLEY	.492	1.631	2.946	4.215	4.995	5.404	5.364	5.560
GOLF COURSE	.151	.820	2.446	3.795	4.905	5.236	4.956	5.374
NAIROBI SOUTH &W.	.106	.795	2.172	3.390	4.367	4.813	5.031	5.264
INDUSTRIAL AREA	.297	1.269	3.117	4.994	5.744	6.792	6.483	5.364
MUGUMUINI	.245	1.225	2.738	4.180	4.944	5.375	5.320	6.000
EMBAKASI	.363	1.369	2.658	4.212	4.476	5.586	3.491	2.333
DANDORA	.265	1.261	2.727	4.291	5.439	6.047	6.381	6.850
HARAMBEE	.118	,964	2.842	4.114	5.552	5.711	5.468	5.095
LUMUMBA	.141	1.029	2.731	4.608	5.852	7.163	6.881	5.613
MAKADARA	.295	1.582	3.294	4.572	5.251	5.458	5.675	6.764
KALOLENI	.230	1.249	3.348	5,179	6.945	7.519	8.822	5.960
MAISHA-MAKONGENI	.341	1.824	3.842	5.478	6.988	7.097	6.667	6.909
MBOTELA	.274	1.499	3.371	5.103	6.596	5.700	6.475	5.103
BAHATI	.236	1.202	3.060	4,807	5.876	6.131	6.286	6.000
MARINGO	.201	1.364	3.126	4.569	5.603	5.507	5.907	6.380
UHURU	.128	.924	2.715	4.134	5.439	5.571	6.608	4.364
SHAURI MOYO	.353	1.685	3.319	5.329	6.131	6.812	6.419	6.813
PUMWANI	.524	1.655	3.188	4.658	5.290	5.324	5.149	5.721
ZIWANI-KARIOKOR	.197	1.226	3.144	4.966	4.229	6.880	6.222	7.077
PANGANI	.140	.934	2.286	3.403	4.191	4.560	4.537	5.045
CITY CENTRE	.213	1.258	2.434	3.549	4.451	5.170	5.000	5.306
NAIROBI CENTRAL	.238	1.049	2.111	2.611	3.120	3.616	4.261	4.128
SPRING VALLEY	.194	1.086	2.219	2.961	3.621	3.667	3.723	3.761
KARURA	.361	1.255	2.639	3.690	4.021	4.557	4.851	3.150
NGARA WEST	.114	.807	1.848	2.721	2.914	3.366	3.964	4.138
NGARA EAST	.124	.957	2.218	3.413	4.369	4.517	4.403	4.869
ROYSAMBU - KAHAWA	.282	1.607	3.296	4.419	5.664	5.854	5.852	6.384
RUARAKA - KASARANI	.558	1.877	3.430	5.107	5.726	5.928	5.800	5.754
KARIOBANGI	.467	1.678	3.240	4.685	5.540	5.565	6.152	5.693
MATHARE	.459	1.717	3.180	4.592	5.176	5.627	5.554	5.513
EASTLEIGH	.226	1.300	2.765	4.111	4.756	5.192	5.559	4.504
PARKLANDS	.101	.689	1.614	2.502	3.580	3.419	3.547	4.065
NAIROBI	.287	1.338	2.774	3.995	4.809	5.106	5.164	5.112

Source: 1979 Kenya Population Census

APPENDIX
TABLE B

1979 CURRENT AGE - SPECIFIC FERTILITY RATES BY WARD - NAIROBI

WARD	AGE GROUPS									
	12-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59
KANGEMI	0.002	0.115	0.294	0.268	0.212	0.116	0.048	0.044	0.012	0.013
KAWANGWARE/RIRUTA	0.003	0.178	0.313	0.291	0.196	0.145	0.067	0.028	0.031	0.011
RIRUTA S./SATELLITE	0.000	0.125	0.304	0.312	0.235	0.194	0.038	0.050	0.035	0.000
WAITHAKA	0.000	0.082	0.259	0.281	0.192	0.142	0.090	0.058	0.000	0.000
UTHIRU	0.000	0.103	0.279	0.250	0.230	0.150	0.064	0.012	0.000	0.019
MUTUINI	0.003	0.121	0.299	0.342	0.205	0.149	0.123	0.000	0.011	0.000
KILIMANI	0.001	0.046	0.115	0.177	0.119	0.073	0.028	0.002	0.002	0.004
KAREN/LANGATA	0.000	0.083	0.199	0.196	0.161	0.089	0.014	0.014	0.000	0.000
KIBERA/WOODLEY	0.003	0.173	0.274	0.262	0.199	0.110	0.055	0.028	0.014	0.022
GOLF COURSE	0.000	0.059	0.158	0.259	0.219	0.149	0.045	0.022	0.010	0.018
NAIROBISOUTH & W.	0.000	0.035	0.146	0.218	0.168	0.097	0.032	0.013	0.000	0.000
INDUSTRIAL AREA	0.000	0.125	0.261	0.292	0.198	0.178	0.057	0.000	0.000	0.000
MUGUMUINI	0.000	0.076	0.221	0.245	0.227	0.162	0.023	0.035	0.000	0.000
EMBAKASI	0.004	0.133	0.229	0.227	0.204	0.083	0.080	0.035	0.000	0.000
DANDORA	0.000	0.087	0.284	0.324	0.207	0.126	0.055	0.035	0.013	0.000
HARAMBEE	0.000	0.036	0.184	0.260	0.196	0.131	0.099	0.032	0.000	0.000
LUMUMBA	0.000	0.056	0.219	0.286	0.207	0.148	0.087	0.017	0.000	0.000
MAKADARA	0.000	0.109	0.297	0.254	0.224	0.093	0.046	0.104	0.055	0.087
KALOLENI	0.000	0.108	0.201	0.270	0.274	0.192	0.130	0.022	0.000	0.000
MAISHA - MAKONGENI	0.000	0.118	0.281	0.337	0.235	0.185	0.129	0.000	0.045	0.000
MBOTELA	0.000	0.085	0.243	0.300	0.223	0.223	0.054	0.066	0.034	0.083
BAHATI	0.000	0.093	0.199	0.278	0.179	0.172	0.033	0.010	0.027	0.051
MARINGO	0.000	0.074	0.237	0.262	0.188	0.177	0.072	0.010	0.020	0.000
UHURU	0.000	0.046	0.211	0.279	0.175	0.121	0.071	0.025	0.000	0.000
SHAURI MOYO	0.002	0.122	0.236	0.253	0.224	0.151	0.061	0.024	0.000	0.026
PUMWANI	0.006	0.230	0.304	0.286	0.171	0.142	0.059	0.015	0.007	0.012

ZIWANI/KARIOKOR	0.000	0.069	0.237	0.235	0.273	0.146	0.060	0.019	0.000	0.000
PANGANI	0.000	0.055	0.216	0.214	0.165	0.087	0.021	0.007	0.000	0.000
CITY CENTRE	0.000	0.058	0.161	0.159	0.129	0.072	0.049	0.000	0.018	0.042
NAIROBI CENTRAL	0.000	0.072	0.151	0.173	0.116	0.035	0.014	0.004	0.012	0.000
SPRING VALLEY	0.000	0.069	0.193	0.194	0.130	0.101	0.029	0.020	0.000	0.000
KARURA	0.000	0.099	0.207	0.228	0.179	0.120	0.052	0.041	0.013	0.000
PARKLANDS	0.000	0.034	0.132	0.184	0.124	0.071	0.022	0.005	0.003	0.009
NGARA WEST	0.000	0.022	0.155	0.193	0.120	0.057	0.019	0.014	0.000	0.000
NGARA EAST	0.000	0.047	0.163	0.213	0.166	0.075	0.034	0.027	0.000	0.000
ROYSAMBU/KAHAWA	0.001	0.102	0.288	0.290	0.243	0.168	0.047	0.068	0.013	0.011
RUARAKA/KASARANI	0.004	0.178	0.291	0.277	0.216	0.165	0.054	0.053	0.013	0.020
KARIOBANGI	0.001	0.159	0.298	0.295	0.209	0.133	0.079	0.051	0.020	0.024
MATHARE	0.003	0.150	0.292	0.202	0.138	0.073	0.037	0.010	0.000	0.010
EASTLEIGH	0.000	0.069	0.223	0.236	0.169	0.093	0.041	0.006	0.007	0.000
NAIROBI	0.001	0.100	0.236	0.253	0.183	0.117	0.050	0.024	0.009	0.008

SOURCE: 1979 Kenya Population Census

APPENDIX
TABLE C

COALE AND DEMENY NORTH MODEL
MORTALITY LEVELS PER WARD - NAIROBI 1979

WARD	MORTALITY LEVEL	APPRO. LIFE EXPECTANCY	
		MALE	FEMALE
KANGEMI	17.7	58.8	62.5
KAWANGWARE/RIRUTA	16.5	56.3	60.0
RIRUTA S. SATELLITE	18.4	58.8	62.5
WAITHAKA	20.9	66.3	70.0
UTHIRU	18.8	61.3	65.0
MUTUINI	20.3	63.8	67.5
KILIMANI	18.9	61.3	65.0
KAREN - LANGATA	17.2	56.3	60.0
KIBERA - WOODLEY	15.7	53.8	57.5
GOLF COURSE	18.6	61.3	65.0
NAIROBI SOURTH & W	20.1	63.8	67.5
INDUSTRIAL AREA	17.2	56.3	60.0
MUGUMUINI	18.1	58.8	62.5
EMBAKASI	16.7	56.3	60.0
DANDORA	17.4	56.3	60.0
HARAMBEE	19.0	61.3	65.0
LUMUMBA	19.0	61.3	65.0
MAKADARA	17.1	56.3	60.0
KALOLENI	16.4	53.8	57.5
MAISHA - MAKONGENI	15.0	51.4	55.0
MBOTELA	16.6	56.3	60.0
BAHATI	18.6	61.3	65.0
MARINGO	18.3	58.8	62.5
UHURU	20.4	63.8	67.5
SHAURI-MOYO	16.4	53.8	57.5
PUMWANI	16.9	56.3	60.0
ZIWANI - KARIOKOR	17.5	58.8	62.5
PANGANI	20.4	63.8	67.5
CITY CENTRE	17.0	56.3	60.0
NAIROBI CENTRAL	18.0	58.8	62.5
SPRING VALLEY	18.3	58.8	62.5
KARURA	15.1	51.4	55.0
NGARA WEST	20.2	63.8	67.5
NGARA EAST	19.0	61.3	65.0
ROYSAMBU - KAHAWA	17.7	58.8	62.0
RUARAKA - KASARANI	13.1	46.7	50.0
KARIOBANI	15.9	53.3	57.5
MATHARE	16.0	53.8	57.5
EASTLEIGH	18.7	61.3	65.0
PARKLANDS	19.7	63.8	67.5

APPENDIX
TABLE D

EDUCATIONAL DISTRIBUTION BY SEX
BETWEEN WARDS - 1979 NAIROBI

WARD	% ADULTS ILLITERATE	% FEMALE 15-49 WITH 7+ YEARS OF SCHOOL	% MALES 15-49 WITH 9+ YEARS OF SCHOOL
KANGEMI	16	33	28
KAWANGWARE/RIRUTA	32	17	18
RIRUTA S. SATELLITE	16	35	31
WAITHAKA	23	16	23
UTHIRU	17	32	22
MUTUINI	30	21	14
KILIMANI	10	63	37
KAREN - LANGATA	19	46	27
KIBERA - WOODLEY	25	28	26
GOLF COURSE	12	57	41
NAIROBI SOUTH & WEST	9	62	43
INDUSTRIAL AREA	20	32	34
MUGUMUINI	15	14	34
EMBAKASI	19	48	37
DANDORA	17	46	33
HARAMBEE	8	55	41
LUMUMBA	8	53	41
MAKADARA	19	28	27
KALOLENI	15	41	30
MAISHA - MAKONGENI	28	26	23
MBOTELA	13	30	27
BAHATI	20	32	31
MARINGO	20	32	27
UHURU	7	55	42
SHAURI MOYO	23	26	25
PUMWANI	32	19	19
ZIWANI - KARIOKOR	15	41	31
PANGANI	10	55	43
CITY CENTRE	22	35	36
NAIROBI CENTRAL	17	44	39
SPRING VALLEY	14	54	34
KARURA	26	38	28
NGARA WEST	11	59	44
NGARA EAST	9	53	43
ROYSAMBU - KAHAWA	23	1	26
RUARAKA - KASARANI	33	16	20
KARIOBANGI	22	29	28
MATHARE	26	18	21
EASTLEIGH	16	42	38
PARKLANDS	10	64	39

Source : 1979 Kenya Population Census

APPENDIX
TABLE E

ETHNIC DISTRIBUTION IN NAIROBI
BY WARD 1979

WARD	% KIKUYU	% LUHYA	% LUO	% KAMBA	% OTHERS
KANGEMI	60.65	22.84	5.41	3.52	7.58
KAWANGWARE/RIRUTA	53.38	24.99	8.32	5.28	8.03
RIRUTA S. SATELLITE	52.62	17.76	12.30	5.39	11.93
WAITHAKA	93.46	1.86	.68	1.58	2.42
UTHIRU	89.72	2.63	2.16	.97	4.52
MUTUINI	93.37	2.11	1.35	.87	2.30
KILIMANI	19.28	18.94	11.20	8.62	41.96
KAREN - LANGATA	29.06	16.50	8.54	13.50	32.40
KIBERA - WOODLEY	15.29	22.02	29.02	16.95	18.72
GOLF COURSE	28.40	16.59	19.80	11.27	23.94
NAIROBI SOUTH & W.	21.17	13.66	19.80	11.27	23.94
INDUSTRIAL AREA	29.22	15.80	16.53	20.01	18.44
MUGUMUINI	25.93	13.06	17.33	15.99	27.69
EMBAKASI	20.18	15.64	18.86	22.36	22.96
DANDORA	35.97	13.68	21.83	17.06	11.46
HARAMBEE	37.34	20.50	20.70	10.92	10.54
LUMUMBA	31.42	23.60	23.23	11.87	9.88
MAKADARA	58.53	10.49	17.64	10.07	3.27
KALOLENI	13.52	23.46	47.09	11.88	4.05
MAISHA - MAKONGENI	15.77	26.18	39.11	13.42	5.52
MBOTELA	21.41	23.31	25.42	24.78	5.08
BAHATI	80.31	4.58	4.70	8.01	2.40
MARINGO	46.80	18.10	15.71	13.97	5.42
UHURU	40.54	17.65	21.55	10.90	9.26
SHAURI MOYO	28.66	21.83	22.87	20.50	6.24
PUMWANI	33.42	14.00	12.37	20.50	19.71
ZIWANI - KARIOKOR	29.64	20.38	26.38	15.50	8.10
PANGANI	29.88	9.33	8.53	11.77	40.49
CITY CENTRE	37.38	8.81	11.53	9.67	32.61
NAIROBI CENTRAL	28.15	4.88	3.24	6.59	57.14
SPRING VALLEY	25.12	19.73	11.53	8.28	35.34
KARURA	42.49	17.50	7.97	11.09	20.95
NGARA WEST	21.39	5.29	6.45	7.45	59.72
NGARA EAST	33.46	9.42	13.87	9.80	33.45
ROYSAMBU - KAHAWA	47.95	10.12	12.56	11.35	18.02
RUARAKA - KASARANI	20.82	15.30	40.90	14.26	8.62
KARIOBANGI	34.09	19.95	30.50	9.53	5.93
MATHARE	37.15	16.10	22.70	17.22	6.80
EASTLEIGH	26.21	14.60	15.94	15.94	27.31
PARKLANDS	13.27	8.80	7.74	9.60	60.59

SOURCE: 1979 Kenya Population Census

APPENDIX F

MATHEMATICAL DERIVATION OF THE BRASS FERTILITY TECHNIQUE

Brass (1968) designed a method whose mathematical procedure is shown here. The method however, cannot be used with confidence when

$$5b_{45} \geq \frac{(5b_{25})^2}{5b_{20}}$$

where $5b_x$ is the average number of children ever born to women in age group (x, x + 4)

From the age-specific fertility rate pattern, the cumulative fertility pattern up to ages 20, 25, 30, ..., 50 can be calculated as

$$CF_{x+5} = \sum_{j=15, 5}^{x} 5P\phi j$$

where

$5P\phi j$ is the pattern of the age-specific fertility rate for women in age group (J, J + 4); and

CF_{x+5} is the cumulative fertility pattern up to age x + 5

The method also calculates factors for adjusting the cumulative fertility pattern (CF_{x+5})

to the level of certility implied by the average number of children ever born (5bx). These factors are calculated with the help of an age-specific fertility rate model distribution. The model uses a function with a fixed shape but with a possibility of determining the mean for each particular case.

The function (l) is given by

$$f(x) = C. (x - s) . (s + 33 - x)^2 \text{ for } S \leq x \leq S + 33$$

where

f(x) is the fertility rate of women aged x years, S is the starting age of the reproductive period and C is a constant. The function f(x) is taken as zero when x is outside the age interval S to S + 33. The starting age of childbearing is calculated as

$$S = \bar{m} - 13.2$$

where

$\bar{m}$ is the mean age of childbearing.

Value of 33 is mean length of reproductive period.

Function (l) integrated from S to a particular age t, then the cumulative fertility up to that age (t) can be obtained by the integral.

$$F(x) = \int_{s}^{t} f(x) \quad dx$$

$$= C \left[(1/4 \; (S + 33 - x)^{4} - 11(S + 33 - x)^{3} \right]_{s}^{t}$$

Therefore an annual 5 - year age specific fertility rate for the age group i, i + 5 will be

$$5fi = 1/5 \left[(F \; (i + 5) - F(i)) \right]$$

Similary by integrating F(x) between the two particular ages and dividing by the interval (n), the mean number of children ever born per woman in the age interval is found by

$$_{n}MC_{i} = \frac{1}{n} \bullet \int_{i}^{i + n} F(x) \; dx$$

$$= \frac{C}{n} \cdot \left[(\frac{11}{4} (S + 33 - x)^{4} - \frac{1}{20} (S + 33 - x)^{5} \right]_{i}^{i + n}$$

Adjusted factors for each age group can then be calculated as

$$_{5}K_{x} = \frac{_{5}MC_{x} - F(x)}{5fx}$$

Adjusted average cumulative fertility will equal to

$$5ACF_x = CF_x + 5^K x \cdot 5P\phi_x$$

Finally, the age-specific fertility rate pattern can be adjusted by either of the two options, if they are close to unity or are consistent.

Option I:

$$5\phi'_x = 5P\phi_x \cdot \frac{5b_{20}}{5ACF_{20}} \text{ or } 5P\phi_x \cdot P(2)/_{F(2)}$$

Option II:

$$5\phi''_x = 5P\phi_x \cdot \frac{5b_{25}}{5ACF_{25}} \text{ or } 5P\phi_x \cdot P(3)/_{F(3)}$$

where $5\phi'_x$ is the corrected (adjusted) age-specific rate for age group x, x + 4 according to option I; $5\phi''_x$ is the adjusted age-specific fertility rate for age group x, x + 4 according to option II; and 5bx and $5ACF_x$ are defined above.

APPENDIX
TABLE G

BRASS Pi/Fi RATIOS IN FIVE YEAR AGE GROUPS (15-49)

WARD	15-19	20-24	25-29	30-34	35-39	40-44	45-49
KANGEMI	1.3065	1.0957	1.0653	1.0872	1.1100	1.2545	1.1550
KAWANGWARE/RIRUTA	1.0146	.9793	1.0247	1.0268	1.0703	1.0638	1.0542
RIRUTA S.SATELLITE	1.3116	1.0226	.9752	1.0104	1.0274	.9720	1.0749
WAITHAKA	1.2843	1.3690	1.2922	1.2522	1.2593	1.3698	1.4097
UTHIRU	1.0905	1.1349	1.2393	1.3090	1.3187	1.2269	1.3422
MUTUINI	1.3842	1.2805	1.1511	1.1426	1.2519	1.1113	1.1436
KILIMANI	1.4259	1.2721	1.3026	1.2338	1.2268	1.2190	1.1596
KAREN - LANGATA	1.3494	1.2006	1.1692	1.2003	1.1084	1.0553	.9905
KIBERA - WOODLEY	1.0578	.9776	.9703	1.0095	1.0180	1.0202	.9750
GOLF COURSE	1.2375	1.0983	1.3103	1.2384	1.2382	1.1956	1.0908
NAIROBI SOUTH & W.	1.7933	1.3636	1.3948	1.3474	1.3969	1.4030	1.4233
INDUSTRIAL AREA	1.0110	.9193	1.1067	1.2447	1.1568	1.2402	1.1671
MUGUMUINI	1.6213	1.2139	1.2316	1.2228	1.1309	1.1349	1.0950
EMBAKASI	1.0559	1.0264	1.0621	1.1734	1.0556	1.1943	1.7055
DANDORA	1.6191	1.0180	.9640	1.0416	1.1059	1.1341	1.1462
HARAMBEE	2.1040	1.3994	1.5156	1.3685	1.4608	1.1357	1.1730
LUMUMBA	1.4517	1.1510	1.2238	1.3366	1.3554	1.4675	1.3526
MAKADARA	1.3197	1.1355	1.1780	1.1431	1.1118	1.0813	1.0172
KALOLENI	.8562	1.1104	1.4144	1.3779	1.4175	1.3185	1.4754
MAISHA - MAKONGENI	1.3164	1.1348	1.2743	1.2404	1.2798	1.1371	1.0377
MBOTELA	1.6083	1.3416	1.3250	1.3303	1.3244	1.1025	1.0914
BAHATI	1.0927	1.1555	1.3284	1.4087	1.3633	1.2978	1.3051
MARINGO	1.4306	1.3098	1.3343	1.3241	1.3390	1.1864	1.2323
UHURU	1.7094	1.1310	1.2817	1.2830	1.3789	1.2650	1.4306
SHAURI MOYO	1.3858	1.3007	1.2967	1.4172	1.3163	1.3220	1.2002
PUMWANI	.7822	.8078	.8982	1.0028	.9736	.9031	.8532
ZIWANI - KARIOKOR	1.5544	1.2092	1.4063	1.3972	1.3713	1.3735	1.2007
PANGANI	1.4703	1.0608	1.1454	1.1586	1.1870	1.2135	1.1878
CITY CENTRE	1.8069	1.6787	1.5459	1.5479	1.6072	1.6851	1.5924
NAIROBI CENTRAL	1.4095	1.3163	1.2870	1.1137	1.1663	1.2981	1.4967
SPRING VALLEY	1.3884	1.2128	1.1710	1.1024	1.112	1.0367	1.0147
KARURA	1.5526	1.1471	1.1876	1.1415	1.0155	1.1047	1.0509
NGARA WEST	3.7227	1.5182	1.2679	1.2258	1.1071	1.2024	1.3737
NGARA EAST	1.4425	1.3773	1.3129	1.2971	1.3706	1.3137	1.2209
ROYSAMBU - KAHAWA	1.3714	1.2073	1.1670	1.0626	1.0973	1.0415	.9766
RUARAKA - KASARANI	1.1827	1.0775	1.0748	1.1571	1.0685	1.0155	.9413
KARIOBANGI	1.1850	1.0097	1.0179	1.0603	1.0564	.9662	1.0074
MATHARE	1.2579	1.0746	1.0428	1.0866	1.0239	1.0127	.9528
EASTLEIGH	1.7327	1.3314	1.2745	1.2984	1.2561	1.2684	1.3272
PARKLANDS	1.7075	1.2754	1.1686	1.1765	1.2206	1.2418	
NAIROBI	1.3012	1.1350	1.1342	1.1354	1.1354	1.043	1.0748

SOURCE: Computer Printout from Brass technique

B I B L I O G R A P H Y

Agbasi, G. (1977): "Fertility in Urban Kenya," A Dissertation for Ph.D in the Department of Sociology and Anthropology, Fordham University, New York.

Andorka, R. (1978): Determinants of Fertility in Advanced Countries, Melhuen & Co. Ltd., London.

Anker, R. and Knowles, J.C. (1980): "Human Fertility in Kenya," World Employment Programme Research, Draft Monograph, I.L.O, Geneva

Bean, F.D. and Wood, C.H. (1974): "Ethnic variation in the relationship between income and fertility," Demography, Vol.II, No. 4, Nov., pp.629-640.

Becker, G.S. (1960): An Economic Analysis of fertility Demographic and Economic Change in Developed Countries, National Bureau for Economic Research, Princeton University Press, Princeton, pp. 209-231.

Behrman, S.J. et al, (1969): Fertility and family planning, A world view, Ann Arbor, University of Michigan Press, pp.127-156.

Blake, J. (1968): "Are Babies consumer Durables?" Population Studies, Vol.20, pp. 19-20.

Blalock, H.M. (Jr) (1981): Social Statistics, Revised second edition.

Bogue, D. J. (1969): Principles of Demography, New York, John Wiley and Sons, Inc.

Brass. W.I. (1968): "Notes on Brass Method of Fertility Estimation," in Brass et al., (eds.), The Demography of Tropical Africa, Princeton University Press, Princeton, Appendix A.

Brass, W.I. and Coale, A.J. (1968): "Methods of Analysis and Estimation," in Brass et al., (eds.) The Demography of Tropical Africa, Princeton University Press, Princeton, pp. 88-139.

Cain, G and Weininger, A. (1973): "Economic Determinants of Fertility Results from cross-sectional Aggregate Data," Population and Development Review Vol.10, No.2, May.

Caldwell, J.C. (1980): "Mass Education as a Determinant of the Timing of Fertility Decline," Population and Development Review, Vol.6, No. 2, June, pp. 225-256.

Caldwell, J.C. (1977): The Persistence of high fertility, population prospects in Third World Countries.

Caldwell, J.C. (1979): "Education as a factor in mortality decline, an examination of Nigerian data," Population Studies, Vol.33, No. 3, pp.359-413.

Coale, A.J. and Demeny, P. (1966): Regional Model Life-tables and stable populations, Princeton University Press, Princeton.

Cochrane, S.H. (1979): Fertility and Education, What do We Really Know?, IBRD, occassional papers, No. 26, John Hopkins, University Press, Baltimore.

Davis, K. and Blake, J. (1956): "Social Structure and Fertility: An Analytical Framework," Economic Development and Cultural Change, 4(April), pp. 211-235.

Dow, T.E.(1967): "Attitudes toward family size and family planning in Nairobi," Demography, Vol.4, No.2,pp.780-797.

Easterlin, R.A. (1980): Fertility and Development in Population Bulletin of ECWA, Number 18, June, pp.1-40.

Gatara, T.H. (1982): "The influence of Religion and Education on current family size and fertility preference in Kenya," Ph.D Thesis, Florida State University.

Genus, (1974): Vol.XL (49), N.3-4, pp.77-95.

Graff, J.H. (1979): "Literacy, Education and fertility, Past and Present: A critical Review," Population and Development Review, Vol.5, No. 1, March, pp: 105-140.

Harnett, D.L. (1975): Introduction to Social Methods, Addison - Wesley Publishing Co. Inc., Philliphines.

Heer, D.M. (1966): "Economic Development and Fertility," Demography, Vol.3, No. 2, pp.423-444.

Heer, D.M. and Smith,D.O. (1968): "Mortality level, desired family size and population increase," Demography, Vol.5, No.1, pp.105-121.

Hiesel, D.F. (1968): "Attitudes and practice of contraceptives in Kenya," Demography, Vol.5 pp.632-641.

Henin, R.A. (1979): "Recent Demographic Trends in Kenya," Population Studies and Research Institute, University of Nairobi.

Henin, R.A. (1979): "Population profiles for the districts of Kenya," Population Studies and Research Institute, University of Nairobi.

Hernandez, D.J. (1985): "Fertility Reduction Policies and Poverty in Third World Countries, Studies in Family Planning, Vol.16, No.2, pp.76-87.

Kangi, M. (1978): "Urban-Rural Fertility Differentials: A case study in Nairobi and Central Province," A Dissertation for M.A. in the Department of Geography, University of Nairobi.

Ken, H. (1980): "Appraisal and Adjustment methods for Demographic census Data," in Population Bulletin of ECWA, number 18.

Kenya, (1969): Population Census, Analytical Report, Vol.IV, CBS, Ministry of Finance and Planning, Nairobi.

Kenya, (1969): *Population Census, 1969: First Report*, Vol.1, CBS, Ministry of Finance and Economic Planning, Nairobi.

Kenya, (1980): *Kenya Fertility Survey 1977-78: First Report*, Vol.1, Nairobi

Kenya, (1981): *Kenya Population Census, 1979: First Report*, Vol.1, CBS, Ministry of Economic Planning and Development, Nairobi.

Kenya, (1983): *Kenya Population Census, 1979: Analytical Report*, Vol.II, CBS, Ministry of Economic Planning and Development, Nairobi.

Knodel, J. (1981): "Child Mortality and Reproductive Behaviour in German village Populations in the past," A micro-level analysis of the replacement effect No. 81-1, Research Report.

Kpedekpo, G.M.K. (1982): *Essentials of Demographic Analysis for Africa*, pp. 59-74.

Loebner, H. and Driver, E. (1973): "Differential Fertility in Central India: A path Analysis," *Demography*, Vol.10, No.3 August, pp.229-250.

Molnos, A. (1972/73): *Cultural Source Materials for Population Planning in East Africa*, East African Publishing House, Nairobi.

Mwobobia, I.K. (1982): "Fertility Differentials in Kenya: A cross-Regional Study." A Dissertation for M.A. in Population Studies and Research Insitute, University of Nairobi.

McNicoll, G. (1978): "On Fertility Policy Research," *Population and Development Review*, Vol.4, pp.681-693.

Muwonge, J.W. (1980): "Urban Policy and Patterns of low-income settlement in Nairobi, Kenya," *Population and Development Review*, Vol.6, No. 4

Myers, G.C. and Morris, E.W. (1966): "Migration and Fertility in Puerto Rico, Population Studies, Vol.20, No.1, pp.85-96.

Nie, M.,Bent, D.H. and Hull, C.H. (1970): Statistical Package for Social Sciences (SPSS), McGraw Hill, Inc.

Okunjo, C. (1962-63): "Fertility levels and Differentials in Africa," in International Population Conference, Liege, Vol.16, pp.200.

Olusanya, P.O. (1969): "Rural/Urban fertility differentials in Western Nigeria," Population Studies, Vol.23.

Ominde, S.H. (1980): Spatial Population Change in Kenya, Population Studies and Research Institute, University of Nairobi.

Shryock, H.S. and Siegel, J.B. (1975): The Methods and Materials of Demography, Vol. I, and Vol.II, U.S. Department of Commerce, Bureau of the Census, Washington, D.C.

Schultz, P.T. "Determinants of Fertility," A micro-economic model on choice, proceedings of a conference by the International Economic Association at Valescure, France on Economic Factors in Population Growth, pp.89-124.

Snyder, D.H. (1975): "Tribal Affiliation and Fertility: A note," Demography, Vol.XXIX, No.1, March, pp.151-154.

Tien, H.Y. (1968): "The Intermediate variables, social structure and fertility change: A critical critique," Demography, Vol. 5, No.1, pp.138-157.

United Nations, (1967): Methods of Estimating Basic Demographic Measures from Incomplete Data: Manual IV, Department of Economic and Social Affairs, New York, pp. 31-39, 73-75.

United Nations, (1983): Indirect Techniques for Demographic Estimation; Manual X, New York, pp.27-72.

United Nations, (1979): Demographic and Socio-Economic Development. Proceedings of the United Nations/UNFPA Expert Group meeting, Istanbul, 27 April - 4 May 1977, pp.5-31; 38-61.

Van de Walle, E. (1968): "Notes on the Effect of Age misreporting," in Brass et al.,(eds.), The Demography of Tropical Africa, Princeton University Press, Princeton, Appendix B.

World Bank, (1974): Population Policies and Economic Development, A World Bank Staff Report, John Hopkins, University Press, Baltimore and London, pp.45-55.

World Bank Report, (1980): Kenya: Population and Development. A World Bank Country Study : East Africa Programs Dept. World Bank Washington, D.C. July.

Zarate, A.O. (1967): "Some Factors Associated with Urban-Rural Fertility Differentials in Mexico," Population Studies, Vol.21, pp.283-293.