

**POPULATION CHANGE AND FOOD AVAILABILITY IN
TANZANIA; A MULTILEVEL MODELING APPROACH**

The Case of Ukerewe Islands

By


Deogratias Solole Malogo

**A dissertation submitted in partial fulfilment for the requirement of the Degree of
Master of Arts (Statistics) of the University of Dar es salaam**

**University of Dar es salaam
August, 2005**

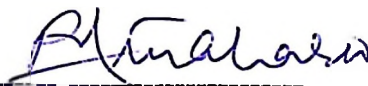
CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by the University of Dar es Salaam this dissertation titled: "*The Population Change and Food Availability in Tanzania; a Multilevel Modeling Approach: The Case of Ukerewe Islands*", in partial fulfillment of the requirement of Master of Arts (Statistics)



Prof. C.L Kamuzora

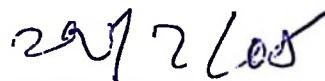
(Supervisor)



Dr. R. Akarro

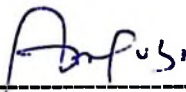
(Second Supervisor)

Date-----



**DECLARATION
AND
COPYRIGHT**

I, **Deogratias Solole Malogo**, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature  _____

This dissertation is copy right material protected under the Berne convention, the Copyright Act 1999 and other international and national enactments, in that behalf, on intellectual property. It may not be reproduced by any means, in full or part, except for short extract in fair dealing, for research or private study, critical scholarly review or discourse with an acknowledgement, without written permission of the Directorate of Postgraduate studies on behalf of both the author and the University of Dar es salaam

ACKNOWLEDGEMENT

I wish to acknowledge with sincere gratitude advice, comment, assistance and encouragement I received from many people in the process of producing this dissertation. However, though it is difficult to mention them all, the following need special thanks.

I am heavily indebted to my supervisors, Prof. C. L. Kamuzora and Dr. R. Akarro of the Department of Statistics, University of Dar-es-salaam. Their valuable criticism, guidance and easy accessibility helped me a lot in shaping my research proposal and in producing the dissertation in its present form.

I am very grateful to the Directorate of Post-graduate studies of the University of Dar-es-salaam for financial support throughout my study, without which, my studies would not have been possible.

I wish to express my sincere thanks to all academic staffs of Statistics Department under the leadership of Prof. R. Katapa for consistent advice, encouragement and really assisted me financially in pursuing this study. Also, I owe much thanks to Dr. Mussa for the support he gave me. Special thanks go to N. Sigalla and A. Msengwa for providing me with the materials for multilevel modeling.

The friendly co-operation I enjoyed from my colleagues Seleman Majige and Pastory Sweya in the MA (Statistics) program is also highly appreciated.

Many thanks go to Mwanza Regional Administrative Secretary, Ukerewe District Administrative Secretary and Village Executive Officers of Bwisya, Bukongo and Kameya, for permission and material support to collect data in the area. I am also grateful to the Hamlet Executive Officer for the tireless effort to assist me during collection of data in their respective administrative blocks.

I owe profound gratitude to my family, particularly my wife Nuru S. Malogo, who shouldered all family responsibilities during my absence.

Nevertheless, the shortcomings of this dissertation remain my responsibility and should be in no way be attributed to any of the above mentioned individuals or institutions.

DEDICATION

This dissertation is dedicated to the loving memory of my lovely son Dickson D. Maula.

ABSTRACT

Primary data from a survey of 150- rural households in Ukrewe district, one of the densely populated rural districts in Tanzania mainland, were used to examine the relationship between socio-demographic variables and household food availability.

The study employed the Principal Component Analysis (PCA) in the construction of households' possession indices which was then used as the proxy determinant of food availability. The 2-level random intercept model with 3-ordered categorical response variable was used in the estimation of coefficient of effects. The findings show that household seasonal migrants, education attainment by household members, farm land resources and life cycle of household at different stage of development that was measured by the age of household head, were significant. It was further noted that seasonal migrants and farm land were likely to reduce the odds ratio of a household of being extremely poor or poor. An increase of a person with secondary or post-secondary education in a household reduced the odds ratio of a household of being extremely poor by 52.8 percent as compared to 19 percent odds ratio reduction by increase of non-educated household member. The findings show that the young aged head of household was 3 and 5 times less likely to be extremely poor as compared to old and middle age headed household respectively.

The data could not allow any viable conclusion to be drawn from variables such as; household sex ratio, sex of household head, size of the household and proportion of household permanent migrants because they were statistically insignificant.

TABLE OF CONTENTS

	Page
Certification.....	ii
Declaration and Copyright.....	iii
Acknowledgement.....	iv
Dedication.....	v
Abstract.....	vi
Table of Contents.....	viii
List of Tables.....	x
List of Figures.....	xii
List of Abbreviation.....	xiii
CHAPTER ONE: INTRODUCTION.....	1
1.0 Background to the problem.....	1
1.1 Statement of the problem.....	6
1.2 Objective of the study.....	8
1.3 Significant of the study.....	8
1.4 Hypotheses.....	9
1.5 Conceptual framework.....	10
CHAPTER TWO: LITERATURE REVIEW.....	12
2.0 Introduction.....	12
2.1 The impact of Population change.....	12
2.2 Food availability.....	20
CHAPTER THREE: METHODOLOGY.....	23
3.0 The study area.....	23
3.1 Selection of the targeted population.....	24
3.2 Study instruments.....	24
3.3 Sample selection.....	25
3.4 Method of data collection.....	27

3.5	Study variables.....	27
3.6	Measurement of study variables.....	27
3.6.1	Construction of poverty index.....	28
3.7	Data processing and analysis.....	29
3.8	Multivariate analysis.....	30
CHAPTER FOUR: EMPIRICAL FINDINGS AND DISCUSSION.....		33
4.0	Introduction.....	33
4.1	Characteristics of the sample.....	33
4.1.1	Size and dependency ratio.....	33
4.1.2	Sex and age distribution.....	34
4.1.3	Economic profile: Quality of housing, toilet and water sources.....	35
4.1.4	Economic profile: Ownership of durable assets.....	36
4.1.5	Household members' education level.....	37
4.1.6	Household farm land acquisition.....	39
4.1.7	Household land shortage problems and solutions.....	41
4.1.8	Household economic activities.....	43
4.1.8.1	Livestock keeping.....	44
4.1.8.2	Farming activities.....	44
4.1.9	Migration status of family members.....	48
4.1.9.1	Seasonal migration.....	48
4.1.9.2	Permanent migration.....	50
4.2	Multivariate analysis.....	52
4.2.1	Logistic regression results.....	52
4.2.2	Hypotheses testing.....	54
CHAPTER FIVE: SUMMARY CONCLUSION AND POLICY IMPLICATIONS.....		62
5.0	Summary.....	62
5.1	Conclusion.....	64
5.2	Policy implication.....	66
5.3	Further research.....	68
APPENDICES.....		69
BIBLIOGRAPHY.....		77

LIST OF TABLES

		Page
Table No 1.1	Estimated population growth through history.....	2
Table No 1.2	Indices of food production per head by region.....	3
Table No 1.3	Tanzania's population growth	5
Table No 2.1	Boserup: Agricultural systems and population density.....	16
Table No 4.1	Total population by age distribution in the islands.....	34
Table No 4.2	Housing condition, toilet and water sources	35
Table No 4.3	Ownership of durable assets.....	37
Table No 4.4	Education level attainment by age distribution of household members.....	37
Table No 4.5	Education level attainment by sex of household members.....	38
Table No 4.6	Percentage distribution of modes of land acquisition by age of household heads.....	40
Table No 4.7	Household poverty level by the size of farm land.....	41
Table No 4.8	Percentage distribution of solution to land shortage in the district by age of household heads	42
Table No 4.9	Farming activities responsibility: Manure	46
Table No 4.10	Percentage distribution of household members participation in farm activities by farm land size	47

	Page
Table No 4.11	Reason for seasonal out-migration48
Table No 4.12	Migration status of family members with respect to age group.....49
Table No 4.13	Reasons for permanent out-migration.....50
Table No 4.14	Type of assistances from migrants.....51
Table No 4.15	Results of Wald test and odds ratio from fitting 2-level logistic Regression53

LIST OF FIGURES

Figure 1.1	The long-run and short-run effect of population growth on food Availability.....	11
Figure 3.1	A map showing geographical location of Ukerewe District in Mwanza Region.....	26

LIST OF ABBREVIATIONS

1. **BCSO – Botswana Central Statistics Office**
2. **FAO – Food and Agriculture Organisation**
3. **ILO – International Labour Organisation**
4. **NBS – National Bureau of Statistics**
5. **PCA – Principal Component Analysis**
6. **SPSS – Statistical Package for Social Scientists**
7. **TFR – Total Fertility Rate**
8. **UN – United Nations**
9. **UNFPA – United Nation Population Fund**
10. **UNICEF – United Nations of children’s Fund**
11. **USA – United States of America**
12. **ZCSO – Zimbabwe Central Statistics Office**

CHAPTER ONE

INTRODUCTION

1.0 Background to the problem

The term population growth is used to refer to the change in population size and its related age structure brought about by fertility, mortality and migration. Food availability refers to the amount of food that can be obtained by a person from his/her own production, income or community support.

According to Robinson (1981), the tremendous increase in size of the World population poses two fundamental problems: Will there be enough living space to accommodate the increased number of the future? OR, Will it be possible to feed adequately all the additional mouths when there is already a serious hunger problem?

From the above fundamental problems, it is noted that population growth with time is regarded as the major factor influencing high demand for natural resources such as land, water and others. Land as the major input for food production has been deteriorating due to population pressure (Todaro, 1992). As shown in table 1.1 below, the growth of the world population is historical. Since 1750 there has been a rapid and accelerating expansion of world population from 3.3 billion in 1965 to 6.4 billion in 2000.

Smil (1994) proclaimed that the earth could still support a population of 10 to 11 billion people during the next century since there enough know-how and capital to create the necessary change of food production. This is contrary to Ehrlich (1970) prediction of maximum global population of 3.7 billion people. According to him hundreds of million people were expected to starve to death during the 1970s.

Table 1.1 Estimated population through history

Year	World population (in million)	Africa (in million)	Tanzania (in million)
AD 14	256	23	-
1000	280	50	-
1500	427	85	-
1750	731	100	-
1965	3,289,002	303,150	11,781
1970	3,631,797	344,484	13,694
1980	4,456,688	456,721	18,581
1990	5,438,165	615,826	25,993
2000	6,493,642	817,751	35,916

Source: Stanley (1987) pp. 4 and 136-137; United Nation (1993)

Robinson (1981) reported that while 3.7 human beings were born every second with the rate of growth been 1.9 percent annually, the world population was projected to 4 billion in 1981 .According to him the population was expected to double in less than 34.5 years. This has posed a challenge of food availability in relation to population growth.

Although enough food is produced worldwide to feed everyone, yet the food and the technology to produce it do not reach those in need. Every year 11 million children

under the age of five die of hunger or related diseases (Lean; Hinrich and Markham, 1990). It is predicted that global food production will exceed population growth by the year 2030 but at the same time millions of people in developing countries will remain hungry (UN Food 2002 and FAO).

Approximately 90 percent of the increase in the world population is taking place in less developed countries (Kiessling and Landbeg, 1994). Starvation and famine are reported to be persistent in these countries. World wide food output per head has been rising, except for the African continent and Tanzania in particular where food output per head has been declining from 100 in 1979-81 to 83.2 in 1990-2 (Table 1.2 below). The indices of food production were calculated in terms of a long standard list of commodities that range from grain and starchy roots to fruits, and deducting production flow back into the agricultural sector such as animal feeding-stuff.

Table 1.2 Indices of food production per head by region.

Region	1974-6	1979-81	1985-7	1990-2
World	97.4	100.0	103.8	104.1
Europe	94.7	100.0	106.4	103.5
North America	90.1	100.0	99.1	99.2
:USA	89.8	100.0	97.9	97.2
Other developed countries	107.5	100.0	98.3	91.6
Africa	104.9	100.0	95.8	94.2
: Tanzania	92.3	100.0	94.0	83.2
Kenya	115.4	100.0	105.6	98.8
Uganda	109.5	100.0	98.0	105.4
Latin America	94.0	100.0	100.5	103.1
Asia	94.7	100.0	111.9	120.8
: India	96.5	100.0	109.2	122.4
China	90.1	100.0	122.7	136.4

Source: L.Kiessling et al (1994) "Population, Economic development and the Environment.

Food importation has been the option to many developing countries to supplement domestic food shortage. It is also predicted that many countries in Africa and Asia will go without food due to their too poor and debt-ridden economies to be able to import food (Sen, 1981, 1984; Sen and Dreze 1989).

In general Africa continent is characterized by both high fertility and population growth rate but also decline has set in (Caldwell, 1977). In the Sub-Saharan Africa, high population growth of over 2.5 percent per annum and the related young age structure, whereby almost half of its population are children, makes it difficult for agricultural sector to cope with the rising demand for food (Kamuzora,1994). By 1985, TFR of 20 sub-Saharan countries averaged between 5.8 and 8.5. Large families were (and are still) regarded as desirable (UNFPA, 1994). The population of Africa is suffering very badly from AIDS pandemic, widespread occurrence of poverty, high illiteracy rate, low technology management capacity, high dependency ratio and a very large number of unskilled workforces (Ogendo, 1993).

Food availability is worst for the Sub-Saharan Africa in which many people suffer from chronic malnutrition (UNFPA, 1994). Africa was at its worst situation in 1983 and 1984, when food output per head declined by 0.8 percent and 0.4 percent respectively. The African drought, overall economic crises and rapid population growth accounted for the great number of undernourished people in the continent (FAO, 1987). The population

problem in Africa in relation to food availability is rather rapid growth in relation to the generation and utilization of natural resources (Ogendo, 1993).

Tanzania's population is characterized by high fertility rate and relatively low mortality rate. Although population is growing fast, total fertility rate has been declining from 7.0 in 1978 to 6.1 in 1994 and further to 5.5 in 1996 children per household (NBS, 1991/92; 1996). Previous population censuses (Table 1.3) indicate continuous growing of Tanzania's population from 7.9 million in 1948 to 34 million in 2002. It is further predicted that the population will continue to increase because of its young age structure (NBS, 1998; 2002).

Table 1.3 Tanzania's population growth.

Year	Population size (in million)	Growth rate per year
1948	7.9	1.8
1957	9.6	2.2
1967	12.3	2.7
1978	17.5	3.0
1988	23.1	2.8
2002	34	2.9

Source: National Bureau of Statistics censuses reports (1948-2002)

In contrast to the growth of population, food production has been fluctuating leading to food shortage in Tanzania. Indices of food production per head in Tanzania declined from 100 in 1979-81 to 83.2 in 1990-92 (Kiessling and Landbeg, 1994). This decline has sometimes created acute shortage of food to the extent that FAO (1999) identified Tanzania as one of the 38 countries in the World requiring emergency assistance of

food. As observed by Mchretu (1995), the problem of food shortage in Sub-Saharan Africa is a result of mismatch between population growth and quality of arable land.

Food availability in Tanzania has in general been deteriorating year after year partly due to the growth of population. This situation raises a special concern towards the understanding of food availability at household level in relation to socio-demographic variables for planning purposes. This makes it even more urgent as over 80 percent of Tanzanian's population live an agrarian (own food production) dependent life.

1.1 Statement of the problem

Given own-food production by most Tanzanian, food availability at household level is determined by its ability to produce it. Further acquisition of other non-food items e.g. clothing, building materials, school fees implies production of surplus beyond food requirement.

In many farming societies, the amount of land available to the farmer is of great importance, particularly where the main factors of production are land and labour. While a number of processes determine the size of farm holding, family size is perhaps the single most important factor. Land resource is fixed by supply. Increase in population size may result into farm land size per person in the household becoming too small to the extent of alienating some of the household members from land resources. This may in turn lead to cultivation of marginal land and stiff competition over other limited

resources in the household. Therefore provision of human basic needs such as food, shelter and education are impaired.

African rural economics being based on low capital but labour-intensive techniques, command high demand for labour. The size of the population in a household at age group 15-60 years determines the amount of labour force available for production process. The quality and labor input at any household is normally affected by out-migration as a response to pressure on resources created by household population growth. Consequently, this aggravates labour shortage in some of the households. Shortage of labour can cause lower agricultural production, thus leading to deterioration of household's economics status. On the other hand the amount of remittance from out-migrants to their original rural households depends on the achievement in their area of destination. Thus food availability as a result of remittance is not a guarantee either.

A number of research questions arise as follows:-

- 1: Does out-migration create shortages of labour in the rural economy? If it does, what is the net effect of out-migration on food availability in the rural household?
- 2: To what extent does shortage of land cause food shortage in some households?
What are the people's perceptions on land shortage? Do they desire to migrate? If so where do they desire to go? What is the state of household's economic welfare as a result of the land shortage?
- 3: Is food availability in the household affected by either the size of the household or household composition such as sex, age and education?

1.2 Objective of the Study.

The general objective of this study is to examine the relationship between population Change and food availability at the household level in Ukerewe districts.

The specific objectives include: -

- 1: To investigate whether land shortage contributes to shortage of food and deterioration of household's economic status.
- 2: To examine the extent at which hunger related poverty in the rural household is due to labour shortage attributed by out-migration.
- 3: To examine the relationship between food availability and intra-household demographic characteristics in terms of size and composition in sex, stage of life cycle (eg. Age) and education attainment of the family members

1.3 Significance of the study

Human existence in this world is only possible when there is adequate supply of food. A large quantity of food in the world is derived from ordinary tilling the land. In less developed countries (Tanzania inclusive) famine is the major characteristic, i.e. inability to feed its ever-increasing population. Arable land is also significantly diminishing due to rapid population growth and consequently, rural poverty is widely spreading.

Therefore, the study seeks to show the linkage between population growth and food availability at micro level so as to identify the nature of households which are prone to food shortage and their associated socio-demographic characteristics.

The study will also enable the policy makers, the ministry of agriculture and other stakeholders to understand the nature and status of food availability at the household level. That is, localized population problems and rural poverty in association to food availability so that this can be integrated in the regional and national planning.

1.4 Hypotheses

This study is guided by the following hypotheses: -

1: Food availability at household level is a function of household composition by:-

- (i) Sex and age of the head of household**
- (ii) Sex of the members of household**
- (iii) Education attainment of household members**

2: A rural household which faces shortage of land is likely to face shortage of food.

3: Shortage of food in the rural households is the function of seasonal out-migration which deprives labour from agriculture activities?

4: Remittance contributions by permanent out-migrants improves the welfare of their original rural households.

5: The small sized households are food self-sufficient compared to big sized households.

1.5 Conceptual framework.

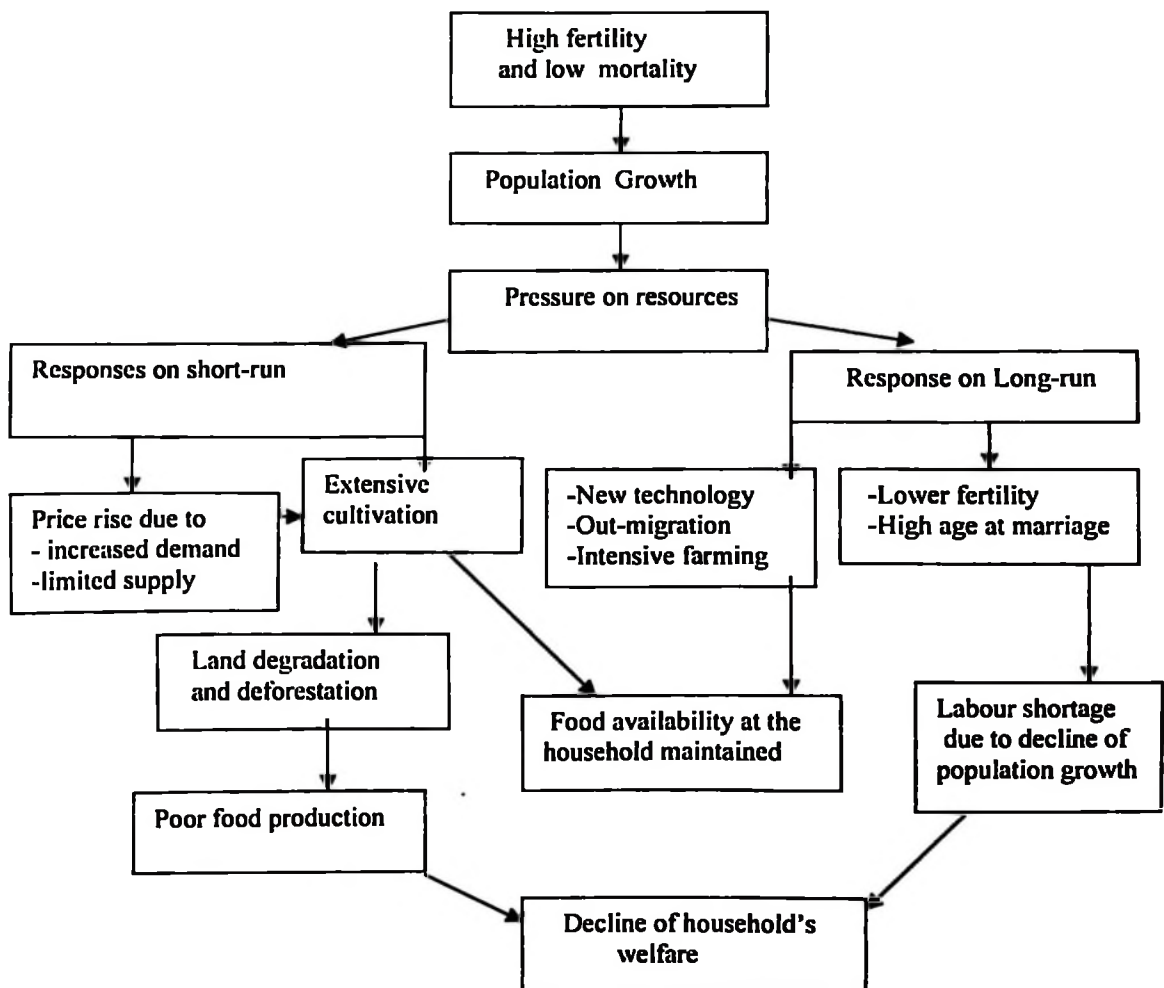
The conceptual framework that was used in this study is illustrated in Figure 1.1. This shows that in the short-run growth of population creates pressure on resources that cause stiff competition on resources. This causes price of food and other necessities to rise due to increases in demand. The easiest alternative available to many rural households for increased production in the short-run is by extensive cultivation. On the other hand excessive clearing of bushes for the expansion of area under cultivation accelerates deforestation and land degradation which then leads to poor food production.

In the long-run, growth of population exerts pressure that creates multiphase responses in demographic and economic variables. These include decline in human fertility, technological innovation, intensive farming, high age at first marriage and out-migration so as to reduce pressure on the resources. The decline in human fertility and high age at marriage creates shortage of labour in the long-run. Food production like any other production depends on labour, short of which, a negative effect is observed.

Population pressure necessitates changes in land use. The long-run effect is observed in the change in land use. It may lead to agricultural intensification or extension of area under cultivation so as to increase food production to meet the growing demand of the increased population. However, a continuous cultivation on the same land over long period may end-up reducing soil fertility. In the other hand, population pressure leads to demand for extra land for farming and other needs such as need for home, fuel, school

water and others . Because land is a limited resource, members of the same family tend to share farm land of what they have on their disposal. Continuous land fragmentation due to household population growth causes shortage of land among family members. In order to survive a man is forced to migrate, abandon some agricultural activities or over-cultivate the same land by applying fertilizers and developing new techniques in all spheres of life, which include farming techniques, food production and processes.

Figure 1.1. The long-run and short-run effect of population growth on food availability.



CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter surveys some theoretical as well as empirical evidence on the relationship between population change and food availability. It is divided into two sections. Section one presents the impact of population change on food availability. Section two identifies factors apart from population that are likely to affect food availability in the community.

2.1 The impact of population change

The main aspects in population change are the size, growth rate and its composition. Increased number of people causes increased demand for food and other essential materials from the resource pool (Repetto and Holmes, 1983). Keyfitz (1991) viewed that too many people may slow down and even prevent development in some areas. This is in line with the argument by Sauvy (1956) that once the welfare of people came to be the main consideration rather than the power and wealth of kings, Malthus 's perspective of population control became inevitable. But according to Ogendo (1993) the population effect on resources depends on the level of development, resources available, level of technology and the size of population in a particular society.

The impact exerted by growth of population in developing countries is a bit complex . It is viewed in three different perspectives. One group of scholars associates it with the factors that intensify the problem of arable land shortage, and hence threatening food availability (Sadik, 1989; Igun, 1972). In contrast to this, scholars such as Boserup (1965), Clackc (1977), Simon (1981), Hirschman (1958) and Todaro (1992) view agricultural production, particularly food production crises as arising largely because of growing production pressure on land resources relative to low level of technology. Thus, the net result is a continuous deterioration of land productivity overtime. The scholars are convinced that population pressure create innovative ideas to stimulate land use changes. In the other hand, scholar such as Dyson (1994) identified institutional ineffectiveness rather than population growth as one serious cause of the problem in agricultural production in sub-Saharan Africa. Thus, a link between population growth and poor production in developing countries is not yet clear.

Malthus (1798) and many other pessimists like Sauvy (1956), Sir Walter (1652) considered land as a fixed resource that cannot be increased and agriculture as a unique form of production. As per Malthus' and classical economists' perspective, successive additions of labour from growing population on fixed land resources would eventually experience diminishing returns. The basic economic theory of production as developed by classical economists school of thought (John ,1965; Ferguson,1969; Robinson, 1953; Rosalind and Rebman, 1982) asserts output being a function of land (L), labour (B), and

capital (K), ($O = f(K, L, B)$). Technology as the fourth factor of production is embodied in both labour and capital equipments.

Since labour is involved in any production process, there is therefore a connection between population and production of food. The population size of age group 15-60 years in a society determines the availability of labour force for any production process. The Neo-Classical economists, Lewis (1954) and Fei and Ranis (1961) suggest the existence of surplus labour in peasant economies meaning zero marginal return to labour. In contrast to the Neo-Classical economists, extensive review of micro-level farm research across Africa before 1950 by Cleave (1974) reveal that Africa smallholder agriculture face severe labour shortage. Similar findings were observed by Friedrich (1968) and Rald (1975). The study by Kamuzora (1980) and later Kamuzora and Gwalema (1998) identified labour shortage in the contemporary Africa rural economy as due to the tolls of AIDS epidemic, complexity of gender inequality connected to woman's heavy workload and the declining labour contribution from children. Furthermore, labour shortage is accelerated by fertility decline, which is now a worldwide problem. In sub-Saharan Africa fertility decline is recorded in almost all Demographic and Health Surveys, notably in Botswana (BCSO, 1988) Zimbabwe (ZCSO, 1984; 1988), and Tanzania (NBS, 1991/92; 1996) and Caldwell et al. (1992) in Nigeria.

In the absence of technological development in the Africa's agricultural sector, population is the primary resource. Population problem in Africa is rather rapid population growth in relation to the generation and utilization of the available natural resources (Ogendo, 1993). The dominance of subsistence agriculture in rural areas of Tanzania, and in many other developing countries encourages high reproduction to meet the ever-growing labour demand. Large family as an important factor for increased production of food surplus (Malcom, 1953) is the focus of this study.

In the intensive agriculture system, the growth of rural population growth doesn't lead to labour surplus and push-migration to urban area. Intensive agriculture has higher labour demands than more primitive low technology system (Boserup, 1990, p.14-18). In Sub-Saharan Africa the rural-urban migration is promoted by food import, and food import is promoted by rural-urban migration, in a vicious circle (Boserup, 1981, p.206). According to UNFPA (1994) the rural-urban migration has been a factor for disappointing performance of sub-Saharan agriculture. In the other hand, the study conducted by Caldwell (1968) in Ghana observed that most rural-urban migrants retain or reform strong link with the village of their origin. To some extent permanent migrants were regarded as members of the household. It was further observed that the rural-urban migrant raise the economic level of the rural household that produce them by remittance and purchase of goods. Ehrlich (1970) asserted that the ability of farmer to feed more than his own family was a prerequisite for urbanization. Thus a fraction of population had to be freed from cultivation of the land. He further put rapid rural-urban migration in Africa as due to the migrant in search of better life. The effect of rural-urban migration

on the economic welfare of the rural household is still vague; therefore, this is a motivation for further inquiries of the subject matter.

Boserup (1965) theory of population growth and technological change has successfully been used to explain agricultural change in different societies. The theory based on historical Europe, applied to understand patterns of development in contemporary developing countries. According to her sub-Saharan Africa is a sparsely populated continent relative to other world regions, as a result, subsistence agriculture and low technology, long fallow systems are predominant in the region. Boserup proposes that a growing population can use land more frequently and increase output by substituting technological input such as fertilizer or irrigation for fallow to retain soil fertility. She developed six different food systems resulting from increase in technological levels and their associated population density (Table 2.1)

Table 2.1 Boserup: Agricultural Systems and Population Density

System	Descriptions	Population Density (person/km ²)
1. Gathering/ Pastoralism	Wild plant and fruits gathering/ possibly domestic animal	0-4
2. Forest -fallow	1 or 2 crops followed by 15-25 years fallow	0-4
3. Bush-fallow	2 or more crops followed by 8-10 years fallow	4-16
4. Short-fallow	1 to 2 crops followed by 1 to 2 years fallow	16-64
5. Annual cropping	1 crop each year with few months fallows	64-256
6. Multi-cropping	2 or more crop in the same field with no fallow	> 256

Source: Boserup, 1981, Table 3.2, p.19 and Table 3.7, p.23

Davis (1963) asserted that population growth cause population pressure; in turn respond by reducing resource demand through a combined response including declines in fertility, marriage and out-migration. In Boserupian (1965) view, population responds economically to resource pressure through change in agricultural technology and ultimately increases food supply. Bilsborrow (1979) further noted that, the more one response is to occur the less likely the others, because are then reduced, stimulus mollified. Bilsborrow cited densely populated area around Kano, Nigeria where population growth resulted into agricultural intensification, change in land tenure and social relation, decline in average farm size, change in crop grown, had insignificant impact in fertility and marriage decline. The empirical study by Kivulia (1997) discovered the dramatic rise in population in Arumeru, (Tanzania) led to intensification of agriculture. A similar study by Ruthenberg (1968) in Ukara island, Ukerewe district which has experienced a long history of land shortage the population exhibited agricultural intensification as a response due to population pressure brought about by growth of population. Regardless of the level of agricultural intensification that may differ across societies and households due to demographic differentials the extent of food availability at the household level is of paramount importance.

Newman and Matzke (1984) summarized the possible outcomes of population growth by a disaster- development scenario which incorporated both Malthus' and Boserups' ideas. They argued that, population increase can either disrupt the man-land support system or

intensify it. If the system gets disrupted, the consequence is environmental deterioration that leads to subsistence deterioration and demographic depression. If the system is intensified, there is resources enhancement leading to increased productivity and demographic moderation. In either case, the direction is towards the attainment of a balance between population and the available resources. It is generally accepted that pressure on land resource increase overtime with the growth of population (Blaike and Brookfield; 1987, WCED: 1987, UNFPA; 1991). Sadik (1989) has remarked on rapid population growth as a cause to inappropriate farming practices that lead to impoverished and eroded soil; reduced vegetation; over-used and improper use of agrochemicals; and frustrated water resources management. The result of such practices is severe land degradation. This motivates to assess the magnitude of land shortage problems in relation to food availability in the households

Population growth in number and increased density on fixed land causes not only population pressure but also land fragmentation (Sadik,1989), later on causing land shortage to the extent of cultivating marginal land (Larsen, 2003; FAO,1996) and rural-urban migration (Bilsborrow, 1979). According to Sadik (1989), land fragmentation affects food production and is a direct result of rapid population growth in many poor countries. Often landholdings are too small to support tolerable livelihood and are turned into part-time farm with some household members, usually the women and children stay at home to attend crop production while others, often the men migrate elsewhere in

search for wage employment. Thus, the issues whether out-migration and sex of members of household influence food availability are of interest in this study.

Tanzania, like other developing countries has been experiencing a rapid population growth since 1950's. However, it shows that the growth of population has caused considerable pressure on the land resources although there is a positive change in farming practices, from shifting cultivation to settled agriculture (Rugumamu and Kishimba, 1993). Bilborrow (1992) also observed a decline in the size of agricultural land in association to intensification process. A study by Mbonile (2000) on food security in Arumeru district noted that population increase result into man-land pressure and therefore the imbalance between man and land resources caused by over-population. Studies by Maro (1974) and Mallya (1996) show that use of intensification and diversification as the key alternatives to population pressure. A study by Ruthenberg (1968) on the impact of land shortage on husbandry practice in Ukara island, Ukerewe district (Tanzania) observed that a share of 98.6 percent of the area was used for agriculture and 1.4 of the area was unproductive (rocky, hill, sandy river-course, settlement areas). The average number of persons per holding was 10.9. Due to the increasing land shortage in the island resulting from high population density, the Wakara devoted to land-conserving method. The practices include: intensification of agriculture system ranged from cultivation in steeply sloping pediments, use of manure, soil erosion control, crop rotation, and river-course irrigation farming system. This has raised special concerns on the implication of continuing rapid population growth in Ukerewe islands on the scarce natural resources and a stable source of food availability in the households.

2.2 Food availability

Ehrlich (1970.a) observed that apart from cultivation of land, food supply can be achieved from the sea/lake by culturing single-celled organisms on petroleum or other substrates, which result into protein-rich material. Pimentel et al. (1994) argued that more than 99 percent of the food available in the world is derived from land cultivation. The continued production of adequate food supply is directly dependent on ample fertile land, water, energy, and the maintenance of biodiversity. As human population grows, the requirement for these resources also grows.

For any household the availability of food depends on several variables such as food production, feeding habits, food wastage, land relation, food price, food supply in the market and others (Alamgir and Arora, 1991). Kiessling and Landberg (1994) proclaimed that peasants and farmers produce food not to demonstrate how much can be grown, but to make economic use of it, that is, to sell, to eat and for exchange. Also the actual production of food and its disposal depend on the demand and profitable opportunities of selling it. This study seeks to assess the impact of household demographic variables on food availability rather than the economic and social motives

The negative policies that have been imposed on Africa countries under the guise of structural adjustments is a factor to consider in the understanding how populations are handling resources in the continent (Ogendo, 1993). Historical research has pointed out that the failure of growth of production in the sub-Saharan Africa is due to the effect of

colonial policies aimed at preventing the threat to European Agriculture from enterprising Africa peasant farmers (Walter, 1982).

Pimentel et al (1996) argued that the shortage of fertile cropland combined with the decreasing land productivity is, in part, the cause of current food shortage and associated human malnutrition. Sadik (1989) proclaimed that in the developing countries, the attempt to increase food production and consumption are undermined by the unequal land distribution, shrinking landholdings, deepening rural poverty, and widespread land degradation. Also Ehrlich (1970.a) attributed the shortage of capital, demand, resources and trained technician to the problem of poor food production in the developing countries. According to UNFPA (1994), a combination of recurrent drought and famine coupled with widespread environmental degradation exacerbated by diminished government attention toward agriculture has pauperized million of farmers in Africa, forcing them off their farm land.

Repetto et al (1989) noted the successful story of Green Revolution in Asia whereby food had managed to keep slightly ahead of population growth, largely because of new breeds of Asian rice and the use of tremendous amount of agricultural chemical. However, Brown (1987), UNFPA (1991) and ILO (1993) observe that excessive use or inappropriate use of agro-technologies has adverse impact on land resource for future generation albeit enhancing production for the present. The UN (1993:3) reports the slow agricultural change in terms of technology, misuse of input such as fertilizer and

pesticides, poor health of peasants and declining of per capita arable land from 0.5 in 1980 to 0.3 in 1987 as the major factors that account for poor food production.

Various Government policies have also been responsible for aggravated land degradation in the situation of population pressure. For instance, subsidization of inputs such as fertilizers, chemicals, etc as incentive ways of increasing food production result to over use leading to Salinization, pollution of soils and the formation of hard pans (UN, 1993.a). The aftermath is poor food production and the widespread rural poverty.

Although the world food problem has always existed, its magnitude has increased partly due to population growth. The extent by which changes in household demographic characteristics affect/influence food availability is the central concern of this study. Much of the surveyed literature have concentrated on showing this relationship only at macro level. In the case of Africa, the relationship between population change and food availability is still vague. Population growth may influence technological advancement as a positive response or cause depletion of resources. The labour shortage in the rural economy jointly with rapid population increase, out-migration and structural obstacle such as imposed negative economic policies and institutional ineffectiveness are seen as the leading obstacles to food availability in the sub-Saharan Africa.

CHAPTER THREE

METHODOLOGY

3.0 The Study Area.

The study area is Ukerewe district, one of the most highly densely populated areas of Tanzania. It is one of the eight districts in Mwanza region. It consists of ten islands found in the Lake Victoria, namely Ukerewe, Ukara, Kwercu, Sizu and Iruḅgwa islands. Others include Iyamwenge, Maremera, Bwiru, Nafub'ha and Kamasi Island. Ukerewe is the largest of them followed by Ukara. The other islands account only for a small proportion of the total area of the district. The district have four divisions which are; Ilangara, Mumbuga, ⁱⁿ ~~Mujambo~~ and Ukara. There are twenty four wards with a total of 74 villages.

In the 1967-Population Census, Ukerewe district with a total of 640 sq. kms area had a total population of 109,242 persons with a growing rate of 2.2 percent and 170.7 persons per sq. km. The size of the population in the district has never been static as shown in 1978, 1988 and 2002 population censuses. In 2002 Population census, Ukerewe population rose to a total of 261,944 persons with annual average growth rate of 3.0 percent and a population density of 409 persons per sq. km (NBS 2003).

The district receives adequate rainfall of about 1200 mm per annum. The soil is of a sandy type limiting arable land to a large extent. A total of 69 percent of the population

is engaged in agricultural activities, 12 percent is employed in business, while fishing employs 6 percent of the population. Salaried jobs employ only 7.5 percent of the population, and small proportion of about 2.6 percent earns its living through elementary work (NBS, 2002)

3.1 Selection of the Targeted Population

The study focuses on the availability of food in rural households in Ukerewe district in relation to household's socio-economic and demographic variables with multilevel approach. Two levels of the study units organised hierarchically were identified. Level one study units included the households which were found to be grouped within the islands as the second higher level units. A total of 151 households as the first level units were selected from two islands, of which, 101 households were from Ukerewe island and 50 households from Ukara island.

3.2 Study Instruments

Detailed questionnaire was used to gather information and data on both demographic and socio-economic variables required from each selected household. The questions included open and closed- ended questions so as to capture sufficient information. The questionnaire had four parts; particulars of the respondent, household demographic characteristics, household's economic status and migration status of the family members. The questionnaire was written in English language and the interviewer had to

translate it into either Kiswahili or Kerewe languages during the interview. This was because most of the respondents understood only Kikerewe and very few respondents were conversant with the Kiswahili language. The questionnaire is appended as Appendix 3.

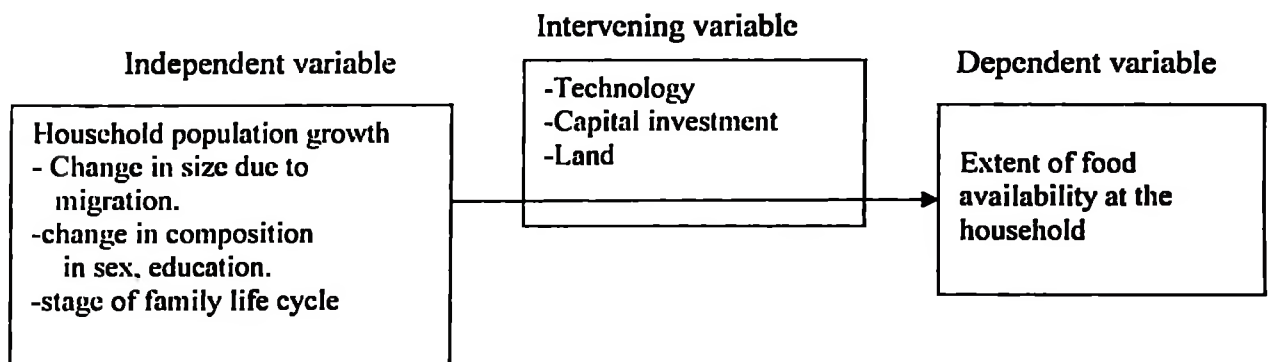
3.3 Sample Selection

The focus of analysis in this study is the households and its members. The sampling strategies employed in this study were the geographical and administrative-multistage cluster design. The sampling design had an advantage of ensuring informative sampling frame so as to reduce sampling variance. Geographically, two cluster areas of sample survey of Ukerewe and Ukara islands were identified. From a list of twenty four wards in both islands, three wards were selected. These islands were chosen because they were easily accessible. In the second stage, one village was selected randomly from each of the selected wards. Since the Ten-cell leaders no longer exist at the village level a list of Hamlet Executive Officers were used to select randomly a sample of two. All households under the selected Hamlet Executive Officer had equal chance to be the study units. Data of interest were selected from the various households. The data collected were household head sex, age, marital status, number and sex of children, education level attained, permanent migrants and seasonal migrants by sex, land acreage, type of crops grown, quality of housing, availability and quality of toilet, type – quality and availability of water including distance from source and possession of various assets.

3.4 Method of Data Collection.

Data for household's demographic characteristics, farming methods, migration and household economic profile were collected through questionnaire interviews. In addition, a participant observation to study the household's economic status such as the quality of the housing and toilet were given due consideration. The motive behind was to physically see the elements of economic welfare so as to avoid any misinformation from the respondents about the welfare of their households.

3.5 Study Variables



3.6 Measurement of the study Variables

Food production level doesn't necessarily signify the extent of food availability at the household level but depends on the extent at which the household relies on this production. In the market-integrated societies like ours, cash income available can be

used to purchase food available in the market. Therefore, measurement of the extent of food availability at household level is a complex phenomenon. In order to trace the history of the extent of food availability at household level, this study employed poverty indicator variables as the proximate determinants. Through history, a poor household is likely to have encountered shortage of food frequently as compared to less poor and rich household. Poverty is the root cause of chronic hunger, whenever poverty decreases, hunger also decreases.

3.6.1 Construction of Poverty Index

The Principal Component Analysis (PCA) was used to construct possession index that would allow determination of the poverty status of the rural household. The first principal component, the linear combination capturing the greater variation among the set of variables were converted into factor scores, which served as weights for the creation of marginality index of each household. The result of principal component is appended as Appendix 2.

The poverty index is based on the formula (Filmer and Pritchett, 1998):

$$A_j = \sum_{i=1}^n F_i \{ (a_{ji} - a_i) / s_i \}$$

Whereby

F_i is the factor score for asset i , a_{ji} is the j^{th} cluster island's value for the asset i , and a_i and s_i the mean and standard deviation of asset i variable over the two island.

To avoid subjectivity the cluster analysis techniques as described by Johnson, T and Wichern, D.W (1992) were employed to create three categories of poverty status based on the marginality index scored by each household. These categories were; extremely poor, poor and less poor which were then used as response variables in this study. However, the extremely poor live in low quality dwelling, lack of access to clean and safe water, open pit latrine or no toilet, small farm size, lack of radio, bicycle, canoes and boat engine. The less poor live in improved housing such as cemented floor and wall, house roof built by corrugated iron sheet, and capital accumulation such as possession of boat engine, bicycle, canoes and others were commonly observed.

3.7 Data Processing and Analysis

For the purpose of multilevel analysis the households were classified according to their geographical location which resulted into two clusters of islands. The first cluster constituted all sampled households in Ukerewe island, while those from Ukara formed the second cluster. Data analysis consisted of the descriptive part and analytical one. The statistical package and software (SPSS) was used for descriptive analysis, while MLwiN was used for the analytical analysis.

3.8 Multivariate Analysis

Multilevel multinomial cumulative logistic regression was used. The household poverty level was regarded as a response variable and had 3-categories or outcomes. The independent variables were household family size (fsize), number of persons in a household attained a secondary or post-secondary education (nsecondr), number of persons in a household not attended any formal education (nschnoat), number of seasonal migrants (nscasmg), number of permanent migrants in a household (npermg), age categories of the household head (young, middle or old age category), size of farm land owned by the household (szland), household head sex categories (male, female and male without a wife) and household sex ratio(hhsexrat) . Two population levels were identified in the study. Level one were the households and level two were the geographical surveyed areas.

The multilevel modelling approach was considered convenient to understand where and how effects were occurring at each level of study units. It also provides better parameter estimates due to recognition of the existence of variation at each level of study units (Goldstein H., 1995; 1987, 1-28).

The cumulative logistic regression was taken into account due to the fact that the dependent variable is an ordered polytomous response variable with three categories, which is whether or not a household is, classified as extremely poor, poor or less poor. The odds ratio $\{\exp(B_i)\}$ are used as indicators to quantify the effect of significant

independent variable on the dependent variable, when all other factors included in a model are held constant.

A two level random intercept model with a response variable ordered in three categories indexed by “S” whereby the third category is chosen as the reference category can be specified as:

$$\text{Logit}(\gamma_{ij}^{(s)}) = \alpha^{(s)} + (XB)_{ij} + Z_{ij}U_j; \quad i=1,2,3 \dots\dots 151, \quad j = 1,2 \quad s= 1,2$$

The model is based upon cumulative response probabilities (γ_{ij}) rather than the response probabilities (Π_{ij}) for each response category such that:-

$$E(y_{ij}^{(s)}) = \gamma_{ij}^{(s)} = \sum_{h=1}^s \Pi_{ij}^{(h)}$$

$$\Pi_{ij}^{(h)} = \gamma_{ij}^{(h)} - \gamma_{ij}^{(h-1)}; \quad 1 < h < 3$$

$$\Pi_{ij}^{(1)} = \gamma_{ij}^{(1)}; \quad \gamma_{ij}^{(3)} = 1$$

The model has the underlying assumption of multinomial distribution for the category probabilities. For two categories “r” and “s”, the covariance matrix of the observed cumulative proportion is given by

$$\text{Cov}(y_{ij}^{(s)}, y_{ij}^{(r)}) = \gamma_{ij}^{(s)} (1 - \gamma_{ij}^{(r)}) / n_{ij}, \quad s \leq r, \quad E(y_{ij}^{(s)}) = \gamma_{ij}^{(s)}$$

Whereby;

γ_{ij} represents the cumulative probability of i^{th} household from j^{th} island

to fall in any of the S-response categories.

$y_{ij}^{(s)}$ is the observed cumulative proportion for the i^{th} household from j^{th} island.

Π_{ij} represents the probability of i^{th} household from j^{th} island to fall in any of the S-response categories.

X_{ij} is a set independent variables.

U_j is islands-level explanatory variable.

α , B_{ij} and Z_{ij} are parameters to be estimated.

The model was fitted by using MLwiN statistical package. The non linear regression estimates were computed by running the first order marginal quasi-likelihood estimation techniques.

To check for multicollinearity, the correlation matrix of the independent variables was computed. This showed that the variables were not highly correlated with each other—certainly not enough to cause any biasness in the coefficients.

Significance testing used advanced statistics testing procedures. These were Bayesian deviance information criterion (DIC) and likelihood ratio statistic for the significance of the model fitted. The Wald test statistic was used for univariate significance of the parameter estimates. The results of the analysis are presented in the next chapters.

The type of toilet used widely in the area was the pit latrine with grass thatched wall. A peculiar situation was discovered in Ukerewe Island in which 10.9 percent of the households had no toilets, attended their natural calls in the bush.

The quality of water source considered in this study was drinking water. There was no cluster of island that was served with piped water. In both clusters water was said to be adequate, but unsafe for domestic use. This was revealed by the proportion of the households found to use unprotected well and spring water, river and lake. This finding included 78.2 percent and 48 percent for both Ukerewe and Ukara islands respectively. Further more, it was noted that a long walk distance to reach the water source was a common feature in both islands.

4.1.4 Economic profile: Ownership of durable assets

Table 4.3 provide a detailed description of assets ownership by cluster of islands. Throughout the survey, ownership records for motorcycle, car, plough, music system, refrigerator and mini-generator had negative response. Very few households owned television and this accounted for only 2.9 percent in Ukerewe island. However, the owners weren't using them because of lack of electricity.

4.1.3 Economic profiles: Quality of housing, toilet and water sources

Table 4.2 below shows that for both island, house built of mud wall were more common as compared to cement, burned bricks walls. This actually reflects the typical housing condition of the poor rural areas in Tanzania (NBS 2002). Both Ukara and Ukerewe clusters had large percentage of 80.2 and 72.0 of houses with mud floor respectively.

Table 4.2 Housing condition, toilet and water sources

	Ukerewe Island		Ukara Island	
	%	sample size	%	sample size
Quality of wall				
Mud wall	86.1	(87)	84	(42)
Cement/ burned bricks	13.9	(14)	16	(8)
Total	100	(101)	100	(50)
Quality of floor				
Mud floor	80.2	(81)	72	(36)
Cement floor	19.8	(20)	28	(14)
Total	100	(101)	100	(50)
Quality of roof				
Thatched grasses	42.6	(43)	44	(22)
Corrugated iron-sheet	57.4	(58)	56	(28)
Total	100	(101)	100	(50)
Quality of toilet				
Pit latrine grasses thatched wall	78.2	(79)	80	(40)
Pit latrine bricks built wall	10.9	(11)	20	(10)
Bushes	10.9	(11)	0	(0)
Total	100	(101)	100	(50)
Quality of water sources				
Unprotected water sources eg lake, river well	78.2	(79)	48	(24)
Protected water sources	21.8	(22)	52	(26)
Total	100	(101)	100	(50)

There was no flush toilet found in the area. The type of toilet used widely in the area was the pit latrine with grass thatched wall. A peculiar situation was discovered in

4.1.2 Sex and Age distributions

Figure 4.1 shows that the total population by age distribution for both Ukara and Ukerewe Islands revealed the young age structure type of population. In both islands, large percentage of population was found to be clustered around the age group 0-15 followed by 16 – 36 years of age.

Figure 4.1 Total population by age distribution in the islands

Age group	Ukerewe Island	Ukara Island
0- 15 years	413 (52.1%)	161 (44.9%)
16- 35 years	248 (31.3%)	127 (35.4%)
36 – 55 years	91 (11.5%)	44 (12.1%)
56 –80 years	41 (5.2%)	28 (7.6 %)
Total population size	793	360

Of the total population found in Ukerewe island 51.1 percent were male and 48.9 percent were female. In Ukara island the male population was 53.6 percent as compared to 46.4 percentage of female population. Further analysis revealed that 8.9 percent of households in Ukerewe island were female headed (single parent) whereas male headed households without a female accounted for 5 percent of the entire households in the island. In this case Ukara island had 10 percent of households headed by female and 6 percent headed by male without a female (single parent).

CHAPTER FOUR

EMPIRICAL FINDINGS AND DISCUSSION

4.0 Introduction

This chapter presents and discusses empirical results of the study. The presentation and discussion is centered on the household socio-demographic characteristics and their impact on food availability. The 2-level random intercept model with 3-ordered categorical response variables (i.e. food availability) was used in the estimation of coefficient of effects of the independent variables (i.e. socio-demographic variables). Various hypotheses advanced in chapter one were also tested in this chapter.

4.1 Characteristics of the Sample.

4.1.1 Size and Dependency ratio

The analysis employed 151 households which were clustered into two geographical areas of enumeration (i.e., level 2- units) of Ukara and Ukerewe islands. The total population sizes found in the study areas migrants were 793 and 360 persons for Ukerewe and Ukara islands respectively. The average number of persons per household was 7 and 8 persons at Ukara and Ukerewe island respectively. The overall age dependency ratio was 96.4% that is; one person in the labour force roughly supports one dependant.

Table 4.3 Ownership of durable asset

Island	Radio	TV	Sewing machine	Canoes	Boat Engine	Bicycle	Fishnet	shop	Total (%) (sample)
Ukerewe	74.2% (75)	2.9% (3)	13.86% (14)	17.82% (18)	1.9% (2)	73% (73)	40.6% (41)	11.9% (12)	100 (101)
Ukara	66% (33)	0% (0)	12% (6)	32% (16)	6% (3)	52% (26)	32% (16)	4% (2)	100 (50)
Total	71.5% (108)	1.9% (3)	13.2% (20)	22.5% (34)	3.31% (5)	63.6% (96)	37.7% (57)	9.3% (14)	100 (151)

4.1.5 Household members' education level

The table 4.4 below shows the education level attainment by age of household members. Ukara Island recorded the worst situation in illiteracy cases of about 77.8 and 20.2 percent within age the group 56-80 and 6-15 years of age respectively. On the other hand, Ukerewe island registered 54.3 and 17.7 percent illiteracy cases for 56-80 and 6-15 age groups respectively.

Table 4.4 Education level attainment by age distribution of household

Category =1 Ukerewe Island

Education level	Age group of family members								Row Total % sample	
	0-5yrs		6-15yrs		16-55yrs		56-80yrs			
	%	sample	%	sample	%	sample	%	sample	%	sample
Not attended	97	(194)	17.7	(39)	17.96	(83)	54.3	(25)	36.7	(341)
Not completed/cont. primary	3	(6)	71.8	(158)	16.7	(77)	8.6	(4)	26.4	(245)
Completed primary education	0.0	(0)	10.48	(22)	56.06	(259)	32.6	(15)	31.8	(296)
Secondary education	0.0	(0)	0.004	(1)	9.3	(43)	4.34	(2)	4.9	(46)
Column Total	21.6	(200)	23.7	(220)	49.8	(462)	4.9	(46)	100	(928)

Category =2 Ukara Island

Education level	Age group of family members								Row Total	
	0-5yrs		6-15yrs		16-55yrs		56-80yrs			
	%	sample	%	sample	%	sample	%	sample	%	sample
Not attended	90.2	(46)	20.2	(23)	9.72	(21)	77.8	(21)	27.3	(111)
Not completed/ cont. primary	9.8	(5)	66.6	(76)	7.8	(17)	0.0	(0)	24.	(98)
Completed primary education	0.0	(0)	9.6	(11)	67.1	(145)	22.2	(6)	39.7	(162)
Secondary education	0.0	(0)	3.5	(4)	15.3	(33)	0.0	(0)	9.1	(37)
Column Total	12.5	(51)	27.9	(114)	52.9	(216)	6.6	(27)	100	(408)

Education level by sex (Table 4.5), shows that Ukerewe island had 64.3 percent of female who hadn't attended formal education as compared to 45.7 percent of male. The same trend was noted for the secondary and post-secondary education whereby female accounted for only 39.1 percent as compared to 60.8 percent male. In Ukara island only 35.13 percent of female were found to have enrolled or attained secondary and post-secondary education as compared to 64.86 percent of male. This is in line with Omary (1994) and Quisumbing (1996) who observed that in Tanzania and across Sub-Saharan Africa women have less access to education, credit, farm input, and labour than men do. The reason behind for this gender imbalance in education system was explained by Rothschild (1980). According to him this was due to the high incidence of poverty.

Table 4.5 Education level attainment by sex of household members

Category =1 Ukerewe Island

Education level attained	Sex of family members				Row Total	
	Male		Female			
	%	sample	%	sample	%	sample
Not attended	45.7	(156)	64.3	(185)	36.7	(341)
Attended/ not completed	47.7	(117)	52.2	(128)	26.4	(245)
Completed primary school	51.6	(153)	48.3	(143)	31.8	(296)
Secondary education	60.8	(28)	39.1	(18)	4.9	(46)
Column Total	50.9	(454)	49.1	(474)	100	(928)

Category =2 Ukara Island

Education level attained	Sex of family members				Row Total	
	Male %	sample	Female %	sample	%	sample
Not attended	54.05	(60)	45.9	(51)	27.2	(111)
Attended/ not completed	47.9	(47)	52.04	(51)	24.0	(98)
Completed primary school	49.4	(80)	50.6	(82)	40.0	(162)
Secondary education	64.86	(24)	35.13	(13)	8.9	(37)
Column Total	54.2	(221)	45.83	(187)	100	(408)

4.1.6 Household farm land Acquisitions

The average sizes of land inherited ranged from 1.2 hectares in Ukerewe to 1.5 hectares in Ukara. Table 4.6 below shows that land acquisition by inheritance was predominant in both islands. That is, 74.3 and 85.1 for Ukerewe and Ukara islands respectively. Due to scarcity of farm land, commercialization of land was emerging business in Ukara island whereby farm land acquired by purchase was 53.2 percent as compared to 7.9 percent in Ukerewe island.

While land acquisition by purchase in Ukara island differed significantly ($p < 0.05$) depending on the age of the household head; land acquisition by rent, inheritance, government allocation or by being given by a friend did not. In Ukerewe Island the age of household head was found to have no significant effect ($p > 0.05$) on any of the forms of land acquisition.

Table 4.6 Percentage distribution of modes of land acquisition by the Age

Category = 1 Ukerewe island

Responses on land Acquisition		Age of the household head			Row total % sample		(X ²) p-values	Spearman correlation
		16-35yrs	36-55yrs	56-80yrs				
Purchase	YES	25	37.5	37.5	7.9	8	0.773	0.06
	NO	30.1	44.1	25.8	92.1	93		
Rent	YES	30.7	53.8	15.4	25.8	26	0.279	-0.096
	NO	29.3	40	30.7	74.3	75		
Inheritance	YES	32	44	24	74.3	75	0.511	-0.114
	NO	23.1	42.3	34.6	25.7	26		
Government reallocation	YES	25	40	35	48.2	49	0.304	0.139
	NO	46.5	65.1	30.2	51.8	51		
Given by friend/relative	YES	50	50	0	4.8	5	0.421	-0.127
	NO	13.8	52.5	33.7	95.2	96		

Category= 2 Ukara island

Responses on land Acquisition		Age of the household head			Row total % sample		(X ²) p-values	Spearman correlation
		16-35yrs	36-55yrs	56-80yrs				
Purchase	YES	4	60	36	53.2	(25)	0.004	0.366
	NO	45.4	31.8	22.7	46.8	(22)		
Rent	YES	0	50	50	8.5	(4)	0.442	0.182
	NO	25.6	46.5	27.9	91.4	(43)		
Inheritance	YES	22.5	47.5	30	85.1	(40)	0.744	0.113
	NO	28.5	50	33.3	17.5	(7)		
Government reallocation	YES	0	100	0	2.3	(1)	0.573	-0.012
	NO	0	68.3	31.7	97.6	(41)		
Given by friend/relative	YES	0	0	0	0	(0)	-	-
	NO	23.9	47.8	28.3	100	(46)		

4.1.7 Household land shortage problems and solutions

Due to the fact that 99 percent of the food available in the world is derived from farm land cultivation (Pimentel et al, 1994), farm land availability and accessibility by peasants of rural households is of great importance. The findings show that, the average size of cultivatable farmland per household in the district was declining. It was found to be varying between 2.6 hectares in Ukerewe and 2.9 hectares in Ukara island per household. As noted by Ruthenberg (1968) farmland size owned by the household in Ukara island was 4.2 hectares which is higher than that observed in this study because of the dynamics of time. From Table 4.7 the p-value of 0.869 suggests that there is no statistical evidence of association between the size of the farm land and the household poverty level at 0.05 percent level.

Table 4.7 Household poverty level by size of farm land

Size of farm land	Poverty level of households					
	Less poor		Poor		Extremely poor	
	%	sample	%	sample	%	sample
No land	0	(0)	25	(1)	75	(3)
Less than 1.5 hectares	9.1	(2)	22.7	(5)	68.2	(15)
1.5hectare-3.5 hectares	15.1	(14)	18.3	(17)	66.7	(62)
More than 3.5 hectares	12.5	(4)	28.1	(9)	59.5	(19)
Column Totals	13.2	(20)	21.2	(32)	65.6	(99)

p-value=0.869 Spearman correlation coefficient= 0.067

As to whether the household had enough farmland for agricultural activities, Ukerewe island registered the highest figure of 72.3 percent shortage while Ukara island recorded 44 percent.

As shown in Table 4.8, it was found that in Ukerewe island the age of the head of the household had a significant effect ($p < 0.01$) on the response to agriculture intensification with correlation coefficient, $r = 0.321$. Further more, it was negatively correlated with $r = -0.284$, and significant at $p < 0.02$ with the response on the household diversified economy as a solution to land shortage. Moreover, in the case of Ukara island the results show that there was no statistical significant effect of the age of the household head to any form of solution to the land shortage.

Table 4.8 Percentage distribution of solution to the land shortage in the District by age of the household heads

Category =1 Ukerewe Island

Responses on solution to land shortage	Age group of the household head			Row percentage % sample	(X ²) p-value	Spearman correlation (r)
	16-35yrs	36-55yrs	56-80yrs			
Agriculture Intensification						
YES	19.3	45.2	35.5	61.3 (62)	0.001	0.321
NO	46.2	41.0	12.8	38.6 (39)		
Encouraged out-migration						
YES	34.7	40.8	24.5	48.5 (49)	0.769	-0.015
NO	25	46.1	28.9	51.5 (52)		
Diversified economies						
YES	56.2	31.2	12.5	15.9 (16)	0.014	-0.284
NO	21	39	25	84.1 (85)		
Land redistribution						
YES	100	0	0	0.09 (1)	0.294	-0.130
NO	29	44	27	99.01 (100)		

Category =2 Ukara Island

Responses on solution to land shortage	Age group of the household head			Row Total % sample	(X ²) p-value	Spearman correlation (r)
	16-35yrs	36-55yrs	56-80yrs			
Agriculture Intensification						
YES	17.9	46.4	35.7	59.6 (28)	0.421	0.191
NO	31.6	47.4	21.0	40.4 (19)		
Encouraged out-migration						
YES	28	50	22	38.3 (18)	0.431	-0.188
NO	20.7	44.8	34.5	61.7 (29)		
Diversified economies						
YES	20	53.3	26.7	31.9 (15)	0.826	0.000
NO	25	43.8	31.5	68.1 (32)		
Land redistribution						
NO	23.9	45.6	30.4	97.88 (46)		

4.1.8 Household economic activities.

Nine economic activities were identified in the study area. Crop farming was found to be the over all leading economic activity whereby an overall 98.67 percent of the households depended upon it. Livestock keeping was next with 78 percent of the households. Fishing activities ranked the third with 70 percent, whereas small business activities recorded only 34.4 percent. Other economic activities such as masonry, tailoring, traditional healing, gardening and civil service, each employed small percentage of less than 6 percent of the respondents.

4.1.8.1 Livestock keeping

It was observed that livestock ownership in both clusters of islands was not very significant. On the average each household owned 2 cattle, 2 goats, 4 chickens and a duck. Traditionally livestock ownership was mainly taken as a store of value or status symbol. The provision of manure for farming activities was another motive for keeping livestock in the study areas. In Ukara island 98 percent of the households depend on livestock manure for crop cultivation activities as compared to 41.6 percent in Ukerewe. (Table 4:9).

4.1.8.2 Farming activities

Cassava and sweet potatoes were two crops identified as forming staple diet in the zone. The other food crops cultivated in the area, but in small quantity, included bambaranuts, maize, rice, beans and peas and sorghum. Due to the fact that cassava and sweet potatoes formed a staple diet for many of the respondents in the study area, an indepth interviews about these crops were conducted. The study revealed that the local species of cassava and sweet potatoes that were previous grown have been abandoned. This includes Cassava crop species identified by their local names as “Lwamburu, Sanyenge” and “Gamweza” The reasons behind for abandoning them was due to the fact that they needed a long growing period of 2 – 3 years before the first harvest. However, other local cassava species like “Lwabakanga” Kitangaza” and “Ismail” were still been grown in the study area. These were said to have a growing period of less than 2 years.

The sweet potato is the second staple food crop in the study area. Although it was grown in large quantity it was never sustainable. The crop faced the problem of rotting in which there was no preservation methods by the households. Sweet potatoes, as the case of cassava crop, the species cultivated in the areas have been changing with time. The current grown species which are locally famous by “Chilile”, “Kolesta”, “Lwamtinginya”, Mzondwa”, “Navukanza”, and “Mtumba” replaced the species like “Bilagara”, “Sinia”, “Marya”, “Kamumu”, “Suguti” and “Myangi”. The reason behind for this replacement is due to the decreasing returns of products derived from those species.

Although there was no major cash crops identified in the zone, cassava crop was found to play a dual role-as food and cash crop to the majority of subsistence farmers. Cassava was sold so as to provide money for purchasing other household necessities.

To understand whether the average crop yield at household level was decreasing or increasing, a total of 70.9 percent of 151 households confirmed decrease whereas 29.1 percent had crop yield on increase. The responses on the average crop yield decrease recorded high in Ukerewe about 80percent as compared to Ukara with only 20 percent.

Table 4.9 below shows the responsibility of carrying manure to the farm that differ significantly ($p < 0.001$) between the two island. Women and children in Ukerewe were the most responsible persons for carrying manure to the farm forming 31.7 percent of the

population. Ukara Island had smallest figure of about 14.9 percent of the households of which women and children were responsible for carrying manure to the farm. On the other hand, observation made by the UNICEF (1990) showed that, that, women carry out over 70 percent of the farming activities in Africa. Despite this unequal sharing responsibility, the majority of the peasants complained of the acute shortage of inorganic fertilizers in their area. Throughout the study area no single peasant found using inorganic manure to replenish the lost soil fertility.

Table 4.9 Farming activities responsibility: Manuring

Islands	Persons responsible for carrying manure		Row Total	
	All household members % sample	Women and children % sample	%	sample
Ukerewe %within Island(101 households)	9.9 (10)	31.7 (32)	41.2	(42)
Ukara %within Island(50 households)	85.1 (40)	14.9 (7)	98	(47)
Total	56.2 (50)	43.8 (39)		89

p-value < 0.001 , Spearman correlation coefficient(r) = -0.617

Participation of the household members in farming activities was found to be affected by the size of the farm land owned by the household (Table 4.10). In Ukara island the p-value of 0.001 suggest a strong evidence of positive association (r = 0.458) between household farm land size and participation by the household members in farming activities. In the case of Ukerewe island such an association is not statistically

significant except for the hired labour ($p < 0.02$), which was positively weak correlated ($r = 0.134$) with the farm land size owned by household.

Table 4:10 Percentage distribution of household members participation in

Category =1 Ukerewe Island

Participation in farming activities	Farm land sizes(in hectare) owned by household			Row total % sample	(X ²) p-value	Spearman Correlation (r)
	Less than 1.5	Between 1.5-3.5	More than 3.5			
All household members						
YES	12	65.3	22.7	75 (76)	0.139	0.208
NO	28	64	8	25 (25)		
Women and children						
YES	32	64	4	26.9 (25)	0.395	-0.284
NO	1.4	72.1	26.5	73.1 (68)		
Hired labour						
YES	9	45.4	45.4	11 (11)	0.010	0.134
NO	16.8	67.4	15.8	89 (89)		

Category=2 Ukara Island

Participation in farming activities	Farm land sizes(in hectare) owned by households			Row total % sample	(X ²) p-value	Spearman correlation (r)
	Less than 1.5	Between 1.5-3.5	More than 3.5			
All household members						
YES	10	57.5	32.5	85.1 (40)	0.001	0.458
NO	28.6	71.4	0	14.8 (7)		
Women and children						
YES	28.6	71.4	0	14.8 (7)	0.186	-0.214
NO	4	57.5	32.5	85.1 (40)		
Hired labour						
YES	8	75	16.7	25.5 (12)	0.445	0.00
NO	14.3	54.3	31.4	74.5 (35)		

4.1.9 Migration status of the family members

4.1.9.1 Seasonal migration

The Table 4:11 shows 71.9 percent of seasonal migration being intra-district and 28.1 percent inter-district. In general fishing activities in the Lake Victoria seemed to have attracted the highest percentage of seasonal migrants in the zone by registering 67.44 percent, followed by migration due to schooling, 16.27 percent, and lastly business and search of employment attracted 11.6 percent.

Table 4.11 Reasons for seasonal out-migration

Reasons	Seasonal migration destinations				Row Total	
	Intra-District %	sample	Inter-District %	sample	%	sample
Business and Employment	8.2	(6)	30.7	(4)	32.7	(10)
Schooling	10.9	(8)	46.1	(6)	16.27	(14)
Visit relatives	5.4	(4)	0	(0)	4.6	(4)
Fishing activities	75.3	(55)	23.1	(3)	67.4	(58)
Column Total	71.9	(73)	28.1	(13)		86

The young age group of 16-35 years of age were the most affected by the seasonal migration (Table 4.12). This formed 80.4 percent in Ukerewe and 77.6 percent in Ukara islands total migration. This result is supported by other studies conducted by Findley (1977), Ogden (1984) and Oberai (1987) explained that the high propensity to migrate was within the economically active population between age group 15-40 years.

Table 4.12. Migration status of the family members with respect to age group**Category = 1 Ukerewe Island**

Age group	Migration status by the family members						Row Total	
	Permanent %	sample	Seasonal %	sample	Non-migrant %	sample	%	sample
0-15 years	2.9	(4)	8.6	(4)	54.7	(409)	45	(417)
16-35 years	70.8	(95)	80.4	(37)	28.4	(211)	37	(343)
36-55 years	22.2	(30)	10.8	(5)	11.5	(86)	13.1	(121)
Above 56 years	3.7	(5)	0	(0)	5.4	(41)	5.0	(46)
Column Total	14.5	(134)	5.0	(46)	80.6	(747)		928

Category =2 Ukara Island

	Migration status by the family members						Row Total	
	Permanent %	sample	Seasonal %	sample	Non-migrant %	sample	%	sample
0-15 years	8.1	(4)	17.5	(7)	48.4	(153)	40.3	(164)
16-35 years	81.8	(40)	77.6	(31)	30.1	(95)	41.3	(169)
36-55 years	10.2	(5)	5	(2)	12.9	(41)	11.8	(48)
Above 56 years		(0)		(0)	8.5	(27)	6.6	(27)
Column Total	12	(49)	9.8	(40)	77.6	(316)		408

Out of the 46 seasonal migrations (Table 4.12) which occurred in Ukerewe island 95.4 percent were by male and 4.5 percent by female. On the other hand, male population in Ukara island accounted for 87.5 percent as compared to 12.5 percent female in seasonal migration.

4.1.9.2 Permanent migrations.

Intra-district permanent migration was predominantly higher than inter-district permanent migration. As shown in Table 4:13, the intra-district migration registered 73.8 percent inter-district permanent migration was 26.2 percent.

Marital reasons such as marriages contributed 57.2 percent of the permanent migration, of which 68.1 percent of it were accounted for by Intra-districts permanent migration. On the other hand business activities and search for employment ranked first for inter-district permanent out-migration by 32.1 percent. This was followed by migration due to marital reasons, 26.5 percent, while a search for arable farm land influenced 24.4 percent of inter-district permanent out- migration.

Table 4.13 Reasons for permanent out-migration

Reasons	Destination of permanent out-migration				Row Total	
	%	sample	%	sample	%	sample
Business and Employment	2.8	(4)	32.7	(16)	10.7	(20)
Marital reasons	68.1	(94)	26.5	(13)	57.2	(107)
Search for arable land	26.8	(37)	24.5	(12)	26.2	(49)
Follow relative/parents	2.2	(3)	12.2	(6)	4.8	(9)
Schooling		(0)	4.1	(2)	1.1	(2)
Column Total	73.8	(138)	26.2	(49)		187

From Table 4.12, as it was for the case of seasonal migration, the young age group of 16-35 years of age were vulnerable group for permanent migration. It registered 81.8 percent in Ukara island, the highest as compared to the other age groups. Likewise, in

Ukerewe island with 70.8 percent permanent out migration was accounted by the age group 16-35 years of age.

As documented by Lee (1966) that migration is sex selective, the study identified that female population contributed more to the permanent migration than the male population. Also they were affected more by permanent migration than seasonal migration. It was found that 63.2 percent of permanent migrations in the zone were accounted for by female population which was higher than 36.8 percent accounted for by the male population. The male population was attracted mostly to seasonal migration, 89.5 percent, while female contributed only 10.5 percent.

The remittance provided by the migrants to their homes included food, money and clothes. Clothing assistance registered 40.7 percent followed by food with 35.6 percent and lastly, financial assistance with 23.7 percent (Table 4.14).

Table 4.14 Type of assistance from migrants

Type of assistances	Cluster of Islands				Row Total	
	Ukerewe Island %	sample	Ukara Island %	sample	%	sample
food	61.9	(13)	38.1	(8)	10.7	(21)
money	71.4	(10)	28.6	(4)	23.7	(14)
clothes	62.5	(15)	37.5	(9)	40.7	(24)
Column total	64.4	(38)	35.6	(21)		59

4.2 Multivariate analysis

4.2.1 Logistic regression results

The estimated coefficients for the 2-level random intercept model with an ordered categorical response variable are presented in the equation appended as 1. A standard error for each of the estimated parameters is presented in the bracket. The regression estimate, Wald test for the univariate parameter estimate and Odds ratio are presented in Table 4.15

The Bayesian deviance information criterion (DIC) was used for the assessment of the Goodness-of-fit of the model. These results indicate that the overall fit for the estimated model is satisfactory. The DIC diagnostic criterion for the fitted model (saturated model) gave DIC = 256.62 and deviance (Debar) = 241.28 which are less than the diagnostic statistics for the model without parameter estimates (unsaturated model).

Debar	D (θ bar)	p^D	DIC
264.56	261.73	2.83	267.39(unsaturated model)
241.28	225.95	15.33	256.62 (saturated model)

Either the likelihood ratio statistics $G^2 = 46.56$ at $\alpha = 0.0001$ allow the rejection of the null hypothesis for testing of goodness of fit, $B = 0$ since $X^2_{0.001} = 31.264 < 46.566$

Table 4:15 Regression Estimates, Weld test and Odds ratio from fitting 2-level Logistic regression

Variable	Estimated coefficient	S.E	Wald test (B / S.E) ²	Odds ratio (e ^B)
Const. Poorest Bo	0.399	0.631	0.3998	1.490334
Const. Poor B1	1.930	0.661	8.525**	6.88951
hhage old B4	1.210	0.590	4.2059***	3.35348
hhage middle B5	1.734	0.523	10.9924 [†]	5.66326
nschnoatt B6	-0.211	0.128	2.7173****	0.80977
nsecondr B7	-0.750	0.233	11.3113 [†]	0.47237
hhsexrat B8	-0.079	0.219	0.13013	1.0822
Szland B9	-0.198	0.112	3.1253****	0.820369
npermg B10	-0.016	0.105	0.02322	1.016128
nscamg B11	-0.322	0.243	1.7559*****	0.72469
Small household B12	1.212	0.604	4.02653***	3.36019
Medium household B13	0.325	0.427	0.57931	1.38403
Sex of household head: female B14	0.203	0.655	0.09605	1.225072
Male B15	0.387	0.866	0.1997	1.472556

Levels of significance:

* significant at $\alpha=0.001$
 ** significant at $\alpha=0.02$
 *** significant at $\alpha=0.05$

**** significant at $\alpha=0.1$
 ***** significant at $\alpha=0.2$

The direction of impact of the predictor variable on the response variable is identified by the sign of its coefficient, of either negative or positive. When coefficient of estimate has a negative sign it simply implies that a unit increase in the predictor variable will cause

the response variable to fall in the high end of the ordinal response variable (extremely poor, poor and less poor). On the other hand the response variable tends to fall in the lower end of the ordinal response variable for unit increase of the predictor variable when the coefficient of estimate is positively signed.

4.2.2 Hypothesis testing

Hypothesis1

(i) The coefficient of estimate for the variable of household head age categories had a positive sign and statistically significant. The coefficient for the variable in the category of old household head (56-80years) was significant at 5 percent level. This appeared not statistically significant at 1 percent level in explaining its effect on the household food availability as it was for the middle aged household head (36-55 years). The findings show that the young age headed households (18-35 years of age as the reference category) was approximately 3 and 5 times less likely to be extremely poor or poor as compared to the old and middle age headed household respectively.

However, it appeared that the old age headed households were roughly 2 (5.60131/3.30355) times better of being extremely poor or poor than their counterpart of the middle age headed households (36-55 years of age). These results are an approval to

the hypothesis that food availability at the household is associated with the age of the household head.

The poorest condition of the middle age headed the households than any other age group of the household head is an issue of great concern. The condition can be explained by the net benefit and cost of children through the family life cycle at different stages of development, as it has been documented by other studies conducted in Tanzania by Kamuzora (1984, 1985) and Lorimer (1967). These studies show that below the age of 40 years of the male head of the household, the cost of children as a whole in the family are higher than their labour contribution. Studies carried out by Caldwell (1977) in Ghana, Nag and Peet (1978) in Nepal, India and Indonesia; Cain (1977, 1984) in Bangladesh show similar results.

(ii) The association between the household sex ratio (number of female/number of male) and poverty level was found to be statistically insignificant. Thus, the findings neither accept nor reject the hypothesis that the household food availability is a function of the household composition by sex. In contrast, a similar study commissioned by the United Nations statistical division reported that the average proportion of women among the poor households in the 14 selected Developing Countries for the study was lower than 55 percent (UN, 1995: 129-130).

(iii) The odds ratio for the estimated coefficient for the sex categories of the household head suggest that the male headed household with a wife was 1.2 and 1.5 less likely of being extremely poor or poor than a counterpart household headed by female and male without a wife respectively. Similarly a female headed household was found to be 1.2 (1.472556/1.225072) times less likely of being extremely poor or poor as compared to male headed household without a wife. Unfortunately these results are statistically insignificant as they do not conform to the findings by Kamuzora C. L. et al (1998) who observed that, the female headed household were less poor compared to the male headed household without a wife, in the case study of Rural Bukoba district in Tanzania. Also studies by Todaro(1990) and FSG/SUA(1992) observed that female headed households were poorer than the male headed ones.

(iv) The household composition by education attainment of the family members had gross significant effects on the state of the household food availability. Both coefficient for the estimated parameter had negative sign to indicate that a unit increase in the number of educated and non-educated household members was likely to cause the response variable to fall in the high levels of the ordinal response variable (i.e. extremely poor, poor and less poor). The net effect of the number of persons in a family with secondary or post secondary education on food availability was found to be highly significant at 1 percent level. An increase of person in the household with such a level of education reduced the odds ratio of the household of being extremely poor or poor by 52.8 percent. On the other hands it was observed that an increase of person in a

household without any formal education (i.e. illiterate) was significant at 10 percent level. This reduced the odds ratio of a household of being extremely poor or poor by 19.0 percent. Thus, the assertion that food availability at the household is a function of the household composition by education attainment of household members, cannot be rejected.

Several studies have shown the role of education on economic welfare of the households. Notable studies include a cross country study by Wangwe et al (1986) in Tanzania, who used regression analysis to determine the level of education of household head being positive correlated to household food availability and access to non-wage employment. Other studies to support Wangwe's findings were reported by Huff Man (1974), Fane (1991) and Jamison and Mook (1984). Moreover, Sen et al. (1989) found out that a farmer with good basic education and skills responded positively and instantaneously to new technology, market opportunity and risk taking.

Hypothesis 2

As regards to farm land owned by the household, this showed marginal effect on the food availability at 10 percent level. The findings suggest that one hectare increase of the farm land owned by the household was likely to reduce the odds ratio of being extremely poor or poor by 17.4 percent. These findings therefore, support the assertion that a rural household which faces shortage of land is likely to face shortage of food. Such findings are supported by Hunt (1977) on the consequences of assigning individual

land title, Mberere in Kenya and Sadik (1989) who observed that food availability in developing countries is undermined by the shrinking landholdings due to land fragmentation, unequal land distribution and deepening rural poverty. Other similar findings include the studies by Das Gupta (1978), Haswell (1975), Roumasset and Smith (1981) who attributed landlessness and poverty to rapid growth of population. In contrast, studies by Pran (1993) and Kessinger (1974) in India attributed rural poverty to lack of productive asset rather than to the shortage of arable farm land due to the growth of population.

Hypothesis 3

The association between the household seasonal migrations on food availability was significant at 20 percent level. According to this finding a seasonal migrant was likely to reduce the odds ratio of the household he/she belongs of being extremely poor or poor by 27.7 percent. Therefore, the null hypothesis that seasonal migrants cause shortage of food is rejected in favour of the alternative that, seasonal migrants improves the household state of food availability in the islands.

Ukerewe district being densely populated with population density of about 409 persons per sq. km (NBS 2003), seasonal migration is largely due the fishing activities in the Lake Victoria which account for 67.44% of all seasonal migrations (Table 4.11). Fishing activities have been identified as the major adjustment used by the residents due to population pressure. This is in line with the observation noted by Mabogunje (1970) that

rural residents when faced with population pressure or structural change tend to migrate. Works by De Haan, Brock and Coulibaly (2002), Ellis (2000), and Hampshire (2002) in Mali and Niger found that seasonal migration is a result of high incidence of poverty. The studies showed that, the rural poor migrate in search of alternative livelihoods in response to deleterious effect of impairing home productions and increasing vulnerability. In such a condition it is the most destitute who migrate seasonally in search for alternative livelihood to support the family by remittance. Empirical evidence from Smith et al. (2001) in Uganda showed that the “extremely poor” (the landless and asset deprived are unable to diversify. The “poor and “average” pursue the most diverse livelihood strategies, while the rich usually had narrower livelihood range. Biro and Shepherd (2003) while researching on the livelihoods and chronic poverty in semi areas in Zimbabwe found that the higher income households received higher share of income from remittance, whereas the severely poor received the lowest share from seasonal migrants.

Therefore, seasonal out-migration in Ukerewe district provides access to additional income source to reduce the vulnerability of the household into food shortage.

Hypothesis 4

The coefficient of effect for the household proportional number of permanent migrants on food availability was found to be statistically insignificant leading to neither

accepting nor rejecting the null hypothesis that remittance contribution by permanent migrants improve the welfare of the household producing them. Possibly low income, salaries and wage received by permanent migrants in their employments may account for this insignificance association as pointed out by Omary and Mbilinyi (1996).

Migration represents a key livelihood diversification and survival strategy for poor and non-poor households. Households may send permanent migrants to provide remittances or accumulate savings, which could be used to maintain consumption during slack seasons and to provide insurance against shocks or fund investment. Several empirical studies have been conducted on the role of permanent migrants on the economic welfare of the households producing them in the rural areas. The finding shows that remittances from permanent migrants improve the life of rural household producing them. Some of these studies include the interesting work of Caldwell (1968) in Ghana, Anker and Knowles (1981) in Kenya, Oberai and Singh (1980) in India, Aldelman and Robinson (1978) in Korea and Todaro (1976).

Hypothesis 5

The findings revealed that a large household (used as reference category) was approximately 3 and 1 times less likely of being extremely poor or poor than small household of 1-4 persons and medium household of 5-7 persons respectively. On the other hand, the medium sized household was roughly 2.4 (3.333/1.389) times actually

less likely of being extremely poor or poor as compared to a counterpart small household. However, in the testing of the significance of these results, it was found that the coefficient of effect for the variable in the category of small sized household turned out statistically significant at 5 percent level, whereas the medium sized category was statistically insignificant. Therefore, these results don't allow any viable judgment on the function of the household size on food availability. A study by Kim K. (2000) in Mbeya, Tanzania supports this finding. A plausible explanation which can be given for this insignificant relationship is that, the size of the household seems not to matter in a developed economy such as diversified and labour intensive peasant agriculture (Kamuzora, 1998). Their results being statistically significant Kamuzora and Mkanta (1998) using possession index observed that the higher the size of the household or family the less the poor it is. In the international cross-section, Caldwell (1977) in Ghana found that large family size contribute to reduction of poverty at household level, but his work was challenged by researchers Madmud and McIntosh (1980) in rural Bangladesh who found a significant deterioration poverty indices with household sizes. Other notable studies include the work of Ward and Sander (1980) in Brazil, Scott and Mathew (1993) in Kerala, in which both reported a significant negative relationship between family size and social welfare of the household in urban area, with no significant relation in rural areas.

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

5.0 Summary

The main objective of this study was to investigate the relationship between population change and food availability at the micro level.

Due to the complexity in measuring food availability at the household level, poverty level index was used as proxy for the extent by which the household was food insecure. It was found that 86.8 percent of the household in Ukerewe district live in absolute poverty with low quality of dwelling, lack of access to clean and safe water, use of open pit latrine or bushes and capital accumulation among them is so negligible. In order to construct the poverty index of each household the first principal component which explained 30.7 percent of the total variation was used.

The study focused on socio – economic and demographic factors and their relationship to food availability in the household. The factors included: household size, household farm land size, and composition of the household in terms of: sex and age composition of a household head, sex proportion of household members, proportion of the household members who were seasonal and permanent migrants, proportion of household members

who had completed secondary or post-secondary education and those who had not attended any formal education.

The 2-level random intercept cumulative logistic model was formulated to estimate the coefficient of effect of the explanatory variable to the response variable. The response variable was the poverty level of the households, whereas the explanatory variables were the socio-economic and demographic variables. The study found out that, the family life cycle at different stages of development being the principal determinant of food availability in the household. The middle age headed household (35-55 years) were extremely food insecure as compared to any other age category of the household heads.

The other principal determinant of the household food availability was found to be proportion of household seasonal migrants. Its effect was significant, and it played important role in ensuring food availability in the households. A seasonal migrant was likely to reduce the odds ratio of the household he/she belongs of being extremely poor or poor by 27.7 percent

The findings show that education attainment by household members is crucial in determining food availability at the household level. The net effect of proportion of household members with secondary or post – secondary education was highly significant and reduced the odds ratio of the household of being extremely poor by more than 50 percent. Educated household members can easily be imparted with a new skill and

knowledge as compared to non-educated household members. Therefore, the households with high proportion of members without basic education are exposed to vulnerability of being extremely food insecure.

Land as one of the factors of production is the most useful determinant of household food availability. That is, increase in the size of the farm land was likely to reduce the poverty level of the household. However, land was found to be very scarce. Land fragmentation as a result of population pressure has left the majority of households owning very small plots of land. Land productivity was found to be hindered by lack of inputs such as manure and fertilizers.

Demographic variables such as household sex ratio, sex of the household head, size of the household and the proportion of household permanent migrants were statistically insignificant. Probably, the sample size was not large enough to pick up their effect.

5.1 Conclusion

The measurement of food availability in the household was a complex phenomenon. Food production level by itself doesn't signify the extent of food availability in the household. This is due to the existence of market structure whereby food can be accessed through purchase. Although different methodologies were available to measure food availability in the household such as nutritional status, health indicators, crop

production level, income and expenditure, this study used household poverty level derived from household possession index as a proxy for the extent at which the household was food insecure. This method is superior over others. As pointed out by Sender and Smith(1990,pp 28-29) and Kamuzora and Gwalema(1998) is not distorted by memory lapse, nor subject to ability of respondents to distort or mislead, and exaggerate or underestimate, the information is easily collected because its elements are physically seen and its inputs are closely correlated with current well-being of the household.

The principal components analysis is based on the statistical techniques for reducing a given number of variables so that there is as much information in the “K” principal components as there in the original “P” variables (i.e. $K < P$). In the construction of the possession index of each household only one principal component had to be used. This is the first principal component which explained 30.745 percent of the total variation. The method could not allow the use of all information available in the dataset since 69.255 percent of the total variation had to be discarded. The degree of accuracy of the constructed possession index depended on the proportion of variation explained by the first principal component. The higher the proportion of variation explained by the principal component the higher the accuracy of the information that can be obtained about the original variables. Therefore, selecting the first principal component so as to construct possession index was subject to loss of important information because only part of the total variation had to be used. Such a shortcoming was likely to affect the results expected from this study.

5.2 Policy Implications

The net benefit and cost of children through the life cycle for different stages of development are greatly associated with the state of the household food availability. The household head with middle age category of 35-55 years seemed to be more food insecure because of the cost of caring children as whole in the family was higher than their labour contribution. This gives a new light on family the planning effort. The emphasis should be on child spacing rather than population control. Also the parents should be educated on the comparable net benefit between educated and non-educated children if they want to receive assistances from them in the future. Education should be given priority as an inter-generation inheritance rather than traditional land inheritance.

The dynamics of population growth and its subsequent pressure it creates on the land resources has induced subdivision of the farm land into small plots through inheritance, purchase of land and rent. Small plots owned by the majority of households were scattered all over with infertile soil which needed expensive manuring inputs. Also premature food crop harvest had greatly reduced food productivity in the majority of the households. As a result, young people in response to population pressure resorted to seasonal migration for fishing activities in the Lake Victoria and in search for seasonal employment and business in the nearby town in order to obtain cash for purchasing of food. Diversification of the household economies is rarely attainable to the majority of the households. The policies should be put forward to support the likelihood strategies

pursued by the rural poor households. These may include: ensuring enabling environment for establishing loan financial facilities in the rural areas so as to stimulate non-farm activities such as fishing, trade, etc.

Although most of the young and middle aged respondents preferred permanent out – migration as a solution to the land shortage in the district, their intention to migrate were hindered by inherent cost of migration and limited access to networks. Therefore, there is an urgent need by the Government to work out enabling environment for individuals who want to migrate in search of farm land outside their districts. One approach can be the same as that of the late 1974 and early 1975 whereby the government deliberately shifted some people from Ukara island to Sengerema district in Mwanza region. This was aimed at reducing the size of population in the island so as to reduce pressure on the resources and improve to access to land through forced migration.

Since rural poverty is closely associated to chronic hunger, deliberate intervention schemes to assist poor families to improve their access to food should be formulated. One approach is the expansion of employment opportunities outside the agricultural sector through rural work programmes and the promotion of cottage and Small Scale Industries.

This study also recommends a greater synchronization between agricultural policies and rural development. This entails provision of basic physical infrastructure such as

accessible roads, electricity, safe and clean water, health facilities, credit facilities, etc upon which rural households can necessarily base their commitment to agriculture.

5:3 Further Research

- This study as part of the on going debate on the impact of the dynamics of population growth on welfare of the household still has many unanswered questions. This instigates further research on peoples' economic and sociological responses on the impact of household population change.
- The possible ways of promoting the non-farm activities in the rural area as a strategy for rural poverty alleviation are identified as useful to be studied.
- More research is still needed to establish the connection between the family size and the wealth of the household.
- This study has employed physical assets as a measure of household's poverty status. Other future studies can use other indices such as nutritional status, health, income and expenditure.

APPENDICES

Appendix 1: Results of the 2-level random intercept equations.

$$\text{resp}_{ijk} \sim \text{Ordered Multinomial}(\text{cons}_{jk}, \pi_{ijk})$$

$$\gamma_{1jk} = \pi_{1jk}; \gamma_{2jk} = \pi_{1jk} + \pi_{2jk}; \gamma_{3jk} = 1$$

$$\text{logit}(\gamma_{1jk}) = 0.400(0.631)\text{cons.}(\leq \text{Poorest})_{ijk} + h_{jk}$$

$$\text{logit}(\gamma_{2jk}) = 1.931(0.661)\text{cons.}(\leq \text{poor})_{ijk} + h_{jk}$$

$$\begin{aligned} h_{jk} = & -0.211(0.128)\text{nschnoatt.}12_{jk} + -0.750(0.223)\text{nsecondr.}12_{jk} + \\ & 0.079(0.219)\text{hhsexrat.}12_{jk} + -0.198(0.112)\text{szland.}12_{jk} + \\ & 0.016(0.105)\text{npermg.}12_{jk} + -0.322(0.243)\text{nseasmg.}12_{jk} + \\ & 1.733(0.523)\text{middle.}12_{jk} + 1.210(0.590)\text{old.}12_{jk} + \\ & 1.211(0.604)\text{small household.}12_{jk} + 0.325(0.427)\text{medium.}12_{jk} + \\ & 0.387(0.866)\text{male.}12_{jk} + 0.203(0.655)\text{female.}12_{jk} + v_{2k}\text{cons.}12 \end{aligned}$$

$$\begin{bmatrix} v_{2k} \end{bmatrix} \sim N(0, \Omega_v) : \Omega_v = \begin{bmatrix} 0.057(0.123) \end{bmatrix}$$

$$\text{cov}(y_{sjk}, y_{rjk}) = \gamma_{sjk}(1 - \gamma_{rjk})/\text{cons}_{jk} \quad s \leq r$$

Appendix 2: Principal Component Analysis

Table A: Total variance explained

	Total variance explained: Initial eigenvalues		
	Total	% variance	Cumulative %
Component 1	2.46	30.748	30.748
Component 2	1.217	15.212	45.960
Component 3	1.062	13.272	59.237
Component 4	0.832	10.394	69.632
Component 5	0.741	9.257	78.888
Component 6	0.699	8.736	87.624
Component 7	0.609	7.608	95.232
Component 8	0.381	4.768	100.000

Table B: Extraction of sum of squared Loadings for the first three principal component

	Sum of squared Loadings		
	Total	% variance	Cumulative %
Component 1	2.46	30.748	30.748
Component 2	1.217	15.212	45.960
Component 3	1.062	13.272	59.237

Extraction method: Principal Component Analysis and 3 Component extracted

Table C: Rotation sum of squared Loadings for the first three Principal component

	Rotated sum of squared loading		
	Total	% variance	Cumulative %
Component 1	2.402	30.022	30.022
Component 2	1.207	15.093	45.960
Component 3	1.130	14.122	59.237

Extraction method: Principal Component Analysis and 3 Component extracted
Rotation method: Varimax

Table D: Component matrix and communalities

	Component			Communalities
	1	2	3	
Quality of house wall	0.735	6.416E-02	-7.94E-02	0.551
Quality of house floor	0.825	7.662E-02	-0.136	0.704
Quality of house roof	0.610	-0.170	-0.268	0.472
Quality of toilet	0.461	0.270	0.627	0.678
Type of water sources	0.286	0.555	0.591	0.740
Bicycle	0.469	-0.325	0.327	0.432
Average acreage per person in the household	3.745E-03	0.797	0.326	0.741
Canoe	0.595	-0.237	0.101	0.420

Extraction method: Principal component Analysis

Appendix 3: QUESTIONNAIRE FOR THE HEAD OF THE HOUSEHOLD

Questionnaire No.....

1. Administration area

Date Ward....., Division.....
 .Name of the ten cell-leader Village
 Name of the household head

2. Household Demographic characteristics,

SNO.	Name of the member	Sex	Age	Relation to Head	marital status	Education level	major occup:

3. Household economic profile**3.1 Type and quality of house (tick appropriate answer)**

01. Wall	Mud wall ,mud bricks	Cement bricks	Burned bricks
02. Floor	Mud floor	Cement floor	floor tiles
03. Roof	Thatched grasses	Corrugated iron sheet, asbestos	Tiles

3.2 Type of toilet

01. No toilet i.e. bushes, neighbour
 02. Pit latrine with bricks built wall
 03. Pit latrine with grasses thatched wall
 03. Flush toilet

3.3 Type of water source

01. Piped water
 03 Protected well and spring
 Water in distant
02. Protected well and spring water near home
 04. Unprotected well, spring and other
 Sources i. e. river, lake

3.4 What other properties do you possess? (Tick the appropriate)

01. Radio		06. Boat engine		11. Music system	
02. Tv		07. bicycle		12. Fish net	
03. Sewing mac		08. Car		13. Saving account	
04. Canoes		09. Motor bike		14. Shop	
05. Bed net		10. Clock /watch		15. Mattress (foam, cotton)	

3.5 Do you keep livestock?

01. Yes 02. No

3.6 What is the motive for keeping livestock?.....

.....

.....

3.7 If yes Question 3.5 above, what types of livestock does you keep?

Type	Amount	Type	Amount
01. Cattle		03. Goats	
02. Sheep		04. poultry	

4. Land possession.

4.1 Do you have enough land for the need of your household?

01. Yes 02. No

4.2 What is the size of the land that you own?

01. Less than one acre 02. One to two acres
 03. Two to five acres 04. More than five acres.

4.3 If you have land, how did you get it?

01. Bought size.....

- 02. Rent size.....
- 03. Inherited size.....
- 04. Allocated by Government village size.....
- 05. Given by a friend/relative size.....

4.4 .Who works in the above farms?

- 01. All household members
- 02. Women only
- 03. Men only.
- 04. Hired labour.

4.5. Are you interested in expanding the size of farm under cultivation?

- 01. Yes
- 02. No.

4.6. Do you have children who have migrated because of land shortage? (if yes go to Qn6.5)

- 01. Yes
- 02. No

4.7. What do you consider are the solution of land shortage?

- 01. Agriculture intensification
- 02. Encourage Out-Migration
- 03 Diversification to other economic activities
- 04 Others, mention.....

5. Agriculture activities.

5.1 What food crops do you cultivate? (Tick appropriate).

Crop		Crop	
maize		Sweet potatoes	
Rice		Bambaranuts	
Millet		Beans and other leguminou	
Sorghum		Other crops(.....)	
Cassava			

5.2 With reference to the previous years what do you think are the average yields?

- 01. Inceasing
- 02. Decreasing

5.3 If you are using manure, who is responsible for carrying manure to the farm?

- 01. All household members
- 02. Women only
- 03. Men only.
- 04. Hired labour.

5.4 If you don't use pesticides and fertiliser, what are the reasons?

- 01. Soil is very fertile
- 02. Chemical/manure is not available.

03. Chemical /manure are expensive
 04. Other reasons.....

5.5 Are there any crop you have stopped cultivating?

01. Yes. 02. No.

5.6 If the answer is Yes for Qn 4.6, mention them.....

5.7 Why did you stop cultivating them?

01. Shortage of land 02. Needed intensive care
 03. Need expensive input. 04. Lack of labour
 05. Other reasons.....

5.8 Are there any crops you have started cultivating recently?

01. Yes 02.No

5.9 If the answer for An 4.9 is Yes, please name them.....

5.10 Do you face food shortage?

01. Yes 02.No

5.11 If Yes for An 4.11, what extent do you face food shortage?

01. Frequently 02. Occassionally

6. Migration.

6.1 Where were you born?

01. Ukerewe island 02. Ukara island
 03. Kweru island 04. Sizu island
 05. Out-side Ukerewe District

6.2 If not born in this island, when did you start living here (year)?

6.3 From Qn 5.2, which factor influenced your movement to this island to live in this village?

01. Search for work 02. Search for farm land
 02. Search for grazing land 04. Followed my family
 03. Other ,specify

6.4 Do you live in the same village with your children in the same family?

01. Yes 02. No

6.5 If the answer for Qn 6.4 is “ No”, where do they live and why did they permanently migrated from this village?

Name	Age at movement	Sex	Place of migration (tick appr.)		Reasons
			Within district	Outside district	

6.6 Are there members from your household who moved occasionally in the last season?
 01. Yes 02. No

6.7 From Qn 5.6 what is the age and sex of those who seasonally moved?

Name	Age	Sex	Place of migration (tick appr.)		Reasons
			Within district	Outside district	

6.8 Do you receive any assistance from both seasonal and permanent migrant?
 01. Yes 02. No

6.9 If yes, what assistance did you receive this season and last two season/year?
 01. Food 02. Money
 03. Clothes 03. .Other, specify.....

6.10 Do you have any remarks/requests regarding this interview.....

BIBLIOGRAPHY

- Adelman, Irma and Robinson, Sherman. (1978) “Migration, Demographic Change and Income Distribution in a Model of Development Country”; in Simon (Ed): 1978.
- Alamgir, M. Arora P. (1991) “Providing Food Security for All”. New York: New York, University Press.
- Anker, Richard, James C. Knowles (1981) “An Analysis of Income Transfers in a Developing Country”: The case of Kenya in *Journal of Development Economics* vol. 8 pp 205 – 226.
- Bilsborrow, R. E. (1979) “Population Pressure and Agriculture Development in Developing Countries: A Conceptual Framework and Recent Evidence”; A paper presented at Population Association of America (PPA) annual Meeting, 1979.
- Bilsborrow, R. E. (1992) “Population growth, internal migration and Environmental Degradation rural areas of Developing Countries: *The European journal of population*. Vol 8 pp 125-148, 1992
- Biro, K. and Shepherd, A. (200) “Livelihoods and Chronic Poverty in Semi-Arid Zimbabwe; *World Development* 31(3):591-610
- Boserup, E. (1965) “The Conditions of Agricultural Growth: The Economic of Agrarian Change under Population Pressure”. London: George Allen and Anwin Ltd. .
- Boserup, E. (1990) “Economic and Demographic Relationships in Development (edited by T. P. Schultz). Baltimore: The John Hopkins University Press, 1990.
- Boserup, E. (1981) “Population and Technological Change”. Chicago: University of Chicago Press, 1981.
- Botswana Central Statistics Office (1988) “ Botswana Family Health Surveys II”. Ministry of Finance and Development Planning and Ministry of Health.

- Blaike and Brookfield (1987) "Land Degradation and society". New York and London. Methuen.
- Brown, L. R. (1987) "State of the World", New York. 1987. N. Norton, W.W.
- Cain, M., T. (1984) "Women Status and Fertility in Developing Countries; Son Reference and Economic Security". World Bank staff Working Paper no.682. Population and Development series no. 7 Washington DC.
- Cain, M. T. (1977). "The Economic Activity of Children in the Village in Bangladesh"; Population and Development Review 4 (3) 201
- Caldwell, J. C (1968) "Africa Rural-Urban Migration: The Movement to Ghana's Town". Australia nation university press. Canberra: C. Hurst & co. London
- Caldwell, J. C. (1977) "The Economic Rationality of High Fertility Investigation Illustrated with Nigeria data". Population studies 31 (II J-27).
- Caldwell, J. C.; Orbuloye, I.O. and Caldwell P. (1992) 'Fertility Decline in Africa: A new type of Transition?'; Population and Development Review 18(2):211-42
- Clacke, C. (1977) "Population Growth and Land Use". New York: St. Martins Press,
- Cleave, J. H. (1874) "African Farmers: Labour Use in Development of Smallholder Agriculture". New York: Praeger publishers
- Das, Gupta and Monica (1978) "Production relation and population". Rampur; in Journal of Development studies, July vol.4 no.4
- Davis, K. (1963) "The theory of Change and Response in Modern Demographic History". Population index, vol 219, no.4 pp. 345-366.
- De Haan K. Brock N. Coalibaly.(2002) "Migration, Livelihoods and Institutions Contrasting Patterns of Migration in Mali" Journal of Development Studies 38 (5) 37-58.
- Dyson, Tim (1994) "Population Growth and Food Production: Recent Global trend": in population and Development review 2121 supp 335-58

- Ehrlich, P. and Ehrlich, A. (1970 a) "Population Resources Environment" Freeman W. H. and company Francisco
- Ehrlich, P. (1970) "Eco-catastrophe" Ramparts 8 No.3: 24-28
- Ellis, F. (2000) "The Determinant of Rural Livelihood Diversification in Developing Countries"; Journal of agricultural economics 51 (2): 289 – 302.
- FAO, (1987) "Agriculture Toward 2000". Rome.
- FAO, (1996) "Country Table : Data on Agriculture Sector". Rome.
- FAO, (1999) "The Continued Impact for Severe Weather Condition and Turmoil in World Financial Market Threat Market Supply Situation Difficult for many Countries Press release" New York.
- Fane, G. (1991) "Education and the Managerial Efficiency of Farmers". Review of Economics and Statistics, 57 (4) 45.2 – 461
- Fei, J. C. and Ranis. (1961) "A Theory of Economic Development". American Economic Review: 533-565
- Ferguson, Charles(1969) "The Neo-Classical Theory of Production and Distribution". Cambridge, University Press.
- Filmer, D. Pritchett L.(1998) "Estimating Wealth Effects Without Expenditure Data-- or Tears": An Application to Education Enrolments in States of India". World Bank Policy Research Working Paper No.1994.
- Findley, S. E. (1977) "Planning for internal Migration":A review of issues and policies in developing countries".
- Friedrich, K.H. (1968) " Coffee-Banana Holding at Bukoba: The reasons for Stagnation at a Higher Level"; in H. Ruthenberg (ed.)
- FSG/SUA, (1992) "Agricultural Diversification and Intensification Study". Oxford, International Development Centre.
- Goldstein, H. (1995) "Multilevel Statistical Models". London, Edward Arnold; New York: Halsted Press.

- Hampshire, Kate (2002) “Fulani on the Move: Seasonal Economic migration in the Sahel as a social Process”. *Journal of Development Studies*
- Haswell, Magret (1975) “The Nature of Poverty”. London: McMillan.
- Huffman, W.E (1974) “Decision Making: The Role of Education”. *American Journal of Agricultural Economics* 56(1) 85 – 97.
- Hunt, Diana(1977) “Poverty and Agriculture Development Policy in Semi-Arid areas of Eastern Kenya”; in *Land use and Development International* .African Institute 210. High Holborn, London WCIV 7 BW.
- Hurschman, A. O. (1958) “The Strategy of Economic Development”. New Heaven: Yale University Press.
- Igun, A. (1972) “An Essay on Social and Economic Effects of Rapid Growth Rates”; in *population growth and Economic Development in Africa*.(Ed), Population Council, New York 1972, pp 280-290.
- International Labour Organisation (FAO), (1993) “Environment, Employment and Development”. Geneva.
- Jamison, D. T. and Moock, P. R. (1984)“Farmer Education and Farm Efficiency in Nepal: The Role of Extension Service and Cognitive skills”. *World Development* 12 (1) 67 – 86.
- Johnson, R.Wichen, D.W (1992) “Applied Multivariate Analysis” .New-Jersey: Prentice-Hall International Editions
- John, Hicks (1965) “Capital and Growth” .Oxford University Press
- Kamuzora, C. L. (1980) “Constraints to Labour time Availability in Africa Smallholder Agriculture: The Case of Bukoba District ,Tanzania”. *Development and Change* 11(1),1980.
- Kamuzora, C.L.(1994) “Evaluation, Smoothing and Analysis of Age Structure”. Tanzania 988 Population Census (Dar-es-salaam: Bureau of Statistics)

- Kamuzora, C.L.(1984) “High Fertility and Demand for Labour in Peasant Economies: the Case of Bukoba District, Tanzania Development and change”.
- Kamuzora, C.L.(1985) “The Material of Value of Children over the Life Cycle of a Family, a Cross Sectional Study of Urban and rural Wasukuma of Mwanza Region”.Tanzania. Contributed paper to Session F 13, IUSSP General conference, Florence, June 1985.
- Kamuzora, C. L. and Gwalema S.(1998) “Aggravation of Poverty in Rural Bukoba District, Tanzania: Labour Constraints, Population Dynamics and AIDS Epidemic”. Research Report 22 june, 1998 (Dar-es- Salaam, REPOA)
- Keyfitz (1991) “Completing the Worldwide Demographic Transition :The Relevance of Past Experience”. *Ambio* 21: 1, 26-30
- Kiessling, L. and Landberg (1994) “Population, Economic Development and the Environment”(ed) 1994.
- Kivellia, J. (1997): “Population Pressure and Land Degradation in Tanzania: A case Study of Arumeru District Arusha region in Tanzania” . MA dissertation; University of Dar-es-salaam.
- Kim’ A. Kayunze (2000) “Poverty Disparities in Small and Larger, Female and Male Headed Households in Rural of Tanzania”. A Case study of Mbeya Region in Tanzania *Journal of Population Studies and Development* Vo. 7 NO. 1 and 2, 2000.
- Larsen, Janet (2003) “Population Growing by 50 Million Annually” .New York : W.W.Norton & Company 2002.
- Lean, Hinrich, Markham (1990) “WWF Atlas of the Environment”. New York, Prentice Hall.
- Lee, E.S. (1966) “Theory of Migration”.*Demography* 3, 47-48.
- Lewis, W. A. (1954) “ Economic Development with Unlimited Supply of Labour”, The Manchester School, may. (Repulished in A. N. Agarwalls and S.P. Singh:*The economics of Underdevelopment*, New York: Oxford University Press 1963)

- Lorimer, F. (1967) “ The Economic of Family Formation under Different Condition” ,World Population Conference, Belgrade 1965, Vol. II (New York; United Nations). 92 -5.
- Mabogunje, A. L. (1970) “System Approach Theory of Rural – Urban Migration”, Geographical analysis 2 (1) 1-8.
- Madmud, S. McIntosh, J. P. (1980) “Return to Scale to Family Size – who gain From High Fertility?: in Population Studies November vol. 34. No. 3.
- Malcom, D.W.(1953) “Sukumaland: An Africa People and their Country”. International Africa Institute.London. Oxford university press..
- Mallya, D. L. (1996) “Population and Land use changes in Tanzania: A case study of Hai District”. M.A. (Demography), University of Dar es salaam.
- Malthus, T.R. (1798) “An Essay on the Principle of Population”. London, 1803.
- Maro, P.S. (1975): “Population Growth and Agricultural Change in Kilimanjaro 1920-1970”. BRAUP Research population.
- Maro, P.S. (1974) “Population and Resources in Northern Tanzania: The Dynamics of change 1920 – 1970”, PhD Thesis, University of Minnesota
- Mehretu, A. (1995) “Spatial Mismatch Between Population Density and Land potential”:The case of Zimbabwe”. African Development, Vol XX No.1, pp 125-146.
- Mbonile, W.J. (2000) “Population and Food Security in Arumeru district, Arusha”,in Tanzania journal of Population Studies and Development, University of Dar Es-salaam, pp 63-83.
- National Bureau of Statistics (NBS), (1988) “Population Census & Housing Report”. Dar es Salaam.
- National Bureau of Statistics (NBS), (2002) “Population Census Housing Report”. Dar es Salaam.

- National Bureau of Statistics (NBS), (1998/99) “The district Integrated Survey 1988/1999 in Mwanza Region”. Dar es Salaam.
- National Bureau of Statistics (NBS), (2003) “Mwanza Region Socio-Economic Profile”: 2nd edition, Tanzania
- National Bureau of Statistics (NBS), (1991/92) “Tanzania Demographic Health Survey”. Planning Commission.
- National Bureau of Statistics (NBS), (1996) “Tanzania Demographic Health Survey”. Planning Commission.
- Newman, J.L. & Matzke, G.E. (1984) “Population: Patterns, Dynamics and Resources”. New Jersey. Prentice Hall inc.
- Oberai, Amarjit S., and Manmohan Singh, H. K. (1980) “Migration Remittance and Rural development: Finding from a case Study in India Punjab”; In International labour review March – April.
- Oberai, A.S. (1987) “Migration and Urbanization and Development”. Geneva, International Labour Organization.
- Ogden, P (1984) “Migration and geographical change”. Cambridge University Press.
- Ogendo, H.W.O.(1993) “ Population and Natural Resources Use; in Population the Complex Reality(ed), Sir Francis Graham. The Royal society.
- Omary,C.K. (1994) “Social and Cultural Factors Influencing Poverty in Tanzania”. In M.S.D Bagachwa(ed.).
- Omary,C.K.and Mbilinyi,D.(1996) “Born to be Less Equal. The Predicament of Girls Child in Tanzania”; in Tanzania journal Population Studies and Development, Dar-es-Salaam. vol.2 No.1 and 2 , 1999.
- Pimentel et al (1994) “Constraint on the Explosions of the Global Food Supply”. *Ambio* 23: 198 – 205.

- Pimentel, D. , Xuewen, H. and Cordova (1996) “Impact of Population Growth on Food Supplies and Environment”; in Population and Development. New York, USA.
- Pran, Chiopra (1993) “The Basis of Hope: Population Poverty and Hope” .BS Uppal New Delhi –11002 India.
- Qusumbing (1996) “Male and Female Difference in Agricultural Productivity”. World Development 24,1579-595.
- Rald, J. and K. Rald (1975) “Rural organisation in Bukoba district”. New York: Africana publishing co., and Uppsala; Scandinavian Institute of African studies.
- Repetto, R.,Magrath W, Well, Beer ,Rossin (1989) “Wasting Assets, Natural Resources in the National Income Accounts”. Washington D.C, World resource Institute.
- Robinson, Joan (1953) “The production Function and the Theory of Capital”. Review of Economic Studies no.2 1953
- Robinson, Harry (1981) “ Population and Resources”. London, Macmillan Press 1981
- Ropetto, R. and Holmes, T.(1983) “The Role of Population in Resources Depletion in Developing Countries” ; in Population and Development Review vol.9 No.4 December 1983.The Population Council; New York USA
- Rosalind, L. and A. Rebmann (1982) “Macro-economics”: An Introduction to Keynesian-Neo Classical Controversies. London, Macmillan education LTD
- Rothschild, Safilios (1980) “The role of Family”: A Neglected Aspect of Poverty”; In P. Knight (ed) implementing program of human Development pp. 311 – 372 World Bank, Washington DC.
- Roumasset, J. R. Joyotee, Smith (1981) “Population Technological Changes and Land-less Workers”; in Population and Development Review September Vol. 7 No.3
- Rugumamu, W.and Kishimba, A. H.(1993) “Population Growth and Land Degradation in Tanzania”; in UN (1993), Population,

Environment and Development in Tanzania, Dar es salaam

- Ruthenberg, H (1968) "Smallholder Farming and Smallholder Development in Tanzania"(ed.). Weltforum Verlag.Munchen 1968.
- Sadik, N. (1989), " Safeguarding the Future". P.8 New York UNFPA.
- Sauvy, A. (1956): "General theory of Population". Weidnfeld and Nicolson, London.
- Scott, Wolf, Mathew. N.T (1993) "Level of Living and Poverty in Kerala". Geneva ,United Nations Research Institute for Social Development.
- Sen, A. (1981) "Poverty and Famine: An Essay on Entitlement and Deprivation". Oxford.
- Sen, A. (1984) "Resources ,Value and Development". Oxford
- Sen, A and Dreze, J. (1989) "Hunger and Public Action". Oxford.
- Sender and Smith(1990) "Poverty,Class and Gender in Rural Africa: A Tanzania case study". London ,Routledge.
- Simon,J.L. (1981): "The Ultimate Resource". Priceton University Press.
- Sir Walter, R. (1652) "The History of the World". London 1652.
- Smith, D.R.,Gordon, A.,Meadows, K. and Zwick,K.(2001) "Livelihood in Diversification in Uganda: Patterns and Determinants of Charge Across two Rural Districts",Food Policy 26(4):421-435
- Smil, V.(1994) "How many People can the Earth Feed? ".Population and Development Review Vol.20 No.2 June 1994.
- Stanley, P.Johnson (1987) "World Population and the United Nations challenge and response". Cambridge University press, pp 4, 136-137.
- Todaro, M. P.(1976) 'Internal Migration in Development Countries'. Geneva, ILO.
- Todaro,M. P.(1990)"Economic Development in the third World". London

,Longman.

- Todaro, M.P. (1992) "Economic for the Development World"
London Longman,
- United Nations (UN), (1993) "Population Environment and
Development in Tanzania". UN. Pp 1- 40.
- United nations (UN), (1993a) "The Sex and Age Distribution of the World
Population. The 1992 Review. New York, 1993.
- UN Food & FAO, (2002) 'World Agriculture Towards 2015/2030'
- United Nations, (1995) "Human Development Report". New York.
- United Nations of Children's Fund (UNICEF), (1990) "Women and
Children in Tanzania Situation Analysis".
The Government of Republic of Tanzania & United Nations
Children's Funds p. 169.
- United Nations Population Fund (UNFPA), (1991) "Population,
Environment and Development in Tanzania:
The critical challenges". London.
- United Nations Population Fund (UNFPA), (1994)"Making the Difference:
Twenty Five Years of UNFPA Experience ".(edited by
N.Sadik), London, Banson 3Turville street,
- Wangwe, S., Paul Collier, Samir Radwan (1986) " Labour and
Poverty in Rural Tanzania". Clarendon Press, Oxford 1986.
- Ward, John, O. Sander, John H. (1980) " Nutritional Determinants and
Migration in Brazil North-East: A Case Study of Rural and
Urban Ceava in Economic Development and Cultural
Change". October Vol. 29 No I.
- Walter, Rodney.(1982) "How Europe Underdeveloped Africa".
Washington D.C. Howard University Press.
- WCED.(1987)" Our common future". New York, Oxford University Press
- White, B. Nag, M. and Peet, C. (1978) "An Anthropological Approach
of the Study of Economic Value of Children in Java, Nepal".
Current Anthropology 192; 293– 306.

- Zimbabwe Central Statistics Office (ZCSO), (1988) “Zimbabwe Demographic and Health Survey”. Ministry of Finance, Economic Planning and Development.