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Submitted to the School of Mathematics in partial fulfilment for a degree in Master of Science in Social Statistics

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Master of Science Project
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Prepared for The Director
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Abstract

With the HIV/AIDS epidemic, there is an increase in the number of female-headed households in Kenya. Most of these are living in abject poverty as compared to the male-headed households. For such households, the socio-economic status, which is reflected in the poverty levels, is indeed low. However, in some regions, some male-headed households are equally deprived. Many studies in the recent past have attempted to identify the determinants of poverty in Kenya but did not compare these determinants across female-headed and male-headed households in different regions of Kenya. Such a comparison would point out the disparities, if any, across types of households in the different regions of Kenya. This study has conducted a comparative analysis of the socio-economic status of female-headed and male-headed households in Kenya using an ordinal logistic regression model. The results obtained indicate that education is the key determinant of socio-economic status. Households headed by both male and female heads who have attained tertiary education are more likely to move to the next higher category of wealth index as compared to households headed by male and female heads with no education. However, both female-headed and male-headed households in rural Kenya are less likely to rise up the wealth index categories as compared to the households in urban Kenya. Though more likely to move up the wealth index categories more than other households across the regions, female-headed households in Nairobi are less likely to rise through the wealth index categories as compared to the male-headed households in the same region. The results also show that female-headed as well as male-headed households in Western Kenya and North Eastern Kenya are the least likely to move to the next higher category of wealth index as compared to households in the other regions. Formulation and implementation of proper policies and procedures can address these disparities and improve the socio-economic status of households across the different regions of Kenya.

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Declaration and Approval

I, the undersigned, declare that this project report is my original work and to the best of my knowledge, it has not been submitted in support of an award of a degree in any other university or institution of learning.

Signature Date

Agnes Mwangi
Reg No. I56/88257/2016

In my capacity as a supervisor of the candidate, I certify that this report has my approval for submission.

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Dedication

This project is dedicated to all those who supported me in one way or the other.

Contents

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Mwangi Agnes

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1 Introduction

1.1 Background Information

The curse of HIV/AIDS has left a trail of destruction and erosion of highly regarded communal values especially in the developing countries. In the African family set-up, every person belonged to an extended family which constituted the communal families. The composition of such a family include grandparents, parents, uncles, aunts, cousins, nephews and nieces. Taking care of children and teaching them life skills was a collective responsibility of the extended family and community as a whole. Widows and orphaned children would find solace in such extended families for they would be well taken care of.

However, the consequences and effects of HIV/AIDS pandemic have overwhelmed these communal families. This is majorly because of the great constraint on the families as they try to cope with the increased medical expenses and home-based tender loving care for those infected. In this epidemic, women are the care-givers for those both infected and affected by the scourge. Time spent in taking care of the sick persons leads to neglection of agricultural activities hence reduced farm output as observed by Kiriti & Tisdell (2003). This in turn leads to food insecurity and compromises the socio-economic status of houeholds as reflected in the high poverty levels witnessed in such households. The families endure difficult economic and emotional period of time even as the patients consequently pass on. With almost every household affected, the role of the communal families can no longer hold. As such , most widows are left taking care of the orphans single handedly, a duty which was largely seen as communal families' responsibility. In the case where both parents succumb to the pandemic, the oldest child takes up the role of heading the household.

In the African family set up, households were headed by men. However, in the face of HIV/AIDS pandemic, there is the emergence of female-headed households as well as child-headed households. HIV/AIDS affects mostly men and women in their reproductive ages. Upon their sad demise, the widowed grandmothers and mothers take up the responsibility of caring for their grandchildren

and orphans albeit facing severe economic constraints according to Jill (1998).

To counter this, women have embraced the new role of heading households as the harsh reality strikes. In some cases, the households dispose off their limited durable possessions in order to cope with the new roles they have assumed. As such, it is hypothesized that many female-headed households are in higher poverty levels as compared to the male-headed households. The number of female-headed households in Kenya is steadily increasing. The World Bank report (2008) estimated the fraction of the female-headed households as one-quarter. However, Kenya Demographic and Health Survey Report (2014) cited the fraction to have risen to about a third of all households in Kenya.

As a result of all these, a better understanding of the socio-economic status of the female-headed households is necessary in order to first identify the key factors that determine their poverty levels and then empower them accordingly. A comparison of the effect of each of the determinants of socio-economic status of the female-headed households with that of the male-headed households would uniquely point out the disparities, which if addressed through policies, would alleviate the poverty levels in the female-headed households.

1.2 Definitions, Notations and Terminologies

- Poverty levels - a measure of inability to meet basic needs such as food, shelter and clothing
- Socio-economic status of households - a household's social and economic position in relation to others in terms of the living standards, mainly reflected in poverty levels
- Wealth index - measure of a household's socio-economic status
- Determinants of socio-economic status - factors which indicate the socio-economic status of a household
- Household level gender disaggregated data - data collected and tabulated separately for men and women at the household level
- KDHS - Kenya Demographic and Health Survey
- HIV/AIDS - human immunodeficiency virus / acquired immunodeficiency syndrome

1.3 Problem Statement

One of the socio-cultural factors that determine the socio-economic status of women in the Kenyan society today is their marital status. In the sad event of the death of the husband, who is the main breadwinner, or separation, divorce or single motherhood, the women are left to take up the responsibilities of heading and providing for their families single handedly. This compromises their socio-economic status which is mainly reflected in the poverty levels of most of the female-headed households as compared to the male-headed households. Not many researchers have analyzed the economic status of women in different regions across Kenya but rather of men since in the socio-cultural aspects in some countries in Africa, women are considered to be under the care of their husbands and do not have equal rights to property and have fewer rights, if any, to inheritance.

Geda et al. (2001) conducted a household level analysis of determinants of poverty using 1994 Welfare Monitoring Survey data. However, the economy of Kenya has since improved and so have the living standards of households with the introduction of devolved funds to the constituency levels. A household level analysis using more recent data would reveal the impact of the improved economy on the socio-economic status of households and also allow for a comparison across female-headed and male-headed households in Kenya in order to identify any disparities.

The research by Kiriti & Tisdell (2003) considered the gender inequality, poverty and human development in Kenya using indicators of poverty as defined by United Nations Development Program (UNDP). Though internationally accepted, these indicators do not capture the actual socio-economic status of households in Kenya. A household level comparative analysis would be more reflective of the real state of affairs across households.

A research conducted on poverty levels and food security among female-headed households by Mwawuda & Nyaoke (2013) pointed out that such households are living in abject poverty in Western Kenya. The research was confined in only one region of Kenya. However, a study conducted in all the regions of Kenya would allow for comparative analysis of all types of households across the regions in order to identify the gaps and put in place policies geared towards bridging such gaps.

According to World Bank Kenya Poverty Report (2008), poverty incidence in Nairobi and Central

was below the national average and higher in Coast and Western Kenya as at 2006. With the devolution of resources to the county level, there has been a general improvement in the quality of life of the larger population. However, we need to measure whether this improvement is equivalent across the regions and whether the female-headed households have a better quality of life.

A comparative analysis of the socio-economic status of the female-headed households with respect to the male-headed households using the households' wealth index, which is determined using more recent household level gender disaggregated data, will enable to identify the disparities, if any. Consequently, the female-headed households can be empowered at the point of weakness. There is therefore a need to carry out a comparative analysis of the key factors that determine the socio-economic status of the female-headed households with respect to the male-headed households in Kenya.

The socio-economic status of households in this paper is described by the category of wealth index a household belongs to. Using the ordinal logistic regression model with the wealth index as the response variable, the measure of effect of each of the key factors determining the socio-economic status of households allows for the comparative analysis for the female-headed as well as the male-headed households.

1.4 Objectives

1.4.1 General Objective

To compare the determinants affecting the socio-economic status of the female-headed and the male-headed households in Kenya.

1.4.2 Specific Objectives

1. To identify the economic factors, socio-cultural factors and demographic factors affecting the socio-economic status and food security of female-headed and male-headed households across regions in Kenya.

2. To draw a comparison of the effect of each of the determinants of the socio-economic status of the female-headed households with respect to the male-headed households in Kenya.

1.5 Significance of the Study

This study is much needed in order to have a clear and concise understanding of the struggles of female-headed households and the strenuous burden on the female head. With this information, the government can formulate policies through The Ministry of Public Service, Gender and Youth Affairs geared towards empowerment of the female heads both economically and socially. The comparative analysis may also reveal equally deprived both types of households. In such a scenario, the formulated policies should seek to empower both types of households.

1.6 Summary

Having identified the need for this study, a review of literature is necessary to give an overview of some of the attempts made in the recent past identifying some of the key determinants of poverty levels among the female-headed households and some of the recommendations proposed to alleviate these poverty levels to ensure better quality of life as summarized in chapter two. Chapter three describes the statistical methods used to analyze the effect of the key factors of the socio-economic status. The main model used is the ordinal logistic regression model with the interaction of the variable sex of household head with the other predictor variables. The results obtained from the model include both the main effects and interaction effects. From this, a comparison of the determinants of the socio-economic status of female-headed households and the male-headed households is drawn. The analysis of data and the subsequent results are in chapter four and the last chapter gives the conclusions from the results obtained from the data analysis and the proposed recommendations.

2 Literature Review

2.1 Introduction

This chapter reviews some of the studies conducted by researchers who sought to identify some of the determinants of socio-economic status among households in Kenya. The socio-economic status is mainly reflected in the poverty levels and as such the researchers have majored in identifying the factors that influence the poverty levels of households in Kenya and the possible measures of alleviating poverty at the household level. At the end, a summary of the factors of socio-economic status from the conclusions of the findings of these researches is given. The factors are classified as economic, socio-cultural and demographic factors.

2.2 Determinants of Socio-economic Status

In the 1995 and 1997 Human Development reports, the United Nations Development Programme (UNDP) introduced the following measures as some of the indicators of poverty.

- Human Poverty Index (HPI)
- Human Development Index (HDI)
- Gender-related Development Index (GDI)
- Gender Empowerment Measure (GEM)

HPI is calculated as the average of the percentage of people expected to die by the age of 40 years, the percentage of illiterate people and the percentage of people without access to health services, safe drinking water as well as the percentage of underweight children under the age of 5 years.

The indicators used to calculate HDI are life expectancy at birth, the expected years of schooling for school-age children as well as the adult population's average years of schooling and gross national income (GNI) per capita (ppp US$).

GDI is used to measure gender equality. It is a ratio of men's HDI against the women's HDI calculated separately. It accounts for disparities between men and women.

GEM is the relative empowerment of men and women in both economic and political spectrums of activity. It is a measurement of gender equity in both managerial and governmental economic activities and professional tasks.

According to UNDP (2016), Kenya's HDI increased from 0.473 (1990 measure) to 0.555 (2015 measure) which is a 17.3 percent increase. Kiriti & Tisdell (2003) analyzed the gender inequality, poverty status and human development in Kenya using the HDI, HPI, GDI and GEM as defined by UNDP. However, the research findings pointed out that poverty in Kenya is not captured by these indicators but by using the households' wealth index which is determined using household level gender disaggregated data. This is because inequality across gender manifests itself clearly at the household level with culture playing a key role in the allocation of family resources and in decision making. In most African communities women are not entitled to property and resources even though they have very demanding responsibilities af taking care of the households especially where men are absent.

Mwawuda & Nyaoke (2013) did a research on poverty levels and food security among the female-headed households in Migori, Western Kenya and concluded that there is a serious situation of food insecurity across the region due to increased number of the female-headed households and identified that deliberate efforts to empower women should be made because women play a vital role in the food chain.

According to Kenya Demographic and Health Survey (KDHS) Report (2010), about one-third of the households are headed by women. Geda et al. (2001) identified that poverty levels of the male-headed households are lower as compared to the poverty levels of the female-headed households and also that one of the key determinants of economic status is the level of education.

Discussed below are specific categories of some of the factors that determine the socio-economic status of different types of households in Kenya as described from the conclusions of the findings of the studies conducted in Kenya.

2.3 Economic Factors

2.3.1 Education Level

Education in any nation is the key to its development. In the Millenium Development Goals (UN Millenium Declaration, 2000), the world leaders committed to combat poverty and hunger, illiteracy, disease, environmental degradation and also discrimination against women. Access to education for both girls and women is a means to reducing poverty levels in the society since the MDGs are inter-dependent.

According to MDG Kenya Report (2013), Kenya has achieved the Universal Primary Education through the Free Primary Education Programme (2003). The Constitution of Kenya (2010) guarantees all children the right to basic education . However, many women across the regions of Kenya still remain semi-illiterate. McCracken et al. (2015) noted that providing accessible schooling is a very effective way of addressing gender inequalities in education. Any government should strategize to improve gender-equal educational access to not only address direct costs of education but also the social aspects that affect the families' decision to send their children to school.

Chege et al. (2015) significantly identified that improvement of literacy levels in any region combats poverty and improves the socio-economic status of the members of the society. This reduces the dependency on the central government and such resources can be used to develop the region like in construction of roads, health facilities and also construction of water dams to improve the agricultural sector. A serious political will is necessary to provide access to quality education for all citizens irrespective of gender.

Female-headed households are more likely to be poor than the male-headed households. As such, empowering the women through formal education and entrepreneurial skills majorly contributes to their quality of life. As witnessed in Nepal, primary, secondary and tertiary education has played a significant and crucial role in economic growth as reported by Nowak & Dahal (2016). According to this research, the result gives the message to the developing countries that there is a high contribution of education to economic growth and ultimately socio-economic development of developing countries especially in Africa and Asia.

Poverty is a global problem that affects millions of people across the globe with women being the most vulnerable as compared to men. This leads to hunger, disease and death. To fight it, there is need for an accumulation of human capital in education and health with availability of public health services according to Sukati (2015). In his research on reducing poverty through education planning and policy formulation in Swaziland, pointed out that with higher levels of education, there was a likelihood of women choosing to have smaller families, sending their children to school, reduced fertility, decreased infant and child mortality, increased work force participation and relatively higher incomes. Empowering women through education will help build strong economies and improve their quality of life thereby placing them on relatively the same level with men.

2.3.2 Occupation

To enter into prestigious occupations in the social system, education is generally observed to be a prerequisite. Some of the highly prestigious occupations include medical functions, managerial positions, legal services and financial functions. It follows that lawyers, bankers, medical specialists and corporation executives are highly rewarded in the society owing to the functions within the jobs they do as observed by Hollingshead (2011). The less prestigious occupations carrying lower rewards include technical work, clerical and sales work among others. More often than not, individuals in the society are identified with respect to their occupational pursuits.

The occupation of both men and women determines the socio-economic status of the household. Employment is a major source of income in Kenya. In Facts and Figures on inequality in Kenya (2004), employment is singled out as an important dimension (among other dimensions) of inequality. As observed, most poor people are employed in the agriculture sector, majority of them being women. The more professional the occupation is, the higher the income. However, in some private institutions, women are not paid equally as their male co-workers for the same job description. This is tantamount to gender discrimination and policies should be put in place to guard against such discrimination.

2.3.3 Income

In any society, an individual who has a regular income, whether from an employment, offering services or farming, is considered to be well-to-do and regarded as of higher status. This is because the household can afford basic needs such as food, education and health services. As such, income is seen as one of the indicators of socio-economic status. It also acts as a predictor of good health as observed by Kennedy et al. (1998).

With a stable income, a household can afford health insurance policy and able to consult medical practitioners for regular check-ups. This keeps them in good shape thereby keeping diseases at bay. A regular income also ensures food security and good education. This can only predict a higher socio-economic status and a secure future.

However, this is not so for households without a regular income. Such struggle with food insecurity which may lead to stress-related diseases that may be fatal amounting to even more economic strife. Due to such economic hardships, the future of such households is both insecure and uncertain. Generally, men have higher income as compared to women owing to the fact that, more often than not, they undertake the technical courses which have better rewards.

2.4 Demographic Factors

2.4.1 Sex of Household Head

According to The World's Women by United Nations (2015), unmarried women with children as well as older women in one-person households in developed and developing regions have higher poverty levels as compared to men with similar characteristics.

World Bank Report on Kenya Poverty (2008) showed that one-quarter of all households were headed by a woman but that fraction keeps increasing. Such households tend to be significantly large with poverty levels averaging five percent points higher than those of male-headed households. The World Bank report gave the following estimated data of female-headed households and the poverty incidence as shown in Table 1.

Status	Population living in female-headed households	Population living in poor female-headed households	Share of population living in female-headed households (percent)	Percentage of poverty incidence
Married Monogamous	2,721,081	1,293,992	29	48
Husband Home	560,355	366,506	6	65
Husband Away	2,160,726	927,486	23	43
Married Polygamous	944,199	552,405	10	59
Husband Home	231,051	193,781	2	84
Husband Away	713,147	358,624	8	50
Living Together	34,137	12,154	0	36
Separated	486,450	249,482	5	51
Divorced	319,128	156,083	3	49
Widow	4,207,061	2,262,827	45	54
Never Married	597,654	169,119	6	28
Missing	43,445	16,568	0	38
Total	9,353,155	4,712,630	100	50

Table 1. WB estimates based on KNBS (2007) and KIHBS 2005-2006

In the African family set-up, men had the responsibility of taking care of the women and children in the household. The wealth of an African man in the recent past was measured by how many wives, children and herds of cattle and goats he had and how well fed the family was. That was his pride. He dedicated his energies, hard work and effort to taking care of his large family. However, with the changing times, women have found themselves taking up the responsibility of heading the households which has proved to be an uphill task. High rates of divorce, separation, losing family heads through HIV/AIDS have contributed to the increase of female-headed households. Though with a lot of struggle, female heads are resilient.

2.4.2 Age of Household Head

As the scourge of HIV/AIDS ravages in the developing countries, the persons who bear its consequences are mostly the orphaned children who take up the role of family heads at a very tender age. Observations from research have shown that when the father dies of HIV/AIDS, the wife

also follows shortly thereafter and the children are left as orphans with limited or no resources at all as reported by Ayieko (2003).

Such children heading households are deprived of their opportunity to attend school and therefore they live in unimaginable economic hardships. The situation becomes dire if the child- head is a girl because she may end up looking for means to sustain the household, increasing her vulnerability to HIV/AIDS infection, child labor and substance abuse. This plunges the household into deeper poverty.

2.4.3 Type of Place of Residence

Geda et al. (2001) pointed out that poverty is highly concentrated in rural areas in Kenya where most people are farmers in the agricultural sector. According to this research, there is need for the government to direct more resources to this sector to improve the quality of land to not only reduce poverty levels but also to ensure that every person across all regions in Kenya is not denied his or her right to be free from hunger and to have adequate food of acceptable quality according to the Constitution (2010), article 43(1)(c).

Interestingly, Mwawuda & Nyaoke (2013) noted that urbanization is one of the many causes of poverty in the rural areas. This is because the able-bodied population migrate to the major urban towns in search of employment leaving behind land which is a main resource for food production. Reduced workforce poses a major challenge for this exposes the households to food insecurity. If the land is managed properly, it would ensure that the household is food secure and the surplus would earn the women in the rural areas some income as such improving the quality of life especially for their households.

The Kenya Integrated Household Budget Survey (2005-2006) showed that almost half of the population (forty-seven percent) lived below poverty line of which eighty-five percent were in rural areas as reported by World Bank (2008). Poverty incidence was significantly lower in urban than in rural areas. The Table 2 shows the regional poverty estimates as outlined by the world bank in 2007 with respect to persons living in both urban and rural areas.

	Poverty measure	Head count (percent)	Number of poor (millions)	Poverty gap (percent)
National	Overall	46.6	16.6	16.6
	Food	45.8	16.3	-
	Severe	19.5	6.9	-
Urban	Overall	34.4	2.5	11.7
	Food	40.4	2.9	13.0
	Severe	8.3	0.6	2.5
Rural	Overall	49.7	14.1	17.8
	Food	47.2	13.4	16.2
	Severe	22.3	6.3	6.9

Table 2. Source: WB estimates based on KNBS (2007)

2.4.4 Geographical Region

Some regions in Kenya receive enough rainfall to support agricultural activities. These regions include the Central highlands, Western Kenya, some parts of Rift Valley and Coastal regions. The households can engage in agricultural production which ensures food security. The surplus food, when sold, generates income and this in turn assures the households good quality of life. Generally, for such households the socio-economic status is relatively higher.

Other regions are semi-arid and arid, receiving minimal amount of rainfall which is several seasons apart. Not much agricultural activity can be done in such regions. The households in such regions mostly keep livestock which, more often than not, succumb to the frequent spells of drought. There is rampant food insecurity and the households may be obliged to sell off their animals to counter the food shortage. Their socio-economic status is therefore compromised.

Agriculture plays a very important role in the livelihood security of households especially in the rural areas. Livelihood security in this case referring to the secured ownership of resources and income-generating activities as pointed out by Acharya (2006). The households in the arable lands are better placed as compared to the households in the semi-arid and arid regions. Female-headed households in arable regions rarely produce cash crops as compared to the male -headed households. This attributes to the difference in the farm output even though in such regions the female-headed households are not less productive Githinji et al. (2011).

2.5 Socio-cultural Factors

2.5.1 Religion

In most communities in Africa, the religion dictates the position of women in the society. Men are considered to be the heads and generally accepted to head the households. Female-headed households find it difficult to blend in such a culture and more often than not are disadvantaged. Across most religions in Kenya, women do not have any right to own land or movable property. The right to property is usually pegged on their relationship to their husbands, fathers or brothers who possess and control the land as noted by FIDA, Kenya (2017).

This leaves the female heads more exposed to lower socio-economic status as compared to men who control the economic resources. However, significant efforts are needed to implement the Constitution which guarantees gender equality in ownership of land and property as recommended by Gaafar (2014).

2.5.2 Number of Household Members

Africans believe in living in communities and have relatively large families which may include relatives who may extend their stay longer than is necessary. The budget of consumption therefore increases compromising the quality of life for the household. According to World Bank Report (2008), the female-headed households tend to be significantly larger in size, especially for women who are divorced, never married or whose husbands are away. Their poverty incidence averages five percent points higher than those of the male-headed households. Ngunyi et al. (2015) recommend the need to promote family planning to ensure that economic gains made and reduced burden on households as a result of free and subsidized education and health services do not translate to higher population growth rate.

2.5.3 Number of Children in the Household

The number of dependent children in a household largely determines the family budget. Many heads of families will deny themselves luxuries so as to take their children through good schools. The more the number of children in a household, the more the expenses on education, food and

health care.

Where resources are limited, the household may find itself in a situation where food insecurity is a reality. Households with fewer number of dependent children may not find it as hard as those with more number of dependent children. Times have changed where having many children was observed as being wealthy and respectable in the society.

Where women have a higher level of education, it is observed that such a household has fewer number of children. Geda et al. (2001) pointed out that the education of the females and their fertility are correlated negatively. The less educated a woman is, the more the number of children, moreso, following each other closely. However, the educated women are knowledgeable on family planning methods and their application.

2.5.4 Marital Status

Marital status largely influences the socio- economic status of a woman. Most females heading households are either widowed, separated, divorced, or never married single mothers. In his research, Shikha (2009), pointed out that unmarried women lack social, financial and economic security in a male-dominated world. Though they have great capacity to do work, they may not find the proper avenues. They lack confidence to venture out unlike their male counterparts who are heading their own households. Generally, this amounts to economic hardships which as a result draws stigma from the immediate family and the society at large all because of their social status.

These female-headed households are deprived of the basic needs, not to mention that the widows are sometimes denied of their entitlement to the land resources left behind by their deceased husbands. Such households end up being casual laborers in the society.

However, not all women heading households are unmarried. In the African culture, polygyny is accepted and recognized. In such a polgynous household, the man, more often than not, lives with the first wife but occasionally visits the other households for the purpose of fulfilling his duty to them. In essence, though the other wives are married, they are the household heads by

default. They go through similar struggles just as for the other female-headed households though not as severe. Married women have it easier for in most of such households, the man is the head.

2.6 Summary

From the literature review, the factors that influence the socio-economic status of households in Kenya are as summarized 1 below.

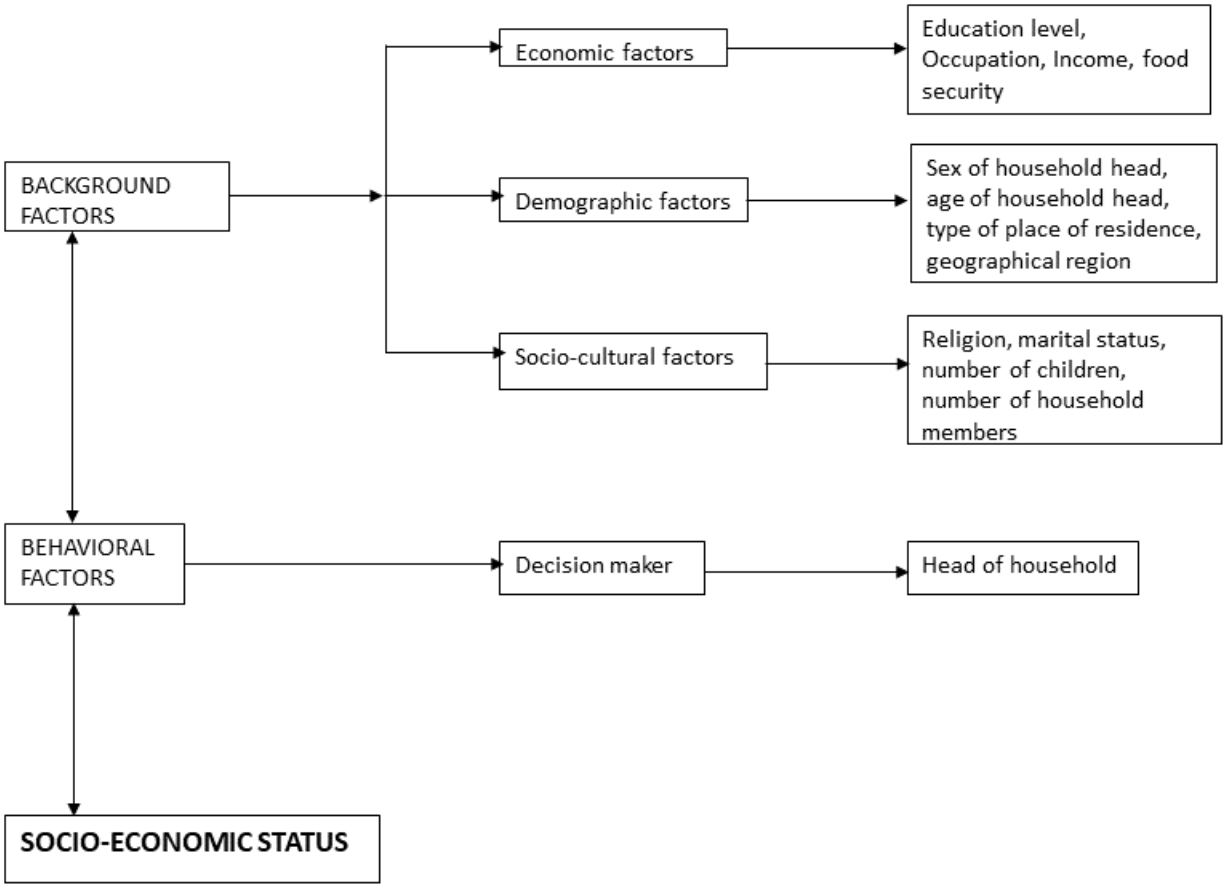

Figure 1. Summary of factors influencing socio-economic status

This paper has used the households' wealth index from the household level gender disaggregated data as the basic measure of socio-economic status of households. However, the model estimated has included sex of household head, type of place of residence, level of education of household head, age of household head, occupation of household head, geographical region and the body mass index of the household head as some of the most significant predictor variables influencing the wealth index of a household.

The ordinal logistic regression model with the interaction of the variable sex of household head with the other predictor variables is the most appropriate model to be used because the response variable, wealth index, is both categorical and has an ordered ranking. The model gives both the main effect and interaction effect estimates. From these results, a comparison of the female-headed households with respect to the male-headed households can be drawn. The findings can be used to address the disparities across households, if any.

3 Methods

3.1 Introduction

This chapter describes the household level gender disaggregated data used which is collected from households living in Kenya. It also gives a detailed description of the ordinal logistic regression model estimated as well as the test statistics of the model. The estimates obtained from the model give the measure of the effect of the factors influencing the socio-economic status of the female-headed and male-headed households.

3.2 Data Collection

The research has used data from Kenya Demographic and Health Survey (KDHS 2008-2009) which was collected using sample survey in all the eight provinces of Kenya (now subdivided into counties). It comprises 6,079 observations.

3.2.1 Sampling Method

The 2008 - 2009 KDHS is one of the population and health surveys conducted in Kenya every five years by Kenya National Bureau of Statistics (KNBS).

The 2008 - 2009 KDHS household-based survey was conducted on population households living in Kenya. A representative sample of 10,000 households was drawn at random to form the national master sample frame. The sampling technique used is multistage. This is a sampling method used in large surveys where primary units are selected in the first stage and then secondary units are selected from the primary units. Stage 1 involved selecting clusters from the national master sample frame. A total of 400 clusters, 133 from urban areas and 267 from rural areas, were selected. Stage 2 involved systematic sampling of households within the clusters using an updated list of households.

3.2.2 Instruments Used for the Survey

The instruments used for the survey were questionnaires. The 2008 - 2009 KDHS used three sets of questionnaires to collect survey data, namely Household, Women's and Men's Questionnaires. The questionnaires reflected relevant issues in Kenya. The questionnaires were then translated from English to Kiswahili and to 10 other local languages. Training of field staff and pre-testing of the questionnaires was done through pilot surveys for the purpose of refining them in order to set up strong, logistical arrangements thereby ensuring the success of the survey.

With the finalised survey instruments, the Household Questionnaire was filled first. This captured the data on the basic characteristics such as age, sex and education for all household members. Also captured by this questionnaire was data on characteristics of household's dwelling unit, ownership of various durable goods, ownership of agricultural land and ownership of domestic animals. This Questionnaire was then used to identify women aged 15 - 49 years as well as men aged 15 - 54 years. These were eligible for the individual interviews using the Women's and Men's Questionnaires.

The Household's Questionnaire provided data on the wealth index of each household in either of the five categories which include poorest, poorer, average, richer and richest. The wealth index reflects the living standard of the households. It is a measure of the socio-economic status of each household and therefore it is used as the response variable in the estimated model. In the Kenya Demographic and Health Survey (KDHS) 2008 -2009 data, the wealth index is based on the data of the household's ownership of consumer goods (which include durable goods, nondurable goods and services), type of toilet facilities, dwelling characteristics and the type of drinking water source.

Using Random Regression Forest and the literature review described in chapter two, about 40 variables from the sample data were identified to be associated to the wealth index. Random Regression Forest is a regression and classification tool used to give a measure of relative significance of predictor variables with respect to the response variable.

However, the most significant of these predictor variables of wealth index as classified include:

- occupation
- region
- type of place of residence
- highest education level
- religion
- number of household members
- age of household head
- total number of children ever born
- sex of household head
- body mass index

Table 3 shows the categories of the variables as used in the model.

3.2.3 Data Management

The data management done involves coding categorical variables to facilitate data analysis. Some of the numerical variables have been categorized and coded for more meaningful comparative analysis.

Qualitative Variable	Category	Code used in the model
Wealth index	Poorest	0 - **reference**
	Poorer	1
	Average	2
	Richer	3
	Richest	4
Region	Rift Valley	0 - **reference**
	Central	1
	Coast	2
	Eastern	3
	Nyanza	4
	Nairobi	5
	Western	6
	North Eastern	7
Type of place of residence	Urban	0 - **reference**
	Rural	1
Highest education level	No education	0 - **reference**
	Primary	1
	Secondary	2
	Tertiary	3
Religion	Christian	0 - **reference**
	Muslim	1
	No religion	2
	Others	3
Sex of household head	Male	0 -**reference**
	Female	1
Age of household head	31-40	0 -**reference**
	15-20	1
	21-30	2
	41-50	3
	51-60	4
	61-100	5
Respondent's occupation	Office employed	0 - **reference**
	unemployed	1
	Manual	2
	Self employed	3
	Services	4
Body mass index	Underweight	0 -**reference**
	Normal weight	1
	Overweight	2
	Obese	3
	Clinically obese	4

Table 3. Categorical variables used in the model

3.3 Data Analysis Techniques

3.3.1 Exploratory Data Analysis (EDA)

Histogram

For the exploration of data, a histogram showing the age distribution of the males and females heading households is plotted. The graph compares the number of the different type of households in each age group.

Chi-square Test of Independence

Cross tabulation and the chi-square analysis is used to identify if any two categorical variables have an association. To test for association of each of the categorical predictor variables with the response variable, we perform the chi-square test of independence using contingency tables for each predictor variable and the response variable. The contingency table shows the observed counts of each category of the predictor variable in each category of the response variable. The chi-square statistic is calculated by the formula

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

where

c is the degrees of freedom calculated from the contingency table using the formula

(number of rows - 1) * (number of columns - 1)

i is the i^{th} position in the contingency table

O is the observed value

E is the expected value which is calculated by the formula

$$E = \frac{row\ total * column\ total}{grand\ total}$$

The expected value shows the frequencies that would be for the sample data if the two variables were independent.

The test hypothesis are

$$H_0 : The\ two\ categorical\ variables\ are\ independent$$

$$H_1 : The\ two\ categorical\ variables\ are\ not\ independent$$

at 5% level of significance. A p-value < 0.05 indicates that the variables considered are associated and therefore there is a relationship between them. The ordinal logistic regression model including these variables is therefore a good fit.

3.3.2 Confirmatory Data Analysis (CDA)

The Ordinal Logistic Regression Model

Unlike the multinomial logistic regression model which gives several binary logistic models each with its own intercept and regression coefficients, the ordinal logistic regression estimates the cumulative probabilities of an event of interest which has an ordered ranking. By this it preserves the information about the ordering of the categories in the response variable.

In other logistic regression models, the odds of an event occurring is given by

$$odds = \frac{probability\ of\ an\ event\ occurring}{probability\ of\ an\ event\ not\ occurring} = \frac{p}{1-p} \quad \textbf{(1)}$$

The cumulative odds of an event in the ordinal logistic model given a response variable with J

categories is given by the expression

$$cumulative\ odds = \frac{cumulative\ probability\ of\ an\ event\ occurring}{cumulative\ probability\ of\ an\ event\ not\ occurring} = \frac{p_1 + p_2 + \cdots + p_j}{p_{j+1} + p_{j+2} + \cdots + p_J} \tag{2}$$

This can be expressed as

$$odds(Y \leq j) = \frac{P(Y \leq j)}{P(Y > j)} = \frac{P(Y \leq j)}{1 - P(Y \leq j)} = \frac{p_1 + p_2 + \cdots + p_j}{p_{j+1} + p_{j+2} + \cdots + p_J} \tag{3}$$

where

$$P(Y \leq j) \ = \ p_1 + p_2 + \cdots + p_j \ = \ \sum_{k=1}^{j} p_k \tag{4}$$

and

$$1 - P(Y \leq j) \ = \ p_{j+1} + p_{j+2} + \cdots + p_J \ = \ \sum_{r=j+1}^{J} p_r \tag{5}$$

where $k = 1, 2, \cdots, j$ and $r = j+1, j+2, \cdots, J$

Taking the natural logarithm of the cumulative odds (also known as cumulative logit) we get

$$logit(Y \leq j) \ = \ ln\left[\frac{P(Y \leq j)}{1 - P(Y \leq j)}\right] = \ ln\left[\frac{p_1 + p_2 + \cdots + p_j}{p_{j+1} + p_{j+2} + \cdots + p_J}\right] \tag{6}$$

The sequence of cumulative logits may be expressed as

$$logit(Y \leq 1) \ = \ ln\left[\frac{P(Y \leq 1)}{1 - P(Y \leq 1)}\right] = \ ln\left[\frac{p_1}{p_2 + p_3 + \cdots + p_J}\right] \tag{7}$$

$$logit(Y \leq 2) \;=\; ln\left[\frac{P(Y \leq 2)}{1-P(Y \leq 2)}\right] = \; ln\left[\frac{p_1+p_2}{p_3+p_4+\cdots+p_J}\right] \tag{8}$$

$$\vdots$$

$$logit(Y \leq J-1) \;=\; ln\left[\frac{P(Y \leq J-1)}{1-P(Y \leq J-1)}\right] = \; ln\left[\frac{p_1+p_2+\cdots+p_J-1}{p_J}\right] \tag{9}$$

The model does not use the last category since its cumulative probability is equal to 1, that is, $P(Y \leq J) = 1$

The ordinal logistic regression model is hence represented as

$$logit(Y \leq j) \;=\; ln\left[\frac{P(Y \leq j)}{1-P(Y \leq j)}\right] = \; \beta_{0j} - (\beta_{1j}X_1 + \beta_{2j}X_2 + \cdots + \beta_{kj}X_k) \tag{10}$$

The linear predictor function of this model is related to the cumulative probabilities by the cumulative logit link function.

However, the predictors do not depend on the category level of the response variable since the probabilities of the lower categories are nested in the cumulative probability of the next higher ordered category. As such, the expression for the ordinal logistic regression model is represented as

$$ln\left[\frac{P(Y \leq j)}{1-P(Y \leq j)}\right] = \; \beta_{0j} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k) \tag{11}$$

Such is called a proportional odds model. The overall odds of an event of interest may differ but the effect of the predictor variables on the odds of the event in the subsequent category is the same for every category.

The odds ratio for the association between the response variable and predictor variable, X_j, holding

all other predictor variables in the model constant is given by

$$odds\ ratio = exp(\beta_j) \tag{12}$$

The model expression for the cumulative probabilities is given by

$$p_m = \frac{exp(\beta_{0m} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k))}{1 + exp(\beta_{0m} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k))} \tag{13}$$

where m is the cumulative ordered category considered.
For a specific category, say j, the probability is given by

$$p_j = \frac{exp(\beta_{0j} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k))}{1 + exp(\beta_{0j} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k))} - \frac{exp(\beta_{0j-1} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k))}{1 + exp(\beta_{0j-1} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k))} \tag{14}$$

For the last category, the probability is given by

$$p_m = 1 - \sum_{j=1}^{m-1} p_j \tag{15}$$

Comparison of Groups in a Logistic Model

We may want to compare the effects of predictor variables across groups in the logistic regression model. By estimating separate regression models and then comparing the regression coefficients, we assume that the error variances are the same for the different models. This is erroneous because the variances are different and so are the standard errors. Therefore the regression coefficients from the separate models may not be compared.

However, we can still compare the effect of predictor variables across groups by including interaction terms between each predictor variable with the predictor variable acting as the basis for the

grouping.

When categorical predictor variables interact in the logistic regression models, the resulting model will have main effect variables and interaction effect variables. The interpretation of the coefficients in the model is no longer the unique effect of that predictor on the probability of the event of interest.

When comparing groups corresponding to the categories of a predictor variable, those categories act as the basis for the grouping. The predictor variable gives as many groups as its number of categories. The first category is the reference group and the other category (if there are only two categories) is the comparison group. We then consider the interaction of this predictor variable with each of the other predictor variables. Mathematically, we have the following.

We consider a logistic regression model of the form

$$ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \tag{16}$$

Case I

Suppose X_1 is the predictor variable acting as the basis for the grouping and has two categories (0,1) and X_2 is the other predictor variable. Then the model becomes

$$ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2 \tag{17}$$

Further, if we want to determine the effect of the predictor variable X_2 on the probability of the event of interest for each category of X_1, where $X_1 = 0$ is the reference group and $X_1 = 1$ is the comparison group, then we consider the following.

If $X_1 = 0$, then the model becomes

$$ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_2 X_2 \tag{18}$$

β_2 is the effect of predictor variable X_2 on the probability of the event of interest for the reference group.

If $X_1 = 1$, then the model becomes

$$ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 + (\beta_2 + \beta_3)X_2 \tag{19}$$

$(\beta_2 + \beta_3)$ is the effect of predictor variable X_2 on the probability of the event of interest for the comparison group.

From this, it shows that when comparing two groups (reference group and comparison group) in the logistic regression model with interactions, the following cases result:

- The coefficient for each predictor variable becomes the coefficient for that particular variable only for the reference group.
- The sum of the coefficient of the predictor variable alone and the coefficient of the interaction term is the coefficient of that particular variable for the comparison group.

That is,

$Comparison = Reference + Interaction$

This implies that we can get the coefficients for both the reference and the comparison groups from the same model.

Case II

Suppose we have more than two predictor variables, say four. The model is of the form,

$$ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 \quad \textbf{(20)}$$

If X_1, with two categories, is still the basis for the grouping, then the model becomes

$$ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_1 X_2 + \beta_6 X_1 X_3 + \beta_7 X_1 X_4 \quad \textbf{(21)}$$

If $X_1 = 0$, then we have

$$ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 \quad \textbf{(22)}$$

β_2, β_3 and β_4 are the effects of predictor variables X_2, X_3 and X_4 respectively on the probability of the event of interest for the reference group.

Similarly, if $X_1 = 1$, then we have

$$ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 + (\beta_2 + \beta_5)X_2 + (\beta_3 + \beta_6)X_3 + (\beta_4 + \beta_7)X_4 \quad \textbf{(23)}$$

$(\beta_2 + \beta_5), (\beta_3 + \beta_6)$ and $(\beta_4 + \beta_7)$ are the effects of predictor variables X_2, X_3 and X_4 respectively on the probability of the event of interest for the comparison group.

We can therefore compare the effect of predictor variables both within groups and across groups in a logistic regression model. This is done by interpreting the unique effect of each predictor

variable within each group at the same time comparing the effect of each predictor variable on the probability of the event of interest across groups.

Case III

Suppose for the same model

$$ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \tag{24}$$

X_1 is the basis for the grouping and has n categories where $n > 2$, that is, $X_1 = (0, 1, 2, \cdots, n)$
The model becomes

$$ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2 \tag{25}$$

The effect of variable X_2 on the probability of the event of interest for n groups of X_1 is obtained as described in case I. However, we could still find the effect of each predictor variable on the probability of the event of interest for each group by estimating n models with each category of X_1 as the reference group. This gives the unique effect for each group in X_1.

3.4 Assumptions of the Model

- The effect of each predictor variable on the odds of the event in the subsequent category is the same for every category (proportional odds assumption).
- The head of the household is the breadwinner and decision-maker in the household.
- The female-headed households are managed and run by women who are either widowed, divorced, separated or single mothers.
- The male-headed households are financially managed by the male head of the household.

3.5 Model Evaluation and Diagnostics

3.5.1 Goodness of Fit

Having selected the most significant predictor variables using the Random Regression Forest, a stepwise model selection is then done using the Akaike Information Criteria (AIC). The best model is the model with the least AIC value which includes only the predictor variables that would give the best fit. This model is then re-fitted.

To assess the goodness-of-fit for the re-fitted model, a likelihood ratio test is done using Analysis of Deviance table which test the hypothesis

$$H_0 : Null\ model\ is\ a\ better\ fit$$

$$H_1 : Fitted\ model\ is\ a\ better\ fit$$

at 5% level of significance. The likelihood ratio is the maximum likelihood when H_0 is true versus the maximum likelihood when H_1 is true. Maximum likelihood is the parameter value under which the observed data have the highest probability of occurrence. The likelihood ratio statistic is given by the formula

$$\triangle\, G^2 = -2\,[log\ likelihood\ (null\ model) - log\ likelihood\ (fitted\ model)]$$

This has a chi-square distribution with degrees of freedom equivalent to the number of restricted parameters, say k, in the null model. The p-value is the probability of observing a chi-square value greater than the obtained assuming the null hypothesis were true, that is,

$$p - value = probability\ (\chi_k^2 \geq \triangle\, G^2)$$

.

A p-value < 0.05 indicates that the re-fitted model is a better fit hence it is significant.

3.5.2 Proportional Odds Assumption

This assumption is also called the parallel regression assumption. The ordinal logistic regression model assumes that the set of coefficients that describes the relationship between the lowest category versus all higher categories of the response variable is the same as the set that describes the relationship between the next lowest category versus all other higher categories.
To test for any violation of this assumption, we fit a non - parallel logistic regression model and compare it with a parallel logistic regression model using the residual deviance to test the hypothesis

$$H_0 : Set\ of\ slope\ coefficients\ is\ the\ same\ (fitted\ model\ is\ a\ better\ fit)$$
$$H_1 : Set\ of\ slope\ coefficients\ is\ not\ the\ same\ (saturated\ model\ is\ a\ better\ fit)$$

at 5% level of significance. This is equivalent to comparing a multinomial logistic regression model to an ordinal logistic regression model for the same data set. The residual deviance statistic is given by the formula

$$\triangle D = -2\left[log\ likelihood\ (fitted\ model) - log\ likelihood\ (saturated\ model)\right]$$

This has a chi-square distribution with degrees of freedom equivalent to the difference between the number of observations, say n, and the number of parameters estimated in the fitted model, say k. The saturated model has a parameter estimate for each observation.

The p-value is the probability of observing a chi-square value greater than the obtained assuming the null hypothesis were true, that is,

$$p - value = probability\ (\chi^2_{n-k} \geq \triangle D)$$

.

A p-value$>$ 0.05 indicates that the set of slope coefficients is the same and therefore the fitted ordinal logistic model satisfies the proportional odds assumption and so it is appropriate for the data.

3.5.3 Predictions

For any new data set, we can use the fitted model to predict the possible category of the response variable within which each observation lies. This is done by calculating the probabilities of the observations in the new data set for each category of the response variable using the results of the fitted model.

The ordinal logistic regression model is estimated using the expression

$$ln\left[\frac{P(Y \leq j)}{1-P(Y \leq j)}\right] = \beta_{0j} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k) \tag{26}$$

The model expression for the cumulative probabilities is therefore given by

$$p_m = \frac{exp(\beta_{0m} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k))}{1 + exp(\beta_{0m} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k))} \tag{27}$$

where m is the cumulative ordered category considered.

The predicted probability for each observation in the new data set in each category of the response variable is therefore calculated using the formula

$$p_j = \frac{exp(\beta_{0j} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k))}{1 + exp(\beta_{0j} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k))} - \frac{exp(\beta_{0j-1} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k))}{1 + exp(\beta_{0j-1} - (\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k))} \tag{28}$$

For the last category, the formula used is

$$p_m = 1 - \sum_{j=1}^{m-1} p_j \tag{29}$$

The predicted category of the response variable within which an observation lies is the category with the highest predicted probability.

We determine the accuracy of the predictions using a confusion matrix which compares the actual categories of the observations in the new data set with the predicted categories and gives the percentage of the correctly predicted categories of the response variable. If the correctly predicted categories are $\geq 50\%$, then the model is a good fit.

3.6 The Model

The predictor variables used in this paper are selected by using literature review and then Random Regression Forest is used to classify them in terms of their significance with respect to their degree of association to the response variable.

The model estimated in this paper is

$$\begin{aligned} Wealth\ index =& \beta_0 + \beta_1 Gender + \beta_2 Region + \beta_3 Residence + \beta_4 Bmi \\ &+ \beta_5 Education + \beta_6 Age + \beta_7 Occupation \\ &+ \beta_8 (Gender * Region) + \beta_9 (Gender * Residence) \\ &+ \beta_{10} (Gender * Bmi) + \beta_{11} (Gender * Education) \\ &+ \beta_{12} (Gender * Age) + \beta_{13} (Gender * Occupation) \end{aligned}$$

The variable gender has the reference category as the male-headed households and the other category as the female-headed households. Its interaction with the other predictor variables gives main effect variables and interaction effect variables. The main effect coefficients are the estimates for the male-headed households which is the reference group.

The sum of the main effect coefficients and the corresponding interaction effect coefficients are the estimates for the female-headed households which is the comparison group.

The β's for the interaction terms are as many as the number of categories of each of the predictor variables with the exception of the reference categories.

3.6.1 The Estimates

A table of the main effect coefficients, interaction effect coefficients and the sum of the two sets of coefficients for each category of the predictor variables in the fitted model except the reference categories is given in chapter 4. The coefficients for each of the reference categories is equal to zero. The main effect coefficients are the estimates for the male-headed households. The sum of the coefficients are the estimates for the female-headed households.

The results for the male-headed households and the female-headed households are given in separate tables.
For each estimate, the odds ratio is calculated using the formula

$$odds\ ratio = exp(\beta_j)$$

The significance of the regression coefficients is tested using z-values which is a ratio of the difference between the estimated value of coefficient and the hypothesized value to its standard error. The hypothesis tested are

$H_0 : \beta_j = 0$
$H_1 : \beta_j \neq 0$
at 5% level of significance.
The z statistic is given by the formula

$$z = \frac{\hat{\beta}_j - \beta_j}{s.e\ (\hat{\beta}_j)} \sim N(0,1)$$

Using properties of maximum likelihood estimators, the asymptotic sampling distribution of the estimators is the normal distribution. The $100(1-\alpha)\%$ confidence interval for each β_j, where α is 5% level of significance, is calculated by the formula

$$\hat{\beta}_j \pm Z_{\alpha\backslash 2} \times s.e\ (\hat{\beta}_j)$$

If the confidence interval includes value 0, then the β_j is not significant. Similarly, if the confidence interval for the exponentiated β_j includes value 1, then the β_j is not significant.

However, the t-value with $n-1$ degrees of freedom is used in place of the z-value , where n is the

sample size. This is because with a large sample size, the sample variance is a good estimator of the population variance.
For each t-value, a p-value is also calculated. This is an alternative significance test for each predictor variable. The p-value is the probability of observing a t-value greater than the obtained assuming the null hypothesis were true. A p-value < 0.05 indicates that the predictor variable is significant where 0.05 is the level of significance used for the fitted model.

The exponentiated β_j gives the odds ratio which is interpreted as the odds of moving to the next higher ordered category of wealth index for any one category of predictor variable as compared to its reference category when all the other predictor variables in the model are held constant. For a continuous predictor variable, the exponentiated β_j is the odds of moving to the next higher ordered category of wealth index for each unit increase in the predictor variable when all the other predictor variables in the model are held constant.

The odds ratio is used to analyze the effect of each of the factors affecting the socio-economic status of female-headed and male-headed households in this paper.

3.6.2 The Comparative Analysis

The comparative analysis of the effect of the factors affecting the socio-economic status of the female-headed households with respect to the male-headed households is done using the log odds ratios. To test whether the odds ratios of the corresponding female-headed and male-headed households are significantly different, we find the absolute value of the difference between each pair of the corresponding log odds ratios (δ). The standard error of δ is calculated using the formula

$$se(\delta) = \sqrt{se_1^2 + se_2^2}$$

The corresponding z score is obtained using the formula

$$Z = \frac{\delta}{se(\delta)}$$

The z statistic is used to test the hypothesis

$$H_0 : Log - odds\ ratios\ are\ not\ significantly\ different$$

$$H_1 : Log - odds\ ratios\ are\ significantly\ different$$

at 5% level of significance. A p-value < 0.05 indicates that the log-odds ratios of the female-headed and male-headed households are significantly different.

However, the difference between each pair of the corresponding log odds ratios are the interaction estimates. We therefore use the p-values for the interaction terms for the comparative analysis.

3.7 Summary

The interpretation of the model estimates gives the measure of effect of each category of the predictor variables on the wealth index. Chapter four gives the results of the ordinal logistic regression model estimated in this paper and their interpretation. An exploratory data analysis on the age distribution of household heads is carried out using a histogram and subsequently cross tabulations which assess the general relationship between the wealth index and each of the predictor variables.

4 Results

4.1 Introduction

This chapter gives the results of the estimated model. All test statistics are at 5% level of significance.

4.2 Exploratory Data Analysis (EDA)

4.2.1 Histogram

The age distribution of the sample data analyzed is as in figure 2 below.

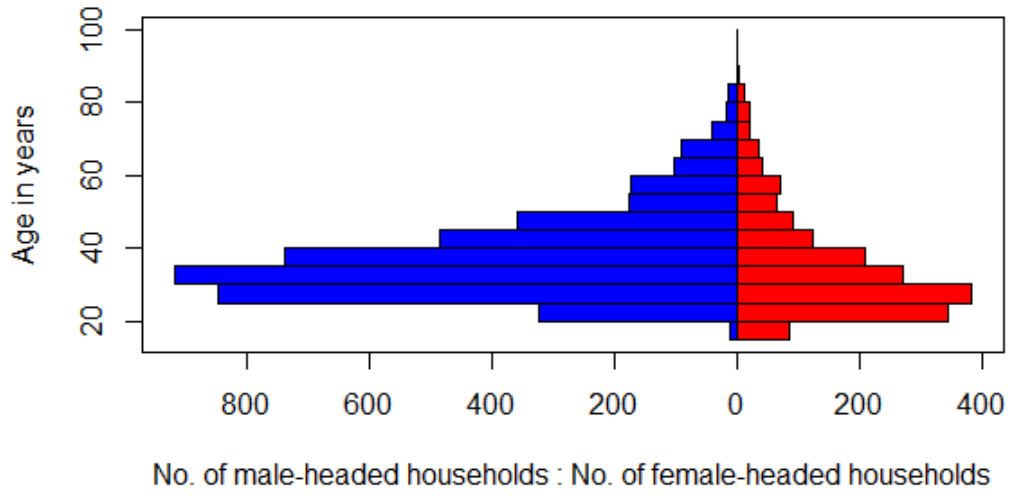

Figure 2. Age distribution by sex of household head

From the figure, it shows that the female-headed households are about a third of the households considered in this sample survey. This makes a significant fraction. It is noted that for this sample, the females heading households are mainly in the age group 20-30 years. Also, a very small

number of households are headed by males in the age group 15-20 years as compared to the households headed by females in the same age group. Above 75 years of age, there is relatively an equivalent number of female-headed and male-headed households.

4.2.2 Cross-tabulations

To test whether there is an association between each of the categorical variables used and the response variable, cross-tabulation was done. These cross-tabulations use the chi-square to test the null hypothesis that the categorical variables are independent, that is, there is no association. Below are some of the cross-tabulations obtained.

Table 4. Wealth index and region

		Region								Total
		0	1	2	3	4	5	6	7	
Wealth index	0	424	11	307	221	217	0	176	421	1777
	1	181	65	122	157	297	0	213	44	1079
	2	166	126	92	156	217	1	192	35	985
	3	148	175	130	165	195	12	128	32	985
	4	141	119	232	45	183	401	81	51	1253
Total		1060	496	883	744	1109	414	790	583	6079

The p-value calculated in table 5 for the chi-square value for cross-tabulation in table 4 is 0.000. This indicates that we reject the null hypothesis of independence of the two variables and conclude that there exist an association between the wealth index and the regions from which the data were collected at 5% level of significance.

Table 5. Chi-square

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2723.685[a]	28	0.000
Likelihood Ratio	2464.358	28	0.000
Linear-by-Linear Association	8.713	1	.003
Number of Valid Cases	6079		

Similarly, considering the wealth index and sex of household head, the cross-tabulation in table 6 was obtained.

Table 6. Wealth index and sex of household head

		Sex of household head		Total
		0	1	
Wealth index	0	1232	545	1777
	1	728	351	1079
	2	693	292	985
	3	681	304	985
	4	970	283	1253
Total		4304	1775	6079

The p-value shown in table 7 is 0.000 indicating that there is an association between the wealth index and sex of household head.

Table 7. Chi-square

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	35.572[a]	4	.000
Likelihood Ratio	36.792	4	.000
Linear-by-Linear Association	19.537	1	.000
Number of Valid Cases	6079		

Other cross-tabulations are in tables 12-23 in the Appendix A.

The p-value for each cross tabulation from tables 12 - 23 is equal to 0.000 indicating that there is an association between the wealth index and each of the predictor variables: age of household head, type of place of residence, level of education, religion, occupation and body mass index.

The predictor variables as included in the model are significant and therefore the model is a good fit.

4.3 Confirmatory Data Analysis (CDA)

The ordinal logistic regression model estimated is given by the expression

$$\begin{aligned} Wealth\ index = &\beta_0 + \beta_1 Gender + \beta_2 Region + \beta_3 Residence + \beta_4 Bmi \\ &+ \beta_5 Education + \beta_6 Age + \beta_7 Occupation \\ &+ \beta_8 (Gender * Region) + \beta_9 (Gender * Residence) \\ &+ \beta_{10} (Gender * Bmi) + \beta_{11} (Gender * Education) \\ &+ \beta_{12} (Gender * Age) + \beta_{13} (Gender * Occupation) \end{aligned}$$

The β's for each term are as many as the number of categories of each of the predictor variables with the exception of the reference categories.

The results and the values of each β obtained from the model estimated are at 5% level of significance.

4.3.1 Estimates from the Model

Variable	Category	Main effects estimates	Interaction effects estimates	Sum of main and interaction effects estimates
Intercepts	Intercept 1	-2.247		
	Intercept 2	-1.048		
	Intercept 3	0.150		
	Intercept 4	2.039		
Regions	Rift Valley	**Reference**		
	Central	1.386	-0.195	1.191
	Coast	0.187	-0.657	-0.47
	Eastern	0.522	0.076	0.598
	Nyanza	0.242	-0.168	0.074
	Nairobi	3.133	-1.372	1.761
	Western	-0.105	-0.100	-0.205
	North Eastern	-0.561	-0.42	-0.981
Residence	Urban	**Reference**		
	Rural	-3.604	-0.035	-3.639
Body mass index	Underweight	**Reference**		
	Normal weight	0.304	0.303	0.607
	Overweight	0.922	-0.012	0.910
	Obese	1.225	0.158	1.383
	Clinically obese	0.450	1.011	1.461
Education	No education	**Reference**		
	Primary	1.677	-0.410	1.267
	Secondary	2.596	-0.334	2.262
	Tertiary	4.233	-0.681	3.552
Age	31-40 yrs	**Reference**		
	15-20 yrs	1.023	-1.171	-0.148
	21-30 yrs	0.201	-0.419	-0.218
	41-50 yrs	-0.124	-0.158	-0.282
	51-60 yrs	-0.496	-0.111	-0.607
	61-100 yrs	-0.274	-0.098	-0.372
Occupation	Office job	**Reference**		
	Unemployed	-0.021	0.007	-0.014
	Manual	0.097	-0.195	-0.098
	Self employed	-0.205	-0.253	-0.458
	Services	0.532	0.020	0.552

Table 8. Estimates from a single model with interactions

The main effect estimates are the coefficients for the male-headed households while the sum of the main effect and interaction effect estimates are the coefficients for the female-headed households.

4.3.2 Goodness of Fit Test Results

Likelihood ratio test

The test for the model is done using analysis of deviance table. The hypothesis tested are :

$$H_0 : Null\ model\ is\ a\ better\ fit$$

$$H_1 : Fitted\ model\ is\ a\ better\ fit$$

$Likelihood\ ratio\ statistic = 5551.535$

$Degrees\ of\ freedom = 49$

$p - value = 0.000$

Since the p-value < 0.05 , the model is significant at 5% level of significance.

Proportional odds assumption

Violation of this assumption is tested by fitting a non - parallel multinomial logistic model and comparing it with a parallel ordinal logistic model. The test has used the residual deviance to test the hypothesis:

$$H_0 : Set\ of\ slope\ coefficients\ is\ the\ same\ (fitted\ model\ is\ a\ better\ fit)$$

$$H_1 : Set\ of\ slope\ coefficients\ is\ not\ the\ same\ (saturated\ model\ is\ a\ better\ fit)$$

$Residual\ deviance\ statistic = 583.44$

$Degrees\ of\ freedom = 6026$

$p - value = 1$

Since the p-value obtained is > 0.05 at 5% level of significance, the fitted ordinal logistic model satisfies the proportional odds assumption.

This therefore indicates that the set of coefficients that describes the relationship between the lowest category versus all higher categories of the wealth index is the same as the set that describes the relationship between the next lowest category versus all the other higher categories.

4.3.3 Analysis of Results

Male-headed Households Results

The odds ratios obtained from the estimates of the model show the relative comparison of each category of the predictor variables with respect to the reference category. For the male-headed households results in Table 9, there is quite a disparity across the regions considered.

Male-headed households in Nairobi are 23 times more likely to move to the next higher ordered category of wealth index as compared to the households in the Rift Valley. The centre of power and economy in Kenya is concentrated in Nairobi. Men in this region have the most opportunities of transacting businesses and engaging in many economic activities. This may possibly be the reason why male-headed households in Nairobi are most likely to rise through the categories of wealth index as compared to households in other regions. The male-headed households in Central Kenya are 4 times more likely to move to the next higher ordered category of wealth index as compared to the households in the Rift Valley. Male-headed households in Eastern Province are 69% more likely to move up the wealth index categories while male-headed households in Coast and in Nyanza are 21% and 27% respectively more likely to move to the next higher ordered category of wealth index as compared to the households in the Rift Valley.
However, male-headed households in Western and North Eastern Kenya are 10% and 43% respectively less likely to move to the next higher ordered category of wealth index as compared to the households in the Rift Valley. This may be attributed to the frequent droughts experienced in North Eastern Kenya every so often. This reduces their livestock which is their main source of livelihood.

Of interest to note is that male-headed households in rural Kenya are 97% less likely to move to the next higher ordered category of wealth index as compared to the households in urban Kenya. This indicates that there is little, if any, economic activities being carried out in the rural Kenya.

Variable	Category	Estimates	Standard error	Odds ratio	Confidence interval (95%)		t-value	p-value
Intercepts	Intercept 1	-2.247	0.179				-12.566	0.000
	Intercept 2	-1.048	0.179				-5.846	0.000
	Intercept 3	0.150	0.178				0.838	0.402
	Intercept 4	2.039	0.175				11.617	0.000
Regions	Rift Valley	**Reference**						
	Central	1.386	0.128	4.000	3.115	5.137	10.868	0.000
	Coast	0.187	0.116	1.206	0.961	1.512	1.62	0.105
	Eastern	0.522	0.111	1.686	1.356	2.096	4.699	0.000
	Nyanza	0.242	0.099	1.274	1.048	1.547	2.437	0.015
	Nairobi	3.133	0.381	22.95	10.87	48.47	8.215	0.000
	Western	-0.105	0.104	0.900	0.735	1.103	-1.013	0.311
	North Eastern	-0.561	0.168	0.571	0.411	0.793	-3.342	0.001
Residence	Urban	**Reference**						
	Rural	-3.604	0.104	0.027	0.022	0.033	-34.809	0.000
Body mass index	Underweight	**Reference**						
	Normal wt	0.304	0.102	1.355	1.110	1.654	2.989	0.003
	Overweight	0.922	0.127	2.515	1.960	3.227	7.249	0.000
	Obese	1.225	0.204	3.405	2.282	5.083	5.996	0.000
	Cl. obese	0.450	0.207	1.569	1.045	2.355	2.172	0.030
Education	No education	**Reference**						
	Primary	1.677	0.108	5.347	4.326	6.610	15.499	0.000
	Secondary	2.596	0.131	13.407	10.38	17.33	19.844	0.000
	Tertiary	4.233	0.234	68.904	43.55	109.0	18.080	0.000
Age	31-40 yrs	**Reference**						
	15-20 yrs	1.023	0.610	2.783	0.842	9.200	1.678	0.093
	21-30 yrs	0.201	0.080	1.223	1.046	1.429	2.524	0.012
	41-50 yrs	-0.124	0.086	0.883	0.747	1.045	-1.448	0.148
	51-60 yrs	-0.496	0.118	0.609	0.484	0.767	-4.216	0.000
	61-100 yrs	-0.274	0.129	0.760	0.591	0.978	-2.131	0.033
Occupation	Office job	**Reference**						
	Unemployed	-0.021	0.073	0.979	0.848	1.130	-0.291	0.771
	Manual	0.097	0.146	1.102	0.828	1.465	0.666	0.506
	Self employed	-0.205	0.098	0.815	0.672	0.988	-2.087	0.037
	Services	0.532	0.179	1.702	1.199	2.416	2.977	0.003

Table 9. Male-headed households estimates

Households headed by males of normal weight and those who are clinically obese are 36% and 57% respectively more likely to move to the next higher ordered category of wealth index as compared to household whose heads are underweight. Households headed by males who are overweight

and obese are 2.5 times and 3.4 times respectively more likely to move to the next higher ordered category of wealth index as compared to the household whose heads are underweight. Though being overweight is detestable in the developed countries, it is considered an indicator of wealth in Africa and as such, little effort is put to shed it off. These results attest to it.

The education level of heads of households plays a very important role in determining the probability of households rising up the categories of wealth index. This is reflected in the results in which households headed by males with primary education, secondary education and tertiary education are 5 times, 13 times and 69 times respectively more likely to move to the next higher ordered category of wealth index as compared to the households whose heads have no education.

In comparison to households whose heads are in the age group 31-40 years, households headed by males aged 41-50 years, 51-60 years and 61-100 years are 12%, 39% and 24% respectively less likely to move to the next higher ordered category of wealth index. Households headed by males aged 21-30 years are 22% more likely to move up the categories of wealth index as compared to the households whose heads are in the age group 31-40 years. The results clearly point out that the most productive age for males heading households is 21-40 years.

Households headed by males offering services as an occupation are 70% more likely to move to the next higher ordered category of wealth index as compared to the households whose heads are office employed. Interestingly, of the sample considered, the households headed by males in manual labour are 10% more likely to move to the next higher ordered category of wealth index as compared to the households whose heads are in office employment. Households headed by unemployed and self-employed males are 2% and 19% respectively less likely to move up the categories of wealth index as compared to households headed by office employed heads. Offering services as an occupation seems to be more promising than working in an office.

Female-headed Households Results

Table 10 shows the results obtained for the female-headed households considered in the model. Comparing the female-headed households from different regions in Kenya to the households in the Rift valley, those in Central and in Nairobi regions are 3 times and 6 times respectively more

Variable	Category	Estimates	Standard error	Odds ratio	Confidence interval (95%)		t-value	p-value
Intercepts	Intercept 1	-2.247	0.179				-12.566	0.000
	Intercept 2	-1.048	0.179				-5.846	0.000
	Intercept 3	0.150	0.178				0.838	0.402
	Intercept 4	2.039	0.175				11.617	0.000
Regions	Rift Valley	**Reference**						
	Central	1.192	0.207	3.293	2.196	4.939	5.762	0.000
	Coast	-0.470	0.181	0.625	0.439	0.891	-2.595	0.009
	Eastern	0.598	0.171	1.819	1.301	2.544	3.495	0.000
	Nyanza	0.073	0.163	1.076	0.781	1.483	0.450	0.653
	Nairobi	1.760	0.516	5.811	2.114	15.97	3.411	0.001
	Western	-0.205	0.189	0.815	0.563	1.180	-1.084	0.278
	North Eastern	-0.98	0.241	0.375	0.234	0.602	-4.063	0.000
Residence	Urban	**Reference**						
	Rural	-3.639	0.159	0.026	0.019	0.036	-22.88	0.000
Body mass index	Underweight	**Reference**						
	Normal wt	0.607	0.148	1.835	1.373	2.452	4.100	0.000
	Overweight	0.911	0.186	2.486	1.727	3.580	4.896	0.000
	Obese	1.383	0.280	3.989	2.305	6.903	4.943	0.000
	Cl. obese	1.461	0.343	4.312	2.202	8.444	4.262	0.000
Education	No education	**Reference**						
	Primary	1.267	0.148	3.549	2.654	4.746	8.544	0.000
	Secondary	2.262	0.185	9.603	6.676	13.81	12.197	0.000
	Tertiary	3.552	0.352	34.868	17.50	69.49	10.093	0.000
Age	31-40 yrs	**Reference**						
	15-20 yrs	-0.148	0.247	0.863	0.532	1.399	-0.599	0.549
	21-30 yrs	-0.218	0.119	0.804	0.637	1.015	-1.831	0.067
	41-50 yrs	-0.282	0.163	0.754	0.548	1.038	-1.731	0.083
	51-60 yrs	-0.607	0.185	0.545	0.379	0.784	-3.277	0.001
	61-100 yrs	-0.372	0.186	0.689	0.479	0.992	-2.006	0.045
Occupation	Office job	**Reference**						
	Unemployed	-0.014	0.114	0.986	0.789	1.233	-0.123	0.902
	Manual	-0.098	0.209	0.907	0.602	1.366	-0.467	0.640
	Self employed	-0.459	0.159	0.632	0.463	0.863	-2.887	0.004
	Services	0.552	0.223	1.736	1.121	2.689	2.472	0.013

Table 10. Female-headed households estimates

likely to move to the next higher ordered category of wealth index. The women in these regions have an advantage over other regions because of their proximity to business centres. This may explain why female-headed households in these regions are more likely to rise up through the

wealth index categories as compared to households in other regions. Female-headed households in Eastern Kenya are 82% more likely to move to the next higher ordered category of wealth index as compared to the households in the Rift Valley. The female-headed households in Nyanza region have almost an equal probability of moving up the categories of wealth index with the households in the Rift Valley. The female-headed households in the Coast, in Western and in North Eastern regions are 38%, 19% and 63% respectively less likely to move to the next higher ordered category of wealth index as compared to the households in the Rift Valley. The results from these three regions may be attributed to the existing customary laws which restrict women's access to property.

Similar to the male-headed households, the female-headed households in rural Kenya are 97% less likely to move to the next higher ordered category of wealth index as compared to the households in urban Kenya. Households in rural Kenya need to engage more on economic activities and possibly embrace new agriculture technology which enhances better yields. This would ensure food security and the surplus sold thereby improving the quality of life in rural Kenya.

Households headed by females of normal weight are 84% more likely to move to the next higher ordered category of wealth index as compared to households whose heads are underweight. The households headed by females who are overweight, obese and also those who are clinically obese are 2.5 times, 4 times and 4.3 times respectively more likely to move up the hierarchy of weath index as compared to the households whose heads are underweight. These results concur to the misinformed common belief in Sub Saharan Africa that the plus-size woman is both healthy and wealthy.

Similar to the households headed by males, households headed by females who have attained primary education, secondary education and tertiary education are 3.5 times, 10 times and 35 times respectively more likely to move to the next higher ordered category of wealth index as compared to the households whose heads have no education. The head of household's education level is a key determinant of the socio-economic status of any household.

Comparing the households headed by females in their respective age groups with the households whose heads are in the age group 31-40 years, households headed by females in the age groups 15-20 years, 21-30 years, 41-50 years, 51-60 years and 61-100 years are 14%, 20%, 25%, 46% and

31% respectively less likely to move to the next higher ordered category of wealth index. Unlike the men, the most productive age for women is 31-40 years according to these results.

The households headed by females providing services are 74% more likely to to rise up the categories of wealth index as compared to the households whose heads are in office employment. However, the households headed by females who are in manual jobs and in self employment are 9.3% and 37% respectively less likely to move to the next higher ordered category of wealth index as compared to the households whose heads are office employed. From the results, both female and male heads of households should be encouraged to venture more into providing services as opposed to working in offices for there is more hope of moving to the next higher category of wealth index in rendering services as an occupation.

4.3.4 Comparative Analysis Across Households

Having analyzed the factors within the two types of households, we need to compare the same across the households to identify the categories of the factors with significantly different log-odds ratios. Table 11 gives the results for the comparison.

From the table of results, a p - value < 0.05 indicates that the odds ratios are significantly different and hence reflecting the disparities existing between male-headed households and female-headed households in Kenya.

The results for Coast and Nairobi regions show that there is a significant difference in the log-odds ratios. This implies that female-headed households in the Coast and in Nairobi regions have a lower probability of moving to the next higher ordered category of wealth index as compared to the male-headed households in these regions. Both the female-headed households and the male-headed households in Central, in Eastern, in Nyanza, in Western and in North Eastern regions have relatively equal probabilities of rising up the categories of wealth index because the log-odds ratios for each of these regions are not significantly different across households. However, individual odds for households in Western and in North Eastern regions indicate that the households have very low probabilities of moving up the categories of wealth index.

The female-headed households and male-headed households living in rural Kenya have almost

Variable	Category	Log odds ratio males (β_a)	Log odds ratio females (β_b)	Absolute difference ($\beta_a - \beta_b$), δ	se (δ)	t - values	p - value
Regions	Region 1	1.386	1.191	0.195	0.242	-0.806	0.420
	Region 2	0.187	-0.47	0.657	0.215	-3.058	0.002
	Region 3	0.522	0.598	0.076	0.204	0.373	0.709
	Region 4	0.242	0.074	0.168	0.191	-0.881	0.379
	Region 5	3.133	1.761	1.372	0.642	-2.138	0.033
	Region 6	-0.105	-0.205	0.100	0.216	-0.463	0.644
	Region 7	-0.561	-0.981	0.420	0.294	-1.429	0.153
Residence	Residence 1	-3.604	-3.639	0.035	0.178	-0.198	0.843
Body mass index	Bmi 1	0.304	0.607	0.303	0.180	1.686	0.092
	Bmi 2	0.922	0.910	0.012	0.225	-0.052	0.958
	Bmi 3	1.225	1.383	0.158	0.346	0.456	0.648
	Bmi 4	0.450	1.461	1.011	0.401	2.524	0.012
Education	Education 1	1.677	1.267	0.410	0.183	-2.244	0.025
	Education 2	2.596	2.262	0.334	0.225	-1.486	0.137
	Education 3	4.233	3.552	0.681	0.419	-1.627	0.104
Age	Age 1	1.023	-0.148	1.171	0.658	-1.78	0.075
	Age 2	0.201	-0.218	0.419	0.143	-2.926	0.003
	Age 3	-0.124	-0.282	0.158	0.184	-0.858	0.391
	Age 4	-0.496	-0.607	0.111	0.219	-0.505	0.613
	Age 5	-0.274	-0.372	0.098	0.226	0.436	0.663
Occupation	Occupation 1	-0.021	-0.014	0.007	0.135	0.055	0.956
	Occupation 2	0.097	-0.098	0.195	0.255	-0.764	0.445
	Occupation 3	-0.205	-0.458	0.253	0.187	-1.356	0.175
	Occupation 4	0.532	0.552	0.020	0.286	0.070	0.944

Table 11. Comparative estimates

equal probabilities of rising up the categories of wealth index. However, the independent odds for each type of households show that the households in rural Kenya are very unlikely to move to the next higher ordered category of wealth index as compared to households in urban Kenya.

There is a significant difference in the log-odds ratios of households headed by females and those

headed by males who are clinically obese. The households headed by females in this category have a higher probability of moving to the next higher ordered category of wealth index as compared to the households headed by males in the same category of body mass index. There is no significant difference in the log-odds ratios of households whose heads are of normal weight, the overweight and the obese indicating that the households headed by females and males in each category have relatively equal probablities of rising up the levels of wealth index.

The households headed by females who have attained primary education have lower probability of rising up the levels of wealth index as compared to the households headed by males having attained the same level of education. However, there are no disparities for the households headed by both females and males who have attained secondary education and those who have attained tertiary education because the log-odds ratios are not significantly different.

Households headed by females in the age groups 15-20 years and in the age group 21-30 years have lower probability of moving to the next higher ordered category of wealth index as compared to households headed by males in the same age groups. However, there is no significant difference in the probabilities of rising up the categories of wealth index for households whose heads are in the age group 41-50 years, in the age group 51-60 years and in the age group 61-100 years. The independent odds for households whose heads are in these age groups also show that they are less likely to move to the next higher ordered category of wealth index.

For all categories of occupation, there is no significant difference between the probabilities of rising up the levels of wealth index for households headed by females and those headed by males.

4.4 Summary

The model estimated can be used to predict the possible category of wealth index for each observation of any new data set at a predictive accuracy of 50.55% as determined using a confusion matrix. This was used to compare the actual categories of the observations in the new data set with the predicted categories. The percentage of the correctly predicted categories of wealth index obtained was 50.55%.

5 Conclusion

5.1 Discussion

From the analysis done, the key indicators that predict the socio-economic status of a household include level of education of the head of household, the type of place of residence, the region where the household lives, occupation of household head, age of household head and interestingly the body mass index. The results from across the regions clearly indicate that households living in Nairobi have the highest probability of moving to the next higher category of wealth index as compared to households in all the other regions. This suggests that there is a great disparity of resources across the regions in Kenya and some regions are underprivileged. The most underprivileged regions as observed are Western and North Eastern regions of Kenya. The comparative analysis of the socio-economic status of households in Western Kenya concurs with the findings of the study Mwawuda & Nyaoke (2013) that female-headed households in Nyatike constituency, Migori county of Western Kenya are in abject poverty. However, both types of households in Western Kenya are equally less likely to move to the next higher category of wealth index.

Education for both men and women plays the most vital role in predicting the socio-economic status of households across Kenya. However, it influences the status of male-headed households more than it does for the female-headed households. Households headed by males who have attained tertiary education are 69 times more likely to rise up the levels of wealth index as compared to households whose heads have no education while households headed by females with tertiary education are 35 times more likely to rise up the levels of wealth index as compared to households whose heads have no education. Though the research by Geda et al. (2001) did not compare across different types of households, it similarly pointed out that education level of the household head is the most important factor that determines the socio-economic status of households in Kenya.

Surprisingly, households whose heads provide services as an occupation are better placed than for those who are in office employment. The returns are more promising in improving the household's

socio-economic status as compared to a monthly salary.

Household heads in the age group 31-40 years are at the prime of productivity and have a higher probability of moving to the next higher ordered category of wealth index. As noted, households whose heads are above 40 years are less likely to rise up the levels of wealth index as compared to households whose heads are in the age group 31-40 years.

From the comparative analysis done across the households, it is evident that the female-headed households in Nairobi and in Coast are underprivileged as compared to the male-headed households in the same regions. However, the disparity across households is insignificant in all the other regions even though they are less likely to move to the next higher ordered category of wealth index as compared to households in Nairobi which have the highest probability of upgrading the socio-economic status.

Of great concern is the households headed by both females and males in rural Kenya because they are 97% less likely to move up the categories of wealth index as compared to households in urban Kenya. Geda et al. (2001) pointed out that high poverty levels are concentrated in the rural areas in Kenya. The comparative analysis results concur with his findings and moreso clearly points out that both female-headed and male-headed households in rural kenya are equally deprived. There may be some other factors contributing to this very low probability of rural households improving on the socio-economic status as compared to the urban households.

Kiriti & Tisdell (2003) analyzed poverty, gender inequality and human development in Kenya using United Nations Development Programme's indicators but pointed out that these indicators were inadequate to capture the actual socio-economic status of households in Kenya. However, the study recommended the use of household level gender disaggregated data as the real measure of the socio-economic status. Having analyzed the socio-economic status of households using household level gender disaggregated data, the results obtained therefore is a clearer picture of the socio-economic status of households in Kenya.

This research paper has identified and analyzed the economic factors, socio-cultural factors and demographic factors affecting the socio-economic status of female-headed and male-headed households in Kenya. It has also drawn a comparison of the effect of each of the determinants

of the socio-economic status of the female-headed households with respect to the male-headed households in Kenya. As such, the objectives of the research are achieved.

5.2 Recommendations

5.2.1 Policies

From the findings of this research, there is evidence of great disparities between households living in rural Kenya and households living in urban Kenya which need to be addressed. Economic development initiatives such as light industries and income generating activities should be devolved across all regions of rural Kenya with more emphasis given to Western and North Eastern regions. This will ensure an improvement in the economic and social well-being of households in rural Kenya.

From the comparative results, service industry proves to be the most promising form of occupation. The service industry should be expanded and nurtured inorder to attract a significant number of service providers. This will in turn improve the quality of life of households.

The secondary school curriculum should be expanded inorder to include agricultural economics as one of the core subjects. This will equip the high school graduates with the necessary skills to engage in economic agricultural activities. This will improve the socio-economic status of households across regions.

5.2.2 Further Research

This research has used Kenya Demographic and Health Survey 2008-2009 data which was collected before the promulgation of the new Constitution of Kenya (2010). Included in the constitution is devolution of power and resources to the counties which are subdivisions of the former provinces. This was aimed at developing all regions of Kenya in order to eradicate poverty. The impact of devolution can be measured by conducting a study of the socio-economic status of households in Kenya using household level gender disaggregated data collected possibly 10 years after introduction of devolution.

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Appendices

A Appendix

Table 12. Wealth index and age of household head

		Age of household head						Total
		0	1	2	3	4	5	
Wealth index	0	574	44	527	322	172	138	1777
	1	375	14	283	206	110	91	1079
	2	329	11	281	188	92	84	985
	3	343	12	326	163	75	66	985
	4	515	16	484	180	38	20	1253
Total		2136	97	1901	1059	487	399	6079

Table 13. Chi-square

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	192.606[a]	20	.000
Likelihood Ratio	221.340	20	.000
Linear-by-Linear Association	71.555	1	.000
Number of Valid Cases	6079		

Table 14. Wealth index and place of residence

		Place of residence		Total
		0	1	
Wealth index	0	27	1750	1777
	1	43	1036	1079
	2	67	918	985
	3	279	706	985
	4	1051	202	1253
Total		1467	4612	6079

Table 15. Chi-square

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3349.532[a]	4	0.000
Likelihood Ratio	3306.951	4	0.000
Linear-by-Linear Association	2561.148	1	0.000
Number of Valid Cases	6079		

Table 16. Wealth index and level of education

		Level of education				Total
		0	1	2	3	
Wealth index	0	905	788	77	7	1777
	1	140	799	133	7	1079
	2	106	684	182	13	985
	3	72	623	247	43	985
	4	77	536	385	255	1253
Total		1300	3430	1024	325	6079

Table 17. Chi-square

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2272.812[a]	12	0.000
Likelihood Ratio	2085.437	12	0.000
Linear-by-Linear Association	1555.703	1	0.000
Number of Valid Cases	6079		

Table 18. Wealth index and religion

		Religion				Total
		0	1	2	3	
Wealth index	0	971	653	147	6	1777
	1	911	133	35	0	1079
	2	857	113	15	0	985
	3	835	134	13	3	985
	4	1034	175	19	25	1253
Total		4608	1208	229	34	6079

Table 19. Chi-square

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	714.446[a]	12	.000
Likelihood Ratio	671.848	12	.000
Linear-by-Linear Association	253.190	1	.000
Number of Valid Cases	6079		

Table 20. Wealth index and occupation

		Occupation					Total
		0	1	2	3	4	
Wealth index	0	510	939	87	197	44	1777
	1	425	397	63	166	28	1079
	2	359	352	50	191	33	985
	3	357	403	44	131	50	985
	4	536	497	76	20	124	1253
Total		2187	2588	320	705	279	6079

Table 21. Chi-square

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	399.369[a]	16	.000
Likelihood Ratio	437.625	16	.000
Linear-by-Linear Association	1.918	1	.166
Number of Valid Cases	6079		

Table 22. Wealth index and body mass index

		Body mass index					Total
		0	1	2	3	4	
Wealth index	0	394	1199	134	14	36	1777
	1	128	793	109	17	32	1079
	2	106	654	161	43	21	985
	3	79	649	180	52	25	985
	4	64	689	342	106	52	1253
Total		771	3984	926	232	166	6079

Table 23. Chi-square

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	598.258[a]	16	.000
Likelihood Ratio	595.319	16	.000
Linear-by-Linear Association	409.322	1	.000
Number of Valid Cases	6079		