CONSTRUCTION OF HOUSEHOLD ASSET-BASED WEALTH INDEX FOR EASTERN REGION, KENYA.

BY

ANNE MUTHONI KARIGI

SCHOOL OF MATHEMATICS
COLLEGE OF BIOLOGICAL AND PHSICAL SCIENCES
UNIVERSITY OF NAIROBI

A Research Project Submitted in Partial Fulfillment for the Degree of Master of Science (MSc) in Social Statistics.

July, 2014

DECLARATION

CANDIDATE:

This Project is my original work and has not been submitted for a degree or any other award in any other University or Institution of Higher Learning.

Signature................................ Date………:........................

Anne MuthoniKarigi

Registration No. I56/82345/2012

SUPERVISORS:

This project has been submitted with our approval as university supervisors.

Signature……………………….. Date……………………………..

Dr. Isaac KipchirchirChumba.

Signature………………………….. Date………………………………

Dr. John Ndiritu.

School of Mathematics

P.0. Box 30197-0010

NAIROBI.

ACKNOWLEDGEMENT

The completion of this study was made a reality through the joint effort and support of a number of persons of whom the author feels greatly indebted. First, I would like to record my deepest and most sincere appreciation to the University of Nairobi (Chiromo Campus, Department of Statistics) and my two supervisors Dr. Isaac KipchirchirChumba and Dr.John Ndiritu for their invaluable support, guidance and high professional counsel.

Secondly, myHeartfelt gratitude goes to my husband J.M Kithumbu and my children Joab, and Joan who were beside me in the most critical stage of my life. Their understanding, encouragement and endurance during my long nocturnal hours merits due recognition. And above all, to God be the glory, honor, and power for his immeasurable love, grace and favor; that enabled my dream for many years become a reality.

DEDICATION

To my children Joab and Joan, who to me is a humbling experience due to their patience while I attended to my classes up to very late in the evening. To my husband,J.M Kithumbu, who was beside in the most critical stage of my life.

ABSTRACT

There are growing concerns regarding inequities in health, with poverty being an important determinant of health as well as a product of health status. Within Eastern region Kenya, disparities in socio-economic position are apparent, with the rural-urban gap of particular concern. The aim of this study was to construct a wealth index for Eastern region Kenya to establish areas of inequalities in resource distribution.

The researcher used data from Kenya Demographic and Health Survey (KDHS) 2008. This data was on ownership of household durable assets, housing characteristics, and utility and sanitation variables in both rural and urban regions. Principal components analysis (PCA) was employed to generate household asset-based proxy indices. Household were grouped into quintiles, from wealthiest to the poorest.

Estimation of wealth index and wealth quintiles of a population in this study did not differ, if the population was first split into rural and urban sampled populations with estimating the wealth index for the entire sampled population.

This study concluded that proxy measures, as compared to direct measures of determining wealth are a reliable method. The wealth index findings in this study were in agreement with UNDP findings on poverty levels in Eastern region (40.8%).

ACRONYMS AND ABBREVIATIONS

DHS	Demographic Health Survey
EFA	Exploratory Factor Analysis
KDHS	Kenya Demographic Health Survey
PCA	Principal Components Analysis
PCs	Principal components
PFA	Principal Factor Analysis
PFs	Principal factors
SD	Standard Deviation
SES	Socioeconomic Status
UNDP	United Nations Development Programme
WI	Wealth index

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1.INTRODUCTION

1.1 Background to the Study

There are growing concerns regarding inequities in health, with poverty being an important determinant of health as well as a product of health status. Within the Eastern part of Kenya, disparities in socio-economic position are apparent and create the need to show urgent concern and come up with viable solutions to this problem. Poverty and people's health status are intimately connected, yet the relationship between them is complex and bi-directional. On one hand, ill-health may lead to economic poverty, or a decrease in expendable income due to high medical bills and /or via a direct reduction, or loss, of wages throughout an illness. On the other hand, poor health may result from poverty, including an inability to afford adequate nutrition, sanitation, housing, education and healthcare, and poverty- related lifestyle factors that increase disease risk and/or decrease access to medical facilities and services.

In general, poverty, income inequality, and natural resource degradation are severe problems in Kenya and more specifically in Eastern Keny. Kenya's poverty rates are among the highest in the developing world with Eastern region that includes Kitui, Machakos, Makueni, Embu, Isiolo, Marsabit, Meru, and Tharakanithi counties having poverty levels between 40.9 and 65.5 %. This has greatly affected the course of income distribution such that disparities in wealth levels should be among the most important social policy issues in the region. Inequalities continue to be widening both across and within different counties in this region. Since wealth levels are an important determinant of health, it is conceivable that, such disparities will lead to large gaps in health care provision within the Eastern part of Kenya.

In order to plan, implement and monitor health programs and other publicly or privately provided services in an equitable way, it is necessary to identify the poor, including individuals or households with low socio-economic status (SES), who might be more vulnerable to poor health outcomes. In many researches, measures of household wealth are done using income and expenditure data collected from the survey. However, income and /or expenditure gather information which has challenges because the data collected issometimes inaccurate and also consumption data requires extensive resources for household survey. Given the significance of the wealth index for economists and mostresearcher, there is a need for an accurate and economical way of getting wealth index in the survey report and economic modeling. This accurate and economical way of getting wealth index is by using household assets data and other socio-economic factors such as gende, age and education level to calculate the wealth index. Respondents are willing to give out their asset-ownership information than their income-expenditure information, thus becoming more accurate because there is less missing orinaccurate information.

From a public health point of view, the proxy wealth index approach is more useful than that of direct measures, since it explains the same, or a greater, amount of the differences between households on a set of health indicators than an income/expenditure index, while requiring far less effort from respondents, interviewers, data processors and analysts. Additionally, proxy measures might be more accurate approximations of wealth, as they measure financial stock ('permanent income') rather than flow ('current income'), and hence are less prone to fluctuation. This study seeks to demonstrate how household wealth index is determined using survey data.

1.2 Problem Statement

Households in the Eastern part of Kenya vary by levels of wealth. The extent, to which this relates to many variables of interes, is central to questions such as how to identify the poor in the Eastern region. In order to plan, implement and monitor development programs and other publicly or privately provided services in this region in an equitable way, it is necessary to identify the poo, including individuals or households with low socio-economic or household wealth, who might be more vulnerable to poor health and economic outcomes. This raises the question of how best to measure wealth or socio- economic status and how to indirectly and accurately derive the wealth index for this region from the widely available information gathered from the surveys. Kenya has developed many development plans, sessional papers and invested heavily in poverty alleviation and wealth creation. However, poverty levels remain high in Eastern region, Kenya. The UNDP report indicates that 40.8% of residents in this part of Kenya are poor. While several reasons could be attributed to the poor results in poverty alleviation and wealth creation, the method used to determine socio- economic status or wealth levels has probably been the main challenge. Development planning and decision making processes in Kenya generally, and Eastern region specifically are amongst other factors based on the poverty index which has many limitations and weaknesses. Though development research emphasises the importance of wealth index as a tool for planning; such an index has not been constructed for Eastern region, Kenya. This study seeks to fill this gap.

1.3Objectives

The overall objective of this study is to construct an asset- based wealth index for the Eastern region, Kenya.

The specific objectives are:

i. To construct wealth index for Eastern region, Kenya using principal components analysis, (PCA).

ii. To establish whether the wealth index differs significantly if the population is first split into rural and urban regions.

1.4Significance of the study

Wealth is a household characteristic that often has a large effect on health, social-economic and financial status of people in a given economy. The accurate measurement of wealth is critical in many areas of research, as it plays an important role as an outcome, a causal facto, and a control. Despite its importance, wealth is an ill-defined concept and therefore difficult to measure. As such, numerous studies have drawn on concrete measures of household income and consumption to capture wealth (Falkingham, 2000), but data on income and consumption are often fraught with measurement error and systematic biases associated with recall and sensitivity to question asked (Scott, 1990; Pradhan, 2000). More importantly,accurate income and expenditure data are not collected in many surveys, particularly in many developing countries with domestic production and informal transactions and in the survey focused on health and education. The measurement issues and the expense of implementing lengthy expenditure modules have led to search for a wealth proxy that is both accurate and easily collectable. The abundanceof data on asset ownership and housing characteristics in surveys such as the Demographic and Health Surveys (DHS) has promoted the use of such indicators as proxies for wealth.

The wealth index constructed in this study will allow for the identification of problems particular to the poor, such as unequal access to health care, poor access to social amenities as well as those particular to the wealthy, such as in Eastern region, Kenya, increased risk for infection with HIV.

1.5. Conceptual Definition of Terms

Asset- Resources owned by a household that have future economic value. For exampleequipment's, land, buildings, vehicles.

Wealth -A measure of the value of all the assets of worth owned by a person, community, company or country. It's the value of all natural, physical and financial assets owned by a household.

Proxy- Alternative way that leads to the same purpose or conclusion. It is the method of determining certain outcomes using calculable quantities or values when you do not have the ability to measure the exact value.

Household- Oneor more people who live in the same dwelling and also share at meals or living accommodation.

Index- Statistical measure of changes in a representative group of individual data points.

Principalcomponent analysis- Astatistical procedure that uses an orthogonal transformation to convert a set of observations of possible correlated variables into a set of values of linear uncorrelated variables called principal components.

Socio- economic status - An economic and sociological combined total measure of a person's work experience and of an individual's orthe family's economic and social position in relation to others, based on income, education, and occupation.

Poverty index-A measurement of how impoverished people are in different parts of the world based on factors such as life expectancy, low literacy levels, and overall living conditions.

Demography - Statistical study of human populations.

Population-The total number of persons under study inhabiting a country, city, or any district or area.

Survey -An investigation about the characteristics of a given population by means of collecting data from a sample of that population and estimating their characteristics through the systematic use of statistical methodology.

Demographic -Characteristics of a population.

Wealth index - A composite index composed of key asset ownership variables; it is used as a proxy indicator of household level wealth.

Correlation- Statistical measure that can show whether and how strongly pairs of variables are related.

Variables -An element, feature, or factor that is liable to vary or change.

CHAPTER 2.LITERATURE REVIEW

2.1. General Literature on Wealth Index.

The modern understanding of wealth is the abundance of valuable resources or material possessions. In a larger understanding of wealth, an individual, community, region or country that possesses an abundance of such possessions or resources to the benefit of the common good is known as wealthy. When analyzing a family's SES; the household income, earner's education and occupation are examined, as well as combined income. The main factors include income, Education, Occupation, Age and Gender of the household head.

To measure socio-economic status (SES), studies have used variables such as ownership of land (Filmer and Pritchett, 2001), farm animals and whether living in rented or owner-occupied housing (Schellnberg et al.,2003), literacy or education level of the head of household, demographic conditions (for example, the ratio of the number of people to the number of rooms in the household to proxy crowding), and other economic proxies such as occupation of head of household (Cortonorvis et al.,1993). Montgomery et al., (2000) identified the absence of a 'best practice' approach of selecting variables to proxy living standards, as, in many studies, variables were chosen on an 'ad-hoc' basis.

In the Demographic Health Surveys (DHS) information is collected on durable asset ownership, access to utilities and infrastructure (for examplesanitation facility and source of water), and housing characteristics (for examlenumber of rooms for sleeping and building materials). The wealth index is calculated using easy to collect data on household's ownership of selected assets, such as televisions and bicycles, materials used for housing construction, and types of water access and sanitation facilities.Socio-economic status (SES) or household wealth,can be measured on multiple levels. In the past it was mostly determined using an individual's education level, sometimes in combination with their occupation. Current approaches for measuring household wealth include ‘direct’ measures of economic status, including income, expenditure, and financial assets (for examplesavings and pensions), and ‘proxy’ measures (for example household durable assets, housing characteristics and access to utilities and sanitation).

The direct measures approach involves collecting data on income, expenditure, and financial assets such as savings and pensions. Wealth index is then constructed using such data. Direct measures can be expensive to collect and may require complex statistical analyses that are beyond the scope of many population wealth indices. In developing country settings in particular, large seasonal variability in earnings and a high rate of self-employment, together with potential recall bias and false reporting, may render such data inaccurate or even unreliable. The proxy measures approach involves the use of data collected on household durable assets, housing characteristics and access to utilities and sanitation.

Proxy measures are thought to be more reliable, since they require only data collected using readily available household questionnaires supported by direct observation .From a public health point of view, the proxy wealth index approach is more useful than that of direct measures, since it explains the same, or a greater, amount of the differences between households than an income/expenditure index, while requiring far less effort from respondents, interviewers, data processors and analysts. Due to the large volume of potentially redundant asset data produced, a data reduction technique known as exploratory factor analysis is often utilized. Exploratory factor analyses evaluate the most meaningful basis to re-express a large pre-determined set of variables, exploring the relationships between them and filtering out noise to reveal indicators that map most strongly to an underlying latent structure.

Two common methods of extracting that structure are principal components analysis (PCA) and principal factor analysis (PFA); which describe variation among the observed variables via a set of derived uncorrelated variables referred to as principal components (PCs) or principal factors (PFs) respectively. Although these two methods often yield similar results, the former (PCA) is preferred as a method for data reduction, while the latter (PFA) is widely used for detecting structure within the data. Based on the Inter-relationship between the set of variables, exploratory factor analysis also assigns weights to ownership of the assets. The weights correspond to the factor loadings of the first derived variable and are used to generate an index of relative wealth. Using weights derived through exploratory factor analysis may be a more appropriate method of assigning weights to the variables than the more simplistic equal weights method, the complex weighted-by-price-of-item approach or on an ad-hoc basis.

The wealth index is a composite measure of a household's characteristics that often has a large effect on health. The wealth index allows for the identification of problems particular to the poor, such as unequal access to health care, as well as those particular to the wealthy, such as, in Eastern region Kenya, increased risk for infection with HIV. Developed by the DHS program with partial funding from the World Bank, the DHS wealth index also allows governments to evaluate whether public health services, vaccination campaigns, education, and other essential interventions are reaching the poor.

The wealth index is particularly valuable in countries that lack reliable data on income and expenditures, which are the traditional indicators used to measure household economic status. The wealth index allows researchers to identify how much household economic status affects health outcomes by using both bivariate and more sophisticated multivariate method. Asset based wealth indices are widely used instruments for measuring the economicsituation of households in developing countries. Most household surveys currently available for these countries include such an index based on the possession of consumer durables and housing characteristics.

Few studies have attempted to verify the extent to which the asset-based index approach is a good proxy for household economic wealth. Concerns include the handling of publicly provided goods and services, and the direct effects of the indicator variables that make up indices, as well as ways of adjusting for household size and age-composition. By comparison, consumption or expenditure measures are much more reliable and are easier to collect than income, especially in most rural settings (Filmer and Pritchett, 2001). However, a limitation is the extensive data collection required, which is time-consuming and therefore costly. Rather than income or expenditure, data are collected for variables that capture living standards, such as household ownership of durable assets (for example, TV, car) and infrastructure and housing characteristics (for example source of water, sanitation facility).While asset-based measures are increasingly being used, there continues to be some debate about their use. Importantly, a key argument revolves around their interpretation. These measures are more reflective of long-run household wealth or living standards, failing to take account of short-run or temporary interruptions, or shocks to the household (Filmer and Pritchett, 2002).Falkingam and Namazie (2002) highlight another issue, that ownership does not always capture the quality of assets. For example, collecting information on TV ownership does not distinguish between better-off households that are more likely to own a newer orcolour or black and white one. However, they also point out that in many countries, this would not alter the overall picture of wealth. Another issue is that some variables may have a different relationship with socio- economic status across sub-groups; for example, ownership of farmland may be more reflective of wealth in rural areas.

The final issue is to aggregate over the range of different variables to derive a uni-dimensional measure of household wealth, and produce a range of critical points differentiating socio-economic levels. This is because each variable, used individually may not be sufficient to differentiate households' SES. More recently, studies have applied principal component analysis (PCA) to such data to derive a SES index and then grouped households into pre-determined categories, such as quintiles, reflecting different SES levels.

2.2. Asset Indices as a Proxy for Poverty Measurement in Africa

The recent debate on whether Sub-Saharan Africa has experienced a greater or lesser "growth miracle" in the last couple of decades than suggested by aggregate income and output data has brought to the fore the appropriateness of the asset index to measure welfare trends. The use of asset indices as proxies of for welfare, wealth, economic status and/or living standards have rapidly become very popular in social epidemiology and development studies following the seminal articles by Sahn and Stifel (2000) and Filmer and Pritchet (2001), who introduced the method in the context of the analysis of poverty, wealth and their correlates in low and middle-income countries. The reasons for this popularity include a number of claimed practical and theoretical advantages over more traditional money metrics, the indices' robust association with other outcome data across a range of contexts, and the fact that large data sets on asset ownership have been available for some time for numerous countries and years, namely due to the inclusion of a module on asset ownership and dwelling characteristics in the USAID - Sponsored Demographic and Health Surveys, which have been implemented since 1980s.

In the African context, asset indices have for some time suggested welfare trends quite distinct from those produced by other indicators. Specifically, they have provided a more optimistic picture of welfare improvement than trends based on the data from household surveys or national accounts (Sahn and Stifel, 2000), argue that the use of asset indices for these purposes is inappropriate, due to several methodological biases that will tend to over-estimate welfare improvements. Equally skeptically, Howe et al., (2009), argue that asset indices correlate poorly with consumption data, that they are poor at differentiating cross-sectional distribution of welfare, and that it is in fact not clear what it is that they really measure.Against this background, theoretical foundations of asset indices have been discussed in papers and what can be determined about their empirical soundness. Based on an examination of the indices' theoretical underpinnings and an appraisal of the available empirical evidence, we claim that asset indices do seem to hold out advantages to both academic and policy researchers working in African countries. However, we also argue that asset indices must be approached cautiously. Specifically, we argue that, in any one setting, the assets to be included in the index must be selected carefully and the technique used to compile it must be applied with caution.

Despite the investment to build up depleted statistical knowledge and capacity in African countries, poverty data based on household surveys of consumption or income remain poor. A number of authors point out that not all African countries have regular household surveys and that those that exist contain problems with reliability and compatibility. At the same time, we can have little confidence in the data on consumption that is obtained through the national accounts exercise, as this is usually computed as a residual and subject to a range of empirical errors.

Asset indices then provide an attractive alternative to measuring changes in either poverty (Sahn and Stifel, 2000), or consumption .Asset indices have been used for some time in sub-Saharan Africa, but it is with the advent of the USAID -funded Demographic and Health Surveys, that its use became widespread. Given the provision of data on household level welfare for countries where there was previously limited and/or unreliable data, the use of asset indices calculated from the DHS data to measure development outcomes has gained steady acceptance, not least because of the Sahn and Stifel (2000), work.Asset indices have been used for two purposes.The first and most common is to describe inequalities in various welfare outcomes among households. The list of welfare outcomes includes the experience of fever and malaria, child nutritional status, child mortality, and educational outcomes. The second use has been the most controversial and is to chart welfare trends over time. The starting point was the work by Sahn and Stifel (2000), who expressly argue that asset data should be used to calculate welfare trends investigations of welfare using asset indices have generally produced more optimistic findings than those using poverty or consumption data.

Among the assets that are typically included in asset indices, some are significantly cheaper than others and, as a consequence, more households, including poorer ones, will tend to own them. However, there is seldom a neat correspondence whereby asset 1 is only owned by the wealthiest households (and owned by all of those households), asset 2 by the wealthiest as well as the slightly less wealthy, asset 3 by the wealthiest, the slightly less wealthy and the relatively well-off, and so on.

The results of a PCA-based analysis by , for example, show “living space per person” to be such an inferior good in a sample made up of Russian households- a seemingly puzzling conclusion that is explained by the fact that both less living space per person and ownership of most assets are positively associated with urban living. Amongst each ofthe “urban” and “rural” sub-samples, however, living space per person is a normal, not inferior good. An asset index computed for Gunea–Bussau found that portable gas stoves were found to be highly valued in one of the villages but not in the other (for locally-specific cultural reasons having to do with the value assigned to add privacy compared to cooking outdoors). This effect,which plausibly accounts for ‘clumping’ in many asset indices exercises, serves to illustrate two more general points: first, that asset ownership is often very strongly influenced by factors other than household wealth; second, that they may be quite different consumption norms or “idioms” among even quite proximate geographical settings. This is most obvious across the rural-urban divide, but, as latter example from Guinea-Bissau illustrates, it may also apply within rural or urban samples.

2.3. Wealth Index Measurement in Kenya.

There are several steps to the construction of the DHS wealth index: determination of indicator variables, dichotomization, calculation of indicator weights and the index value, and calculation of distribution cut points. The selection of indicator variables is relatively straight forward. Almost all household assets and utility services are included, including country-specific items.

The reason for using a broad criterion rather than selected items is that the greater the number of indicator variables, the better the distribution of households with fewer households being concentrated on certain index scores. Generally, any item that will reflect economic status is used.

Two additional items are constructed for most surveys: whether there is a domestic servant and whether the household owns agricultural land. The first is constructed by examining the occupation of interviewed members who are not related to the head of the household. If the respondent or spouse works as a domestic servant and is not related to the head of the head, then the household is considered to have a domestic servant. The second is based on interviewed members. If any interviewed member (related to the head or not) or interviewed member's spouse works his/her own or his/her family's land, then the household is considered to own agricultural land. To determine the weights and apply them to form the index, it is necessary to break these variables into sets of dichotomous variables, (Yes or No) to indicate the ownership of each asset (Vyass and Kumaranayake, 2006).

Many times there is no obvious ordering of the categories. For example, are wealthier people more likely to use carpet or ceramic tiling than parquet? A possibility would be to collapse these categories into a single one, but doing so would decrease the distinctions that could be made between households on the index. Some categories are routinely collapsed in constructing the wealth index. The category “surface water” includes supplies of drinking water from “river”, “pond”, and “stream”, since the differences between these categories have more to do withlocation of source than wealth. There are various ways to assign weighting values to the indicator variables. Ad hoc weights, such as assigning “1” for a bicycle, “3” for a motorcycle, and “5” for a car or track, work to a certain extent, but they are arbitrary with regard to researcher and are difficult to assign when the wealth ordering is not readily apparent. For this reason, Filmer and Pritchett (2000) recommended using principal components analysis (PCA) to assign the indicator weights, the procedure that is used for the DHS wealth index. DHS uses the SPSS factor analysis procedure. This procedure first standardizes the indicator variables (calculating –z-scores); then the factor coefficient scores (factor loadings) are calculated, and finally, for each households, the indicator values are multiplied by the loadings, and summed to produce the household’s index value. In this process, only the first of the factors produced is used to represent the wealth index. The resulting sum is itself a standardized score with a mean of zero and a standard deviation of one.

Other procedures have been suggested instead of PCA. One is to use the inverse of the proportion of households with an asset or service as the weight for the indicator. The thinking behind this procedure is that the costlier an item, the wealthier a household needs to be to possess one, giving the highest weights to the least possessed assets. Presumably, “negative” assets”, such as “ having a dirt floor”, would be used as inverses (“not having a dirt floor”). One of the problems with this weighting scheme is that certain assets, such as motorcycles, may be rare since better substitutes, such as a car or truck, are possessed by wealthier households. Additionally, certain items, such as drinking water from a spring, are rarely used, and when they are used, it is used, it is usually by poorer people.

The characteristics of the head of household are important to the living conditions of all household members, that is; sex, age, education, and marital status of the head. A common premise is that many poor households are headed by women, usually single mothers, widow, or women who have been abandoned. However, study results have shown that overall, only one in six households in the lowest quintile are headed by women and that women-headed households tend to be somewhat wealthier. Indeed, even in Sub-Saharan Africa, where more than a fifth of poor households are headed by women, the percentage of female-headed households is higher in the richer households. The marital status of the household head is determined by whether a spouse is a member of the household; studies have shown that there are small differences in marital status by wealth. Overall, there is little difference by wealth quintile in the age of the head of the household. There is difference in the household's economic status based on the number of years of education of the head of the household.

CHAPTER 3: METHODOLOGY

3.1. Characteristics of Study Area.

This study utilized Kenya's Demographic and Health Survey (KDHS) 2008 data for Eastern region. Eastern region was initially known as Eastern Province before the new constitution 2010 came into being. Currently, it comprises of eight counties namely; Embu, Meru, Tharaka Nithi, Isiolo, Marsabit, Kutui, Makueni and Machakos. This region is approximately 24,033km^2 with a human population of 4,128,000 as per the 2009 census and a population density of 16,000 people per square km. The majority of the population 57.3% is aged between 15 to 64 years while those aged between 0 to 14 years account for 37.5% and the rest being over 65 years.

Eastern region occupies among the most prime fertile lands in the Kenyan highlands, with its weather favourable for a variety of agricultural activities. Economic activities include growing of food crops like maize, beans and millet; cash crops like coffee, tea and tobacco. There is also livestock keeping like goats, sheep, and chicken. Poverty levels in this region however stand at 40.8% with dependency ratio being 100:74.7. This study area was chosen because there is available data and the poverty levels are relatively high which requires urgent attention. Iequally have special interest in poverty eradication and sustainable development based on proper utilization of the available resources by both the County governments in conjunction with the National Government.

3.2. Data Description

The 2008 KDHS data used in this study is a nationally representative sample survey of 8,444 women age 15 to 49 and 3,465 men age 15 to 54 selected from 400 sample points (clusters) throughout Kenya. It is designed to provide data to monitor the population and health situation in Kenya as a follow up to the 1989, 1993, 1998, and 2003 KDHS surveys. Since for this study the data for Eastern region is a subset of the KDHS 2008 dataset, the sampling design is summarized as follows: The survey utilized a two-stage sample based on the 1999 population and housing census, 400 sample points (clusters) were selected throughout Kenya.

The researcher in this study adopted both probability and non-probability sampling techniques. Because of the nature of this study (diagnostic), and the study population (heterogeneous), stratified random sampling was adopted in getting the sample. Stratified random sampling was employed because it gave each household equal chance of falling in the sample and hence minimizing biases. The sample is therefore expected to be very representative. The key target groups were the households. Data was collected by use of questionnaires administered during an interview.

Data collection took place over a three-month period, from 13th November 2008 to late February 2009.The questionnaires were administered to the head of household. Measures of household wealth included presumed proxies of wealth, income living conditions and education. Some of these indicators used in this study were: household assets, housing conditions, household head education level and gender, and the number of people in the dwelling units.Household assets ownership was considered using an index of currently owned household and productive assets: refrigerator, television, radio/tape recorder, mattress and bed, bicycle, etc. Assets in the index were those mostly included in asset indices used to estimate wealth.

Household conditions were included in the survey dataset based on the interviewer observation and therefore the data is most reliable and deemed accurate. Measures of housing conditions included: roof, floor and wall material of the main dwelling unit in the household. These measures are weighted to harmonize and reduce household variations in the data. House and land ownership is highly influenced by economic power of the household in Kenya and hence an important measure in this study. These variables were considered as dichotomous measures in this study unlike the variable measured in the KDHS data.

The head of each household was invited to respond to the questions; if the household head was absent on the day of interview, the interviewer returned to that area of residence the following day, for up to 14 days, after which the next of kin was asked to respond.

The index is a range of 1 to 20 where land and home ownership account for five points which is the highest and maximum in this study, roof and floor type for two points maximum and other assets one point maximum. Answers and responses were solicited for covering the following areas:

- Types of assets owned and their availability in the household
- Gender of the household head
- Education level of the household head
- Number of children who are in living in the dwelling unit
- Household location; either rural or urban.

Questionnaire method was adopted for data collection in this study because they are easier to administer and follow. A questionnaire provides stimulus to all the subjects and the respondent is not influenced by the researcher.

The questionnaire was designed to collect the following information:

Could you tell me if you have the following in your house:		Response	
Television		(1) Yes	(0) No
Refrigerator		(1) Yes	(0) No
Clock		(1) Yes	(0) No
Radio		(1) Yes	(0) No
Cellular phone		(1) Yes	(0) No
Vehicle		(1) One	(0) No
		(2) Two	
		(3) Three	
Solar panel		(1) Yes	(0) No
Microwave oven		(1) Yes	(0) No
Indoor plumbing		(1) Yes	(0) No

Once this data was obtained in raw form, the key question was how to compute a wealth index based on household assets that enjoy internal validity; in other words, a wealth indicator that is able to effectively discriminate between economically well-off and worse-off individuals.

One common choice, frequently used in the analysis of Latin American Public Opinion Project (LAPOP) surveys in the past, is to create an index based on the “count” of household assets.The rationale has been that since there is no a “priori” way of weighting the various assets, assuming an equal weight of each was a reasonable way to precede. This approach, however, can lead to inaccurate results since two individuals with very different economic resources and therefore standards of living can be assigned the same wealth score. For example, an individual who has an indoor plumbing and who owns a television would be assigned the score as one with indoor plumbing and who owns a car; obviously, using this methodology could result in large measurement error by underestimating the wealth of the individual with a car. Instead, a more appropriate methodology is adapted and will be used in this study to compute the wealth index. This method weights luxury assets more heavily in the distribution of household assets. In order to make these weights non-arbitrary and replicable, we calculate them systematically, based on the principal component analysis (PCA).

Before we get into the PCA details we wish to note the issue of how to compute a wealth index that will work across space; that is, we want to be able to compare individuals who live in rural areas versus urban areas, but we know that in many rural areas in Eastern region, Kenya public services such as potable water and electricity are not widely available, whereas in the urban areas they are. We do not want to call an individual "poor" if she lives in the rural area, without water or electricity, yet owns a car, a cell phone etc. Thus, our index must be sensitive to contextual variation in terms of location.

3.3. Principal components analysis (PCA).

Principal components analysis (PCA) is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. This transformation is defined in such a way that the first principal component has the largest possible variance (that is, it accounts for as much of the variability in the data as possible), and each succeeding component in turn has the highest variance possible under the constraint that it is orthogonal to(uncorrelated with) the preceding components. The method is mostly used as a tool in exploratory data analysis and for making predictive models.PCA can be done by eigenvalue decomposition of a data covariance (or correlation) matrix or singular value decomposition of a data matrix, usually after mean centring (and normalizing or using z-scores.)

The aim of PCA is dimension reduction, more precisely, to describe the variation in a set of correlated x variables, $x_1, \dots, x_p$ in terms of a new set of uncorrelated variables $y_1, \dots, y_q$ each of which is a linear combination of the x variables; where $q < p$.

3.3.1. Algebraic Basis of Principal Component Analysis (PCA)

The first principal component of the observations y_1, is the linear combination;

$$y_1 = a_{1_1}x_1 + a_{1_2}x_2 + \cdots + a_{1q}x_q = \mathbf{a}_1' \mathbf{x} \qquad (1)$$

whose sample variance is greatest among all such linear combinations.

Since the variance of y_1 could be increased without limits simply by increasing the coefficients $a_{11}, a_{12}, \dots, a_{1q}$ (which is written as the vector $\mathbf{a}_1$), a restriction must be placed on these coefficients. Thus, $\mathbf{a}_1$ is such that:

$$\mathbf{a}_1' \mathbf{a}_1 = 1 \qquad (2)$$

The second principal component y_2 is the linear combination

$$y_2 = a_{2_1}x_1 + a_{2_2}x_2 + \cdots + a_{2q}x_q = \mathbf{a}_j' \mathbf{x} \quad ; (3)$$

which has the greatest variance subject to the following two conditions:

$a'_2 a_2 = 1$ (4)

$a'_1 a_2 = 0$

The second condition ensures that y_1 and y_2 are uncorrelated. Similarly the j^{th} principal component is that linear .

$$y_j = a'_j x \quad (5)$$

which has the greatest variance subject to the conditions

$$a'_j \ a_j = 1 \quad (6)$$

$$a'_j a_i = 0 \ (i < j)$$

The elements of $a_1, a_2, \dots, a_q$ satisfying these conditions corresponds to the eigen-vectors of S for the respective eigenvalues $\lambda_1, \lambda_2, \dots, \lambda_q$.

If the eigenvalues of S are $\lambda_1, \lambda_2, \dots, \lambda q$, then since

$$a'_i a'_i = 1 \quad (7)$$

then the variance of the i^{th} principal component is λ_i. The total variance of the q principal component will enqual the total variance of the original variable

$$\sum_{i=1}^{q} \lambda_1 = S_1^2 + S_2^2 + \dots + S_q^2 \quad (8)$$

Where s_1^2 is the sample variance of x_i we can write this more concisely as

$$\sum_{i=i}^{q} \lambda_i = trace(s) \quad (9)$$

Consequently, the j^{th} principal component accounts for a proportion p_j of the total variation in the original data is given by

$$p_j = \frac{\lambda_j}{trace\,(S)} \,. \quad (10)$$

The principal components derived from the covariance matrix S will depend on essentially arbitrary choice of units of measurement. To remove the effect of units of measurement and make variables equally important we perform PCA on the correlation matrix. That is performing PCA on the standardized variables.

3.3.2. Summarizing sample variation by principal components

Suppose the data $x_1, x_2, \dots, x_n$ represent n independent drawing from some p-dimensional population with mean vector μ and the covariance matrix $\sum$. These data yield the sample mean x and the sample covariance matrix S.

Recall that the n variables of any linear combination given by equation (1),has sample mean $a_1'x$ and sample variance $a_1'Sa_1$. The pair $a_1'x, a_2'x$ for the two linear co1mbination, have sample covariance $a_1'Sa_2$.

The principal components are defined as those linear combinations which have maximum sample variance such that:

- 1^{st} sample principal component refers to linear combination given by equation 1 that maximizes the sample variance of a_1' S a_1 subject to equation (2).

- 2^{rd} sample principal component refers to linear combination given by equation (3) that maximizes the sample variance of a_2' Sa_2 subject to equation (4)and zero sample covariance for the pairs $a_1'x_1, a_2'x_2$

- j^{th} sample principal componentrefers to the linear combination given by equation (5) that maximizes the sample variance of $a_j' Sa_j$ subject to equation (6) and zero sample covariance for all pair $(a_1(i)^{Tr} x_1j\ a_1k^{Tr} x_1j)$; $\kappa < i$

If S=$((s_{ik}))$ is the pxp sample covariance matrix with eigenvalue-eigenvector pairs (λ_j, e_j)$j = 1,2, \ldots, q$. The j^{th} sample principal componen is given by

$$y_j = e_j' x \qquad j = 1,2, \ldots, q \tag{11}$$

Where $\lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda_q \geq 0 \quad and$

Var$(Y_1 j)$ $= \lambda_j \;.j = 1,2, \ldots .q \qquad and \qquad (12)$

Cov$(Y_1 j.Y_1 K = 0 \;, \qquad j \neq k \;, j, k = 1,2, \ldots, q$ (13)

In addition, the total sample variance is given by equation (8).

3.3.3. Choosing the number of components

Different ad hoc methods are used to select the number of principal components to retain; namely,

1. Retain just enough components to explain some specified, large percentage of total variation of the original variables. Values between 70% and 90% are usually used.

2. Exclude those principal components whose eigen values are less than the average $\sum_{i}^{q}\frac{\lambda_i}{q}$ since $\sum_{i}^{q}\lambda_i = trace(S)$. The average eigen value is also the average variance of the xi'^s .

3. When the components are extracted from the correlation matrix trace $(R) = q$, (the dimension), and the average is thus 1. Components with eigen value less than one are therefore excluded. Better to exclude components extracted from a correlation matrix whose associated eigen values are less than 0.7.

4. Examination of the λ_i against i , the so called scree plot diagram. The number of components selected is the value of i corresponding to an " elbow" in the curve, this point being considered to be where " large" eigen values cease and "small" eigen values begin.

3.3.4. Calculating principal component scores

If we need say, m principal components using any of the methods above, then we will generally wish to calculate the scores on each of these component for each individual in our sample, for example having used S, the m principal components scores for individual i with original $px1$ vector of variable value x_i, are obtained as;

$$y_{ij}=\boldsymbol{a}_j'\boldsymbol{x}_i, \qquad i = 1,2,\ldots,n\ ;\ j = 1,2,\ldots,m. \qquad (14)$$

If the components are derived from the correlation matrix then x_i would contain individual i 's standardized score for variable.

The principal components scores calculated as above have variance equal to λ_j , $j = 1,2,\ldots,$ m.

The principal scores with mean zero and variance 1 are,

$$Z = \Lambda^{-1} A_m' \quad (15)$$

Where, Λ_m is mxm diagonal matrix with $\lambda_1, \lambda_2, \dots, \lambda_m$ on the main diagonal, and

$$A_m = [a_1\ a_2\ \dots\ a_m] \quad (16)$$

Is a pxm matrix and x is the $px1$ vector of standardized scores.

3.4. Constructing the Wealth index using(PCA.)

This study implemented a weighting system for constructing wealth indices based on the assets that relies on principal component analysis (PCA). Filmer and Pritchett (2001), popularized the use of PCA for estimating wealth levels using asset indicators to replace income or consumption data. Based on their analysis of household assets for India and the validation of their results using both household assets and consumption data for Indonesia, Pakistan, and Nepal, they concluded that PCA “provides plausible and defensible weights for an index of assets to serve as a proxy for wealth” (Filmer and Pritchett, 2001).

Filmer and Pritchett (2001),noted that asset-based measures depict an individual or a household’s long-run economic status and therefore do not necessarily account for short-term fluctuations in economic well-being or economic shocks. Thus, although we expect the income variable to be correlated with the wealth measure here estimated, we are aware that the two might tap different dimensions of economic well-being, as previous studies have found .Following Filmer and Pritchett (2001), many other studies, especially in the fields of economics and public policy, have implemented and recommended the use of PCA for estimating wealth effects Vyass and Kumaranayake, 2006.

Formally, the wealth index for household i is the linear combination,

$$y_i = \sum_{k=1}^{p} \alpha_k \left(\frac{x_{ki} - \overline{x}_k}{s_k}\right), i = 1,2, \ldots .n \qquad (17)$$

Where x_{ki} is asset k for i^{th} household, $\overline{x}_k = \frac{1}{n}\sum_{i=1}^{n} x_{ki}$ is the mean of asset k, s_k is the standard deviation of asset k, α_k is the weight for the k^{th} asset with respect to the first principal component.

By definition the first principal component variable across households or individuals has a mean of zero and a variance of λ which corresponds to the largest eigenvalue of the correlation matrix of x . The principal component yields a wealth index that assigns a larger weight to asset that vary the most across households so that an asset found in all households is given a weight of zero (McKenzie, 2005). The first principal component or wealth index can take positive as well as negative values. The wealth index here estimated is based on 1127 respondents from Eastern region, Kenya; 1049 of which are from the rural areas and 78 respondents from the urban areas.

3.5. Procedure of Estimating the Wealth Index:

3.5.1. Indicator Variables.

To determine the indicator variables, all the household assets and utility services from the KDHS (2008) data set were included. The reason for using a broader criterion rather than assets only, as it's common in most demographic surveys in wealth index construction is because the greater the number of indicator variables, the better the distribution of households with fewer households being concentrated on certain index scores.

Given that many variables were used in wealth construction, there was need to categorize them mainly as they were captured in the survey. The identified variables were all set to dichotomous variables as (1=yes, 0=No): This was done using the SPSS syntax for dichotomization .

3.5.2. Calculation of Indicator Weights and Index Value.

Calculation of indicator weights and index value was done using PCA. This procedure first standardizes the indicator variables, then the factor coefficient score (factor loadings) are calculated and finally, for each household, the indicator values are multiplied by the loadings and summed up to produce the household's index value. In this process only the first of the factors produced is used to represent the wealth index. This is because the first principal component variable across households or individuals has a mean of zero and a variance of λ . The principal component yields a wealth index that assigns a larger weight to asset that vary the most across households. The first principal component or wealth index can take positive as well as negative values.

3.5.3. Calculation of the Wealth Quintiles.

For tabular analysis with the KDHS 08 eastern region wealth index, Quintiles are used. Quintiles are used instead of other percentiles as a compromise between limiting the number of categories to be tabulated and adequately representing the relationship between wealth and the phenomenon of interest. The cut points in the wealth index at which to form the quintiles are calculated by obtaining a weighted frequency distribution of households, the weight being the product of the number of permanent members of the household and the sampling weight of the household. Thus, the distribution represents the regional household population, where each member is given the wealth index score of his or her household. The persons are then ordered by the score, and the distribution is divided at the points that form the five 20- percent sections. Then the household score is recoded into the quintile variable so that each member of a household also receives that household's quintile category.The four steps of wealth construction were performed through the use of the Statistical program for Social Sciences SPSS.

CHAPTER 4.DATA ANALYSIS AND RESULTS.

4.1. Descriptive Analysis

The wealth index took into account the distribution of assets in urban and rural areas in order to reflect the household's economic conditions. Table 2.Shows the distribution of residents both in the urban and the rural areas.78 residents were from the urban area while 1049 were from the rural area. Figure 1 (Bar chart) summarises the results for the type of place of residence for the 1127 households, 1049 from rural area and 78 from the urban area.

Appendix 1 outlines all the variables that were used to construct the wealth index for each of the 1127 households.

Table 1: Type of Place Of Residence

		Region	Total
		Eastern	
Type of place of residence	Urban	78	78
	Rural	1049	1049
Total		1127	1127

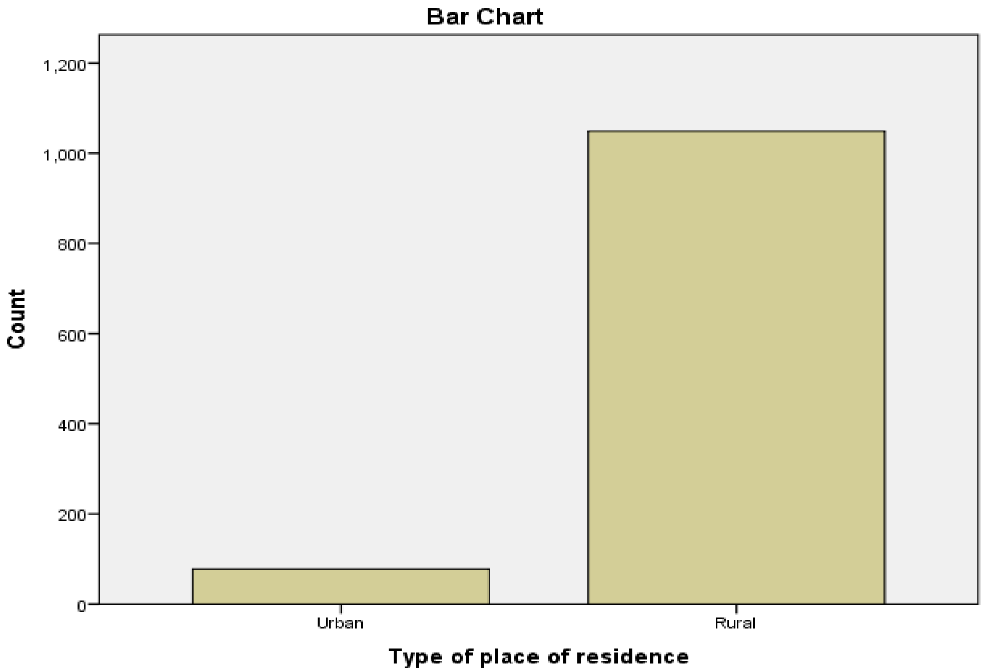


Figure 1: Type of Place of Residence

Figure 1 shows that 1049 households who were interviewed from this region were from the rural areas while 78 households were from the urban areas.

Table 2 shows the frequencies of the variables that were available for each household in part. The complete frequencies for the 1127 households is shown in appendix 2.

Table 2.Frequencies.

		Water source:piped into dwelling	water source:piped to yard/plot	public tap/ standpipe	Tube well or borehole	Protected well
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Unprotected well	Protected spring	Unprotected spring	River/dam/lake/pond/stream etc	Rain water
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Tanker truck	Cart with small tank	Bottle water	Flush - to piped sewer system	Flush - to septic tank
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Flush - to pit latrine	Flush - dont Know where	Pit latrine - ventilated improved pit (VIP)	Pit latrine - with slab	Pit latrine - without slab/open pit
N	Valid	1127	1127	1127	1127	1127

4.2. Principal components analysis (PCA).

4.2.1. Dichotomization of indicator variables.

The identified variables were all set to dichotomous variables as (Yes=1, No=0). This was to categorize them mainly as they were captured in the survey. Table 3 shows the results of dichotomization in part. The full table is indicated in appendix 3.

Table 3. Dichotomized variables

* Water sources.
* surface water includes all means water can be obtained from the surface. variable label unpwel 'Unprotected well'. COMPUTE pipedwel=0. if V113=11 pipedwel=1.
variable label pipedwel ' Water source:piped into dwelling' . COMPUTE pipeyard=0. if V113=12 pipeyard=1.
variable label pipeyard 'water source:piped to yard/plot'. COMPUTE pubtab=0. if V113=13 pubtab=1.
variable label pubtab 'public tap/ standpipe'. COMPUTE tubwelbor=0. if V113=21 tubwelbor=1.

variable label tubwelbor 'Tube well or borehole'. COMPUTE prowel=0. if V113=31 prowel=1.
variable label prowel 'Protected well'.

4.2.2. Determination of principal components and indicator weights.

Table 4 shows the first principal components in part. The full list is shown by appendix 4.

Table 5 shows part of the factor scores (weights) computed from the first principal component.

The full list is in appendix 5.

Table 4.Principal components.

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	4.735	10.760	10.760
2	2.403	5.462	16.223
3	1.844	4.191	20.414
4	1.732	3.935	24.349
5	1.601	3.638	27.987

Table 5. Factor score(weights) of first principal components.

	Component
	1
Water source:piped into dwelling	.354
water source:piped to yard/plot	.285
public tap/ standpipe	-.055
Tube well or borehole	-.026
Protected well	-.084
Unprotected well	-.157
Protected spring	-.064
Unprotected spring	-.106

4.3. Constructing the wealth index and wealth quintiles.

Table 6 shows the wealth scores for the 1127 households in part, the full list in appendix 6.

Table 6.Wealth scores (index).

		Frequency	Percent	Cumulative Percent
Valid	-.89413	39	3.5	3.5
	-.87451	33	2.9	6.4
	-.85220	5	.4	6.8
	-.85099	10	.9	7.7
	-.84415	4	.4	8.1
	-.83607	1	.1	8.2
	-.82877	12	1.1	9.2
	-.81677	1	.1	9.3
	-.81086	9	.8	10.1
	-.79823	31	2.8	12.9
	-.79502	5	.4	13.3
	-.77861	2	.2	13.5
	-.75630	14	1.2	14.7
	-.75509	3	.3	15.0
	-.74826	1	.1	15.1
	-.73288	3	.3	15.4
	-.73121	25	2.2	17.6
	-.71497	10	.9	18.5
	-.71160	7	.6	19.1
	-.69913	12	1.1	20.1
	-.69095	1	.1	20.2
	-.68973	2	.2	20.4
	-.68929	3	.3	20.7
	-.68807	1	.1	20.8
	-.68124	4	.4	21.1
	-.66586	10	.9	22.0
	-.65386	4	.4	22.4
	-.64961	2	.2	22.5
	-.64795	5	.4	23.0
	-.64624	4	.4	23.3
	-.63658	1	.1	23.4
	-.63532	28	2.5	25.9
	-.62393	2	.2	26.1
	-.62272	1	.1	26.2
	-.62100	2	.2	26.4
	-.61815	1	.1	26.4
	-.61570	12	1.1	27.5
	-.61466	1	.1	27.6
	-.61193	3	.3	27.9
	-.60139	2	.2	28.0
	-.59504	8	.7	28.7
	-.59339	13	1.2	29.9
	-.59218	11	1.0	30.9
	-.58850	2	.2	31.1
	-.58535	5	.4	31.5
	-.58259	2	.2	31.7
	-.57977	1	.1	31.8

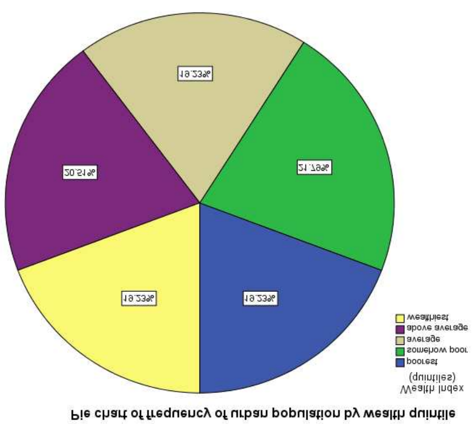
4.3.1. Wealth quintiles for the urban region

Table 7.Wealth quintile for urban region.

		Frequency	Percent	Cumulative Percent
Valid	Poorest	15	19.2	19.2
	somehow poor	17	21.8	41.0
	Average	15	19.2	60.3
	above average	16	20.5	80.8
	Wealthiest	15	19.2	100.0
	Total	78	100.0	

This table shows that 41.0% of the househplds in Eastern region, Kenya are poor (19.2+21.8), and only 19.2% being wealthiest.This has been represented using a pie chart (figure 2).

Figure 2: Pie Chart of Frequency of Urban Population by Wealth Quintile



4.3.2. Wealth quintile for rural areas

		Frequency	Percent	Cumulative Percent
Valid	Poorest	212	20.2	20.2
	somehow poor	199	19.0	39.2
	Average	221	21.1	60.2
	above average	207	19.7	80.0
	Wealthiest	210	20.0	100.0
	Total	1049	100.0	

This has been represented using a pie chart (figure 3).

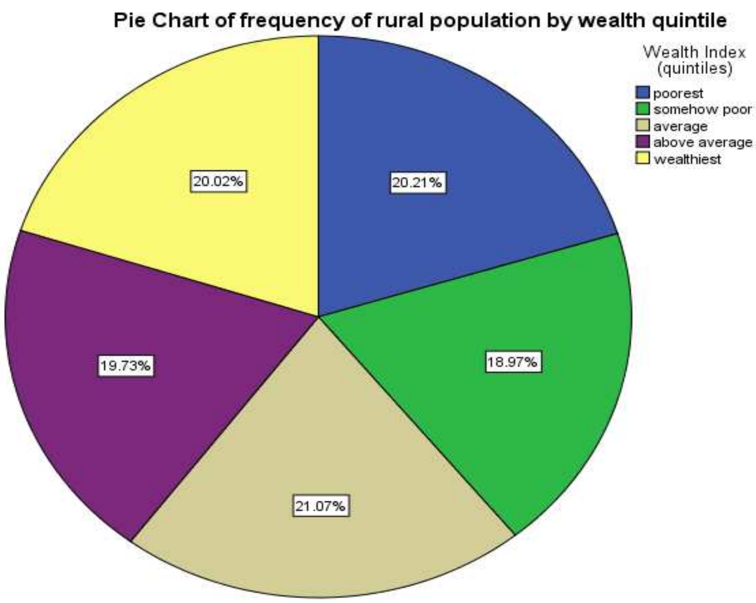


Figure 3: Pie Chart of Frequency of Rural Population by Wealth Quintile

This shows that 39.2% of households in the rural area are poor. The wealthiest form 20%.

4.3.3. Wealth quintile for combined region.

		Frequency	Percent	Cumulative Percent
Valid	poorest	227	20.1	20.1
	2	222	19.7	39.8
	3	227	20.1	60.0
	4	226	20.1	80.0
	wealthiest	225	20.0	100.0
	Total	1127	100.0	

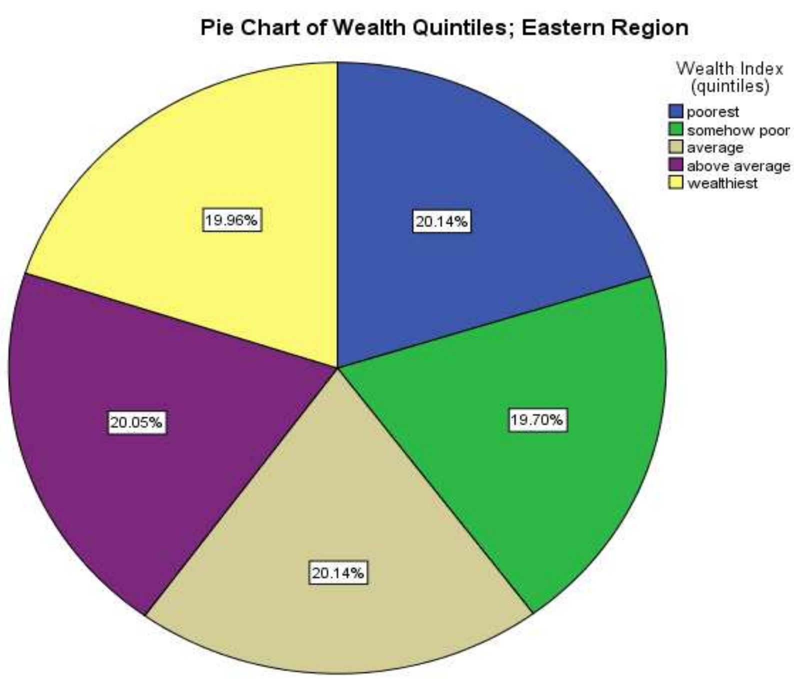


Figure 4: Pie Chart for the combined region region

This shows that 39.8% of households in Eastern region are poor. The wealthiest form 20.0%.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS.

5.1. Conclusions.

1.This study concludes that proxy measures, as compared to direct measures of determining wealth are a reliable method. The wealth index findings in this study were in agreement with findings by UNDP on poverty levels in Eastern Region of Kenya (UNDP 1999).This asset index provides an attractive alternative to measuring changes in either poverty or consumption in this region. This Asset index constructed to Eastern region, Kenya can be used to describe inequalities in various welfare outcomes among households. The internal validity of the wealth index as indicated identified the areas that require urgent attention for purposes of improving the livelihoods of the people in this region. Majority of the poor people in this region (98.1%) for instance do not have access to safe and clean water in their areas of residence. This is an area that needs to be addressed soonest possible.

2.Estimation of wealth index and wealth quintiles for the population in this study did not significantly differ, if the population was first split into rural and urban sampled populations with estimating the wealth index for the entire sampled population. This meets the second objective. This is even after most assets and accessed facilities in urban region being dropped for non-existence in the urban region but they existed in the rural region.The wealth index for the urban region plus wealth index for rural region divided by two was equal to the wealth index the whole region when computed without splitting the region.

5.2. Recommendations.

1. This study employed principal components analysis in the construction of the wealth index, however further research is recommended to compare (PCA) with other mehods like principal factor analysis (PFA).

2. Wealth is known to have a relationship with other socio-economic factors like gender of household head, education level of household head, age of household head among others. This study did not run a correlation to establish existence of such relationship between the wealth index and such factors. Further research is therefore recommended to establish the relationship between the wealth index an and socio-economic factors.

3.This study employed the use of quintiles based on the index to evaluate the characteristics of the poor and the rich.However, further research is recommended on the use of other methods like percentiles instead of quintiles to evaluate the characteristics of the poor and the rich.

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APPENDIX 1 : VARIABLES

Water sources;

- Piped into a dwelling
- Piped to yard / plot
- Public tap / stand pipe
- Tube well or borehole
- Protected well
- Unprotected well
- Protected spring
- Unprotected spring
- River / dam / lake / pond
- Rain water
- Tanker truck
- Cart with small tank
- Bottle water

Type of toilet facilities

- Flush toilet
- Flush – to piped sewer system
- Flush – to septic tank
- Flush – to pit latrine
- Flush – to somewhere else
- Flush – don’t know where
- Pit latrine
- Pit latrine – ventilated improved pit (VIP)
- Pit latrine – with slab
- Pit latrine – without slab / open pit
- No facility
- Bush/ field

- Composting toilet
- Bucket toilet
- Hanging toilet / hanging latrine

Type of cooking fuel

- Electricity
- LPG / natural gas
- Biogas
- Kerosene
- Coal / lignite
- Charcoal
- Wood
- Straw / shrubs / grass
- Agricultural crop
- Animal dung

Main floor material

- Natural
- Earth, sand
- Dung
- Rudimentary
- Wood planks
- Palm, bamboo
- Finished
- Parquet, polished wood
- Vinyl, asphalt strips
- Ceramic tiles
- Cement
- Carpet

House-hold durable goods / possession

- Clock

- Radio
- Television
- Mobile telephone
- Non-mobile telephone
- Refrigerator
- Solar panel
- Bicyle
- Animal drawn cart
- Motorcycle / scooter
- Car / truck
- Boat with a motor
- Ownership of dwellings
- Ownership of land on which dwelling is built
- Ownership of agriculture land
- Ownership of farm animals

APPENDIX 2: Frequencies.

Statistics

		Unprotected well	Protected spring	Unprotected spring	River/dam/lake/pond/stream etc	Rain water
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Tanker truck	Cart with small tank	Bottle water	Flush - to piped sewer system	Flush - to septic tank
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Flush - to pit latrine	Flush - dont Know where	Pit latrine - ventilated improved pit (VIP)	Pit latrine - with slab	Pit latrine - without slab/open pit
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		no facility/bush/field	Composting toilet	Bucket toilet	Hanging toilet/ hanging latrine	LPG / Natural gas
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Biogas	Kerosene	charcoal	Wood	Straw / shrub/ grass	Natural Earth, sand
N	Valid	1127	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0	0

Statistics

		Natural dung	wood planks	vinyl, asphalt strips	ceramic tiles	cement
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Carpet	Has radio	Has Television	Has refridgerator	Has Bicycle
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Has motorcycle/scooter	Has car/truck	Has telephone
N	Valid	1127	1127	1127
	Missing	0	0	0

		Water source:piped into dwelling	water source:piped to yard/plot	public tap/ standpipe	Tube well or borehole	Protected well
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Unprotected well	Protected spring	Unprotected spring	River/dam/lake/pond/stream etc	Rain water
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Tanker truck	Cart with small tank	Bottle water	Flush - to piped sewer system	Flush - to septic tank
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Flush - to pit latrine	Flush - dont Know where	Pit latrine - ventilated improved pit (VIP)	Pit latrine - with slab	Pit latrine - without slab/open pit
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		no facility/bush/f ield	Composting toilet	Bucket toilet	Hanging toilet/ hanging latrine	LPG / Natural gas
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Biogas	Kerosene	charcoal	Wood	Straw / shrub/ grass	Natural Earth, sand
N	Valid	1127	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0	0

Statistics

		Natural dung	wood planks	vinyl, asphalt strips	ceramic tiles	cement
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Carpet	Has radio	Has Television	Has refridgerator	Has Bicycle
N	Valid	1127	1127	1127	1127	1127
	Missing	0	0	0	0	0

Statistics

		Has motorcycle/scooter	Has car/truck	Has telephone
N	Valid	1127	1127	1127
	Missing	0	0	0

APPENDIX 3: Dichotomization.

SPSS 21 syntax

```
freqvars=V113 to V129
* Water sources.
* surface water includes all means water can be obtained from the surface.
COMPUTE pipedwel=0.
if V113=11 pipedwel=1.
variable label pipedwel ' Water source:piped into dwelling' .
COMPUTE pipeyard=0.
if V113=12 pipeyard=1.
variable label pipeyard 'water source:piped to yard/plot'.
COMPUTE pubtab=0.
if V113=13 pubtab=1.
variable label pubtab 'public tap/ standpipe'.
COMPUTE tubwelbor=0.
if V113=21 tubwelbor=1.
variable label tubwelbor 'Tube well or borehole'.
COMPUTE prowel=0.
if V113=31 prowel=1.
variable label prowel 'Protected well'.
COMPUTE unpwel=0.
if V113=32 unpwel=1.
variable label unpwel 'Unprotected well'.
COMPUTE prospr=0.
if V113=41 prospr=1.
variable label prospr 'Protected spring'.
COMPUTE unpspr=0.
if V113=42 unpspr=1.
variable label unpspr 'Unprotected spring'.
COMPUTE surface=0.
if V113=43 surface=1.
```

```
variable label surface 'River/dam/lake/pond/stream etc'.
COMPUTE rain=0.
if V113=51 rain=1.
variable label rain 'Rain water'.
COMPUTE tantru=0.
if V113=61 tantru=1.
variable label tantru 'Tanker truck'.
COMPUTE cart=0.
if V113=62 cart=1.
variable label cart 'Cart with small tank'.
COMPUTE bottle=0.
if V113=71 bottle=1.
variable label bottle 'Bottle water'.
VALUE LABELS
pipedwel to bottle
1 'Yes' 0 'No'.
EXECUTE.
* type of toilet facilities.
COMPUTE flushpipe=0.
if V116=11 flushpipe=1.
variable label flushpipe 'Flush - to piped sewer system' .
COMPUTE flushseptic=0.
if V116=12 flushseptic=1.
variable label flushseptic 'Flush - to septic tank'.
COMPUTE flushpit=0.
if V116=13 flushpit=1.
variable label flushpit 'Flush - to pit latrine'.
COMPUTE flushsmwea=0.
if V116=14 flushsmwea=1.
variable label flushsmwea 'Flush - to somewhere else'.
COMPUTE flushdk=0.
```

```
if V116=15 flushdk=1.
variable label flushdk 'Flush - dont Know where'.
COMPUTE pitvip=0.
if V116=21 pitvip=1.
variable label pitvip 'Pit latrine - ventilated improved pit (VIP)'.
COMPUTE pitslab=0.
if V116=22 pitslab=1.
variable label pitslab 'Pit latrine - with slab'.
COMPUTE pitnoslab=0.
if V116=23 pitnoslab=1.
variable label pitnoslab 'Pit latrine - without slab/open pit'.
COMPUTE nofacil=0.
if V116=31 nofacil=1.
variable label nofacil 'no facility/bush/field'.
COMPUTE comptoilet=0.
if V116=41 comptoilet=1.
variable label comptoilet 'Composting toilet'.
COMPUTE bucket=0.
if V116=42 bucket=1.
variable label bucket 'Bucket toilet'.
COMPUTE hanging=0.
if V116=43 hanging=1.
variable label hanging 'Hanging toilet/ hanging latrine'.
VALUE LABELS
flushpipe to hanging
1 'Yes' 0 'No'.
EXECUTE.
* type of cooking fuel.
COMPUTE elec=0.
if V161=1 elec=1.
variable label elec 'Electricity' .
```

```
COMPUTE lpg=0.
if V161=2 lpg=1.
variable label lpg 'LPG / Natural gas'.
COMPUTE bio=0.
if V161=4 bio=1.
variable label bio 'Biogas'.
COMPUTE kero=0.
if V161=5 kero=1.
variable label kero 'Kerosene'.
COMPUTE colig=0.
if V161=6 colig=1.
variable label colig 'coal/lignite'.
COMPUTE charc=0.
if V161=7 charc=1.
variable label charc 'charcoal'.
COMPUTE wood=0.
if V161=8 wood=1.
variable label wood 'Wood'.
COMPUTE stshrgra=0.
if V161=9 stshrgra=1.
variable label stshrgra 'Straw / shrub/ grass'.
COMPUTE agricrop=0.
if V161=10 agricrop=1.
variable label agricrop 'Agricultural crop'.
COMPUTE anidung=0.
if V161=11 anidung=1.
variable label anidung 'Animal dung'.

VALUE LABELS
elec to anidung
1 'Yes' 0 'No'.
```

```
EXECUTE.
* Main floor material.
COMPUTE earth=0.
if V127=11 earth=1.
variable label earth 'Natural Earth, sand' .
COMPUTE dung=0.
if V127=12 dung=1.
variable label dung 'Natural dung'.
COMPUTE woodplank=0.
if V127=21 woodplank=1.
variable label woodplank 'wood planks'.
COMPUTE palbam=0.
if V127=22 palbam=1.
variable label palbam 'Rudimentary; palm, bamboo'.
COMPUTE parpolwood=0.
if V127=31 parpolwood=1.
variable label parpolwood 'Finished; parquet, polished wood'.
COMPUTE vinasp=0.
if V127=32 vinasp=1.
variable label vinasp ' vinyl, asphalt strips'.
COMPUTE certiles=0.
if V127=33 certiles=1.
variable label certiles 'ceramic tiles'.
COMPUTE cement=0.
if V127=34 cement=1.
variable label cement 'cement'.
COMPUTE carpet=0.
if V127=35 carpet=1.
variable label carpet 'Carpet'.
VALUE LABELS
earth to carpet
```

```
1 'Yes' 0 'No'.
EXECUTE.
*addational commands
COMPUTE ecectricity=0.
if V119=1 electricity=1.
variable label electricity 'Has electricity'.
value label electricity 1 'yes' 0 'No'.
COMPUTE radio=0.
if V120=1 radio=1.
variable label radio 'Has radio'.
value label radio 1 'yes' 0 'No'.
COMPUTE tv=0.
if V121=1 tv=1.
variable label tv 'Has Television'.
value label tv 1 'yes' 0 'No'.
COMPUTE fridge=0.
if V122=1 fridge=1.
variable label fridge 'Has refridgerator'.
value label fridge 1 'yes' 0 'No'.
COMPUTE bicycle=0.
if V123=1 bicycle=1.
variable label bicycle 'Has Bicycle'.
value label bicycle 1 'yes' 0 'No'.
```

Appendix 4: List if principal components.

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	4.735	10.760	10.760
2	2.403	5.462	16.223
3	1.844	4.191	20.414
4	1.732	3.935	24.349
5	1.601	3.638	27.987
6	1.454	3.304	31.291
7	1.332	3.028	34.319
8	1.293	2.938	37.257
9	1.272	2.891	40.149
10	1.226	2.785	42.934
11	1.204	2.737	45.671
12	1.166	2.649	48.321
13	1.162	2.641	50.962
14	1.133	2.575	53.537
15	1.123	2.553	56.089
16	1.079	2.453	58.542
17	1.043	2.371	60.913
18	1.022	2.323	63.236
19	1.016	2.309	65.545
20	1.007	2.289	67.834
21	.994	2.258	70.092
22	.976	2.217	72.309
23	.945	2.149	74.458
24	.925	2.103	76.561
25	.912	2.072	78.633
26	.899	2.044	80.677
27	.881	2.002	82.680
28	.848	1.927	84.607
29	.826	1.876	86.483
30	.817	1.856	88.340
31	.749	1.701	90.041
32	.631	1.433	91.474
33	.620	1.409	92.883

34	.608	1.382	94.266
35	.566	1.286	95.552
36	.468	1.063	96.614
37	.443	1.007	97.621
38	.367	.835	98.456
39	.322	.732	99.188
40	.251	.570	99.758
41	.093	.211	99.970
42	.011	.025	99.995
43	.001	.003	99.998
44	.001	.002	100.000

Extraction Method: Principal Component Analysis.

Appendix 5: Full list of weights (factor scores).

Component Matrix[a]	
	Component 1
Water source:piped into dwelling	.354
water source:piped to yard/plot	.285
public tap/ standpipe	-.055
Tube well or borehole	-.026
Protected well	-.084
Unprotected well	-.157
Protected spring	-.064
Unprotected spring	-.106
River/dam/lake/pond/stream etc	-.260
Rain water	.141
Tanker truck	.232
Cart with small tank	-.007
Bottle water	.042
Flush - to piped sewer system	.619

Flush - to septic tank	.270
Flush - to pit latrine	.020
Flush - dont Know where	.052
Pit latrine - ventilated improved pit (VIP)	.162
Pit latrine - with slab	.131
Pit latrine - without slab/open pit	-.224
no facility/bush/field	-.351
Composting toilet	-.025
Bucket toilet	-.016
Hanging toilet/ hanging latrine	-.060
LPG / Natural gas	.641
Biogas	.032
Kerosene	.156
charcoal	.364
Wood	-.640
Straw / shrub/ grass	.040
Natural Earth, sand	-.669

Natural dung	-.020
wood planks	-.015
vinyl, asphalt strips	.144
ceramic tiles	.343
Cement	.495
Carpet	.393
Has radio	.357
Has Television	.668
Has refridgerator	.690
Has Bicycle	.142
Has motorcycle/scooter	.170
Has car/truck	.627
Has telephone	.442

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Appendix 6: Full list of wealth score.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-.89413	39	3.5	3.5	3.5
	-.87451	33	2.9	2.9	6.4
	-.85220	5	.4	.4	6.8
	-.85099	10	.9	.9	7.7
	-.84415	4	.4	.4	8.1
	-.83607	1	.1	.1	8.2
	-.82877	12	1.1	1.1	9.2
	-.81677	1	.1	.1	9.3
	-.81086	9	.8	.8	10.1
	-.79823	31	2.8	2.8	12.9
	-.79502	5	.4	.4	13.3
	-.77861	2	.2	.2	13.5
	-.75630	14	1.2	1.2	14.7
	-.75509	3	.3	.3	15.0
	-.74826	1	.1	.1	15.1
	-.73288	3	.3	.3	15.4
	-.73121	25	2.2	2.2	17.6
	-.71497	10	.9	.9	18.5
	-.71160	7	.6	.6	19.1
	-.69913	12	1.1	1.1	20.1
	-.69095	1	.1	.1	20.2
	-.68973	2	.2	.2	20.4
	-.68929	3	.3	.3	20.7
	-.68807	1	.1	.1	20.8
	-.68124	4	.4	.4	21.1
	-.66586	10	.9	.9	22.0
	-.65386	4	.4	.4	22.4
	-.64961	2	.2	.2	22.5
	-.64795	5	.4	.4	23.0
	-.64624	4	.4	.4	23.3
	-.63658	1	.1	.1	23.4
	-.63532	28	2.5	2.5	25.9
	-.62393	2	.2	.2	26.1
	-.62272	1	.1	.1	26.2
	-.62100	2	.2	.2	26.4
	-.61815	1	.1	.1	26.4
	-.61570	12	1.1	1.1	27.5
	-.61466	1	.1	.1	27.6
	-.61193	3	.3	.3	27.9
	-.60139	2	.2	.2	28.0
	-.59504	8	.7	.7	28.7
	-.59339	13	1.2	1.2	29.9
	-.59218	11	1.0	1.0	30.9
	-.58850	2	.2	.2	31.1
	-.58535	5	.4	.4	31.5
	-.58259	2	.2	.2	31.7
	-.57977	1	.1	.1	31.8
	-.57908	1	.1	.1	31.9

-.57786	3	.3	.3	32.1
-.57273	2	.2	.2	32.3
-.57152	1	.1	.1	32.4
-.56996	29	2.6	2.6	35.0
-.56676	2	.2	.2	35.1
-.55886	1	.1	.1	35.2
-.55205	4	.4	.4	35.6
-.55035	10	.9	.9	36.5
-.54068	1	.1	.1	36.6
-.53774	4	.4	.4	36.9
-.53622	9	.8	.8	37.7
-.53244	1	.1	.1	37.8
-.53140	11	1.0	1.0	38.8
-.53022	1	.1	.1	38.9
-.52803	9	.8	.8	39.7
-.52682	2	.2	.2	39.8
-.51999	6	.5	.5	40.4
-.51390	12	1.1	1.1	41.4
-.51251	1	.1	.1	41.5
-.51188	2	.2	.2	41.7
-.50737	2	.2	.2	41.9
-.49995	3	.3	.3	42.1
-.48670	2	.2	.2	42.3
-.47086	5	.4	.4	42.8
-.46687	1	.1	.1	42.9
-.46604	2	.2	.2	43.0
-.45809	4	.4	.4	43.4
-.45654	1	.1	.1	43.5
-.45175	4	.4	.4	43.8
-.44855	3	.3	.3	44.1
-.44652	1	.1	.1	44.2
-.43730	2	.2	.2	44.4
-.43213	6	.5	.5	44.9
-.41680	1	.1	.1	45.0
-.41616	2	.2	.2	45.2
-.40861	5	.4	.4	45.6
-.40483	1	.1	.1	45.7
-.39274	1	.1	.1	45.8
-.39219	2	.2	.2	46.0
-.38639	2	.2	.2	46.1
-.37896	2	.2	.2	46.3
-.37838	3	.3	.3	46.6
-.37483	2	.2	.2	46.8
-.36953	1	.1	.1	46.9
-.36848	9	.8	.8	47.6
-.36678	1	.1	.1	47.7
-.35935	2	.2	.2	47.9
-.35265	5	.4	.4	48.4
-.35099	20	1.8	1.8	50.1
-.35081	4	.4	.4	50.5
-.34437	1	.1	.1	50.6
-.34325	1	.1	.1	50.7

-.34159	1	.1	.1	50.8
-.33642	2	.2	.2	50.9
-.33033	2	.2	.2	51.1
-.32831	1	.1	.1	51.2
-.32684	2	.2	.2	51.4
-.32454	2	.2	.2	51.6
-.32151	1	.1	.1	51.6
-.30947	4	.4	.4	52.0
-.30313	2	.2	.2	52.2
-.28564	6	.5	.5	52.7
-.28354	1	.1	.1	52.8
-.28248	1	.1	.1	52.9
-.26364	1	.1	.1	53.0
-.26286	1	.1	.1	53.1
-.25982	2	.2	.2	53.2
-.25389	8	.7	.7	53.9
-.24403	1	.1	.1	54.0
-.23957	2	.2	.2	54.2
-.23251	1	.1	.1	54.3
-.22928	7	.6	.6	54.9
-.22865	4	.4	.4	55.3
-.21546	4	.4	.4	55.6
-.20903	2	.2	.2	55.8
-.20028	1	.1	.1	55.9
-.19922	2	.2	.2	56.1
-.19585	1	.1	.1	56.2
-.18853	2	.2	.2	56.3
-.18672	1	.1	.1	56.4
-.18551	1	.1	.1	56.5
-.18094	1	.1	.1	56.6
-.17376	3	.3	.3	56.9
-.17232	1	.1	.1	57.0
-.16742	5	.4	.4	57.4
-.16393	1	.1	.1	57.5
-.15904	1	.1	.1	57.6
-.14602	1	.1	.1	57.7
-.14572	1	.1	.1	57.8
-.13573	1	.1	.1	57.9
-.12954	1	.1	.1	57.9
-.11957	9	.8	.8	58.7
-.11403	1	.1	.1	58.8
-.10841	3	.3	.3	59.1
-.10525	1	.1	.1	59.2
-.10206	3	.3	.3	59.4
-.09995	6	.5	.5	60.0
-.09891	1	.1	.1	60.1
-.07929	1	.1	.1	60.2
-.07764	3	.3	.3	60.4
-.07666	3	.3	.3	60.7
-.07643	1	.1	.1	60.8
-.07031	4	.4	.4	61.1
-.06960	3	.3	.3	61.4

-.06783	2	.2	.2	61.6
-.06211	1	.1	.1	61.7
-.05547	1	.1	.1	61.8
-.05421	11	1.0	1.0	62.7
-.03990	1	.1	.1	62.8
-.03630	1	.1	.1	62.9
-.03460	7	.6	.6	63.5
-.03355	1	.1	.1	63.6
-.03351	1	.1	.1	63.7
-.02474	1	.1	.1	63.8
-.02047	1	.1	.1	63.9
-.01228	3	.3	.3	64.2
-.01107	1	.1	.1	64.2
-.00967	3	.3	.3	64.5
-.00757	1	.1	.1	64.6
-.00615	1	.1	.1	64.7
-.00496	2	.2	.2	64.9
-.00145	1	.1	.1	65.0
.00185	1	.1	.1	65.0
.00247	1	.1	.1	65.1
.00387	1	.1	.1	65.2
.01007	2	.2	.2	65.4
.01301	2	.2	.2	65.6
.01620	1	.1	.1	65.7
.01719	1	.1	.1	65.7
.03819	1	.1	.1	65.8
.04489	1	.1	.1	65.9
.05568	6	.5	.5	66.5
.05766	3	.3	.3	66.7
.05853	1	.1	.1	66.8
.05947	1	.1	.1	66.9
.06366	14	1.2	1.2	68.1
.06400	5	.4	.4	68.6
.06555	1	.1	.1	68.7
.07284	1	.1	.1	68.8
.07634	1	.1	.1	68.9
.07727	1	.1	.1	68.9
.08362	3	.3	.3	69.2
.08743	2	.2	.2	69.4
.09895	1	.1	.1	69.5
.09959	3	.3	.3	69.7
.10080	1	.1	.1	69.8
.11397	2	.2	.2	70.0
.12301	2	.2	.2	70.2
.12356	1	.1	.1	70.3
.12936	2	.2	.2	70.5
.13704	2	.2	.2	70.6
.14092	5	.4	.4	71.1
.14263	1	.1	.1	71.2
.14727	2	.2	.2	71.3
.14897	2	.2	.2	71.5
.15884	1	.1	.1	71.6

.16311	1	.1	.1	71.7
.16476	1	.1	.1	71.8
.16494	2	.2	.2	72.0
.16755	1	.1	.1	72.0
.17129	3	.3	.3	72.3
.17299	2	.2	.2	72.5
.17390	1	.1	.1	72.6
.17739	1	.1	.1	72.7
.17845	1	.1	.1	72.8
.17907	1	.1	.1	72.8
.19442	1	.1	.1	72.9
.19979	1	.1	.1	73.0
.22085	1	.1	.1	73.1
.22175	3	.3	.3	73.4
.23011	5	.4	.4	73.8
.23576	1	.1	.1	73.9
.23925	1	.1	.1	74.0
.24136	1	.1	.1	74.1
.24646	1	.1	.1	74.2
.25159	1	.1	.1	74.3
.25959	4	.4	.4	74.6
.26187	1	.1	.1	74.7
.27100	3	.3	.3	75.0
.27414	2	.2	.2	75.2
.28647	1	.1	.1	75.2
.28710	1	.1	.1	75.3
.29542	1	.1	.1	75.4
.30672	1	.1	.1	75.5
.31659	1	.1	.1	75.6
.32810	1	.1	.1	75.7
.33001	1	.1	.1	75.8
.33636	1	.1	.1	75.9
.34199	4	.4	.4	76.2
.34519	1	.1	.1	76.3
.34833	4	.4	.4	76.7
.35774	2	.2	.2	76.8
.38336	1	.1	.1	76.9
.38621	2	.2	.2	77.1
.40734	2	.2	.2	77.3
.41076	2	.2	.2	77.5
.41859	2	.2	.2	77.6
.43909	1	.1	.1	77.7
.44212	1	.1	.1	77.8
.44316	1	.1	.1	77.9
.44544	2	.2	.2	78.1
.44725	1	.1	.1	78.2
.44846	1	.1	.1	78.3
.45529	1	.1	.1	78.3
.48858	2	.2	.2	78.5
.49561	1	.1	.1	78.6
.49808	2	.2	.2	78.8
.50533	1	.1	.1	78.9

	.50608	2	.2	.2	79.1
	.50626	1	.1	.1	79.1
	.50747	1	.1	.1	79.2
	.51079	1	.1	.1	79.3
	.51167	1	.1	.1	79.4
	.51382	1	.1	.1	79.5
	.51550	1	.1	.1	79.6
	.51763	1	.1	.1	79.7
	.52677	2	.2	.2	79.9
	.54027	2	.2	.2	80.0
	.54760	2	.2	.2	80.2
	.55637	1	.1	.1	80.3
	.57143	7	.6	.6	80.9
	.57428	1	.1	.1	81.0
	.57707	1	.1	.1	81.1
	.57966	1	.1	.1	81.2
	.60318	6	.5	.5	81.7
	.60865	1	.1	.1	81.8
	.61522	1	.1	.1	81.9
	.62950	1	.1	.1	82.0
	.66461	1	.1	.1	82.1
	.66854	3	.3	.3	82.3
	.67459	1	.1	.1	82.4
	.68330	4	.4	.4	82.8
	.68786	1	.1	.1	82.9
	.68965	3	.3	.3	83.1
	.69314	1	.1	.1	83.2
	.69420	1	.1	.1	83.3
	.69885	1	.1	.1	83.4
	.70125	1	.1	.1	83.5
	.71017	1	.1	.1	83.6
	.71651	1	.1	.1	83.7
	.73360	1	.1	.1	83.8
	.73795	2	.2	.2	83.9
	.74866	3	.3	.3	84.2
	.75500	3	.3	.3	84.5
	.76008	1	.1	.1	84.6
	.76922	1	.1	.1	84.6
	.77369	1	.1	.1	84.7
	.77534	6	.5	.5	85.3
	.77814	1	.1	.1	85.4
	.78675	6	.5	.5	85.9
	.79168	1	.1	.1	86.0
	.79600	2	.2	.2	86.2
	.84577	2	.2	.2	86.3
	.85211	3	.3	.3	86.6
	.85501	1	.1	.1	86.7
	.85895	1	.1	.1	86.8
	.87037	2	.2	.2	87.0
	.87245	1	.1	.1	87.0
	.87524	1	.1	.1	87.1
	.87671	2	.2	.2	87.3

.88009	1	.1	.1	87.4
.89311	1	.1	.1	87.5
.91383	1	.1	.1	87.6
.91560	1	.1	.1	87.7
.95257	1	.1	.1	87.8
1.00266	3	.3	.3	88.0
1.01793	1	.1	.1	88.1
1.04968	2	.2	.2	88.3
1.05149	1	.1	.1	88.4
1.05602	1	.1	.1	88.5
1.06557	1	.1	.1	88.6
1.07932	1	.1	.1	88.6
1.08566	1	.1	.1	88.7
1.10611	2	.2	.2	88.9
1.11666	4	.4	.4	89.3
1.13098	1	.1	.1	89.4
1.13103	1	.1	.1	89.4
1.13528	1	.1	.1	89.5
1.13737	2	.2	.2	89.7
1.14328	1	.1	.1	89.8
1.15439	2	.2	.2	90.0
1.16701	2	.2	.2	90.2
1.21575	3	.3	.3	90.4
1.22301	1	.1	.1	90.5
1.23066	1	.1	.1	90.6
1.24014	3	.3	.3	90.9
1.24038	1	.1	.1	90.9
1.25360	1	.1	.1	91.0
1.26149	1	.1	.1	91.1
1.27912	1	.1	.1	91.2
1.29471	1	.1	.1	91.3
1.30023	4	.4	.4	91.7
1.31572	1	.1	.1	91.7
1.32685	1	.1	.1	91.8
1.35860	6	.5	.5	92.4
1.35924	1	.1	.1	92.5
1.36854	1	.1	.1	92.5
1.40579	1	.1	.1	92.6
1.40591	1	.1	.1	92.7
1.42396	1	.1	.1	92.8
1.45566	1	.1	.1	92.9
1.46978	3	.3	.3	93.2
1.47295	2	.2	.2	93.3
1.48794	1	.1	.1	93.4
1.57815	1	.1	.1	93.5
1.58085	1	.1	.1	93.6
1.58872	3	.3	.3	93.9
1.60621	2	.2	.2	94.1
1.63086	4	.4	.4	94.4
1.63586	2	.2	.2	94.6
1.65085	1	.1	.1	94.7
1.67796	1	.1	.1	94.8

	1.74346	1	.1	.1	94.9
	1.79292	1	.1	.1	94.9
	1.81358	1	.1	.1	95.0
	1.88008	3	.3	.3	95.3
	1.90186	1	.1	.1	95.4
	1.90409	1	.1	.1	95.5
	1.91946	2	.2	.2	95.7
	1.94543	1	.1	.1	95.7
	1.96385	1	.1	.1	95.8
	1.98482	3	.3	.3	96.1
	2.04547	1	.1	.1	96.2
	2.10073	1	.1	.1	96.3
	2.12088	1	.1	.1	96.4
	2.18037	1	.1	.1	96.5
	2.21697	1	.1	.1	96.5
	2.26208	1	.1	.1	96.6
	2.26473	1	.1	.1	96.7
	2.56105	1	.1	.1	96.8
	2.64527	2	.2	.2	97.0
	2.64710	1	.1	.1	97.1
	2.68419	1	.1	.1	97.2
	2.71858	2	.2	.2	97.3
	2.98761	1	.1	.1	97.4
	3.08208	1	.1	.1	97.5
	3.11446	1	.1	.1	97.6
	3.24233	1	.1	.1	97.7
	3.30331	1	.1	.1	97.8
	3.30769	1	.1	.1	97.9
	3.83142	2	.2	.2	98.0
	3.91128	1	.1	.1	98.1
	4.03379	3	.3	.3	98.4
	4.05571	2	.2	.2	98.6
	4.24525	1	.1	.1	98.7
	4.38548	2	.2	.2	98.8
	4.42565	2	.2	.2	99.0
	4.51653	3	.3	.3	99.3
	4.57937	2	.2	.2	99.5
	4.79507	1	.1	.1	99.6
	4.96891	4	.4	.4	99.9
	5.28826	1	.1	.1	100.0
	Total	1127	100.0	100.0	