UNIVERSITY OF CAPE COAST

LOGISTIC REGRESSION ANALYSIS OF HOUSEHOLD INCOME AND EXPENDITURE PATTERNS IN GHANA

By

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A thesis submitted to the Department of Mathematics & Statistics, School of Physical Sciences, University of Cape Coast, in partial fulfillment of the requirements for the award of Master of Philosophy Degree in Statistics
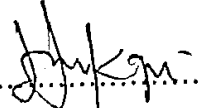
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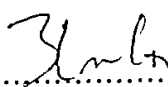
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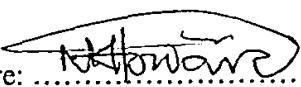Candidate's Signature: .... Date: 2/09/09

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ABSTRACT

Studies into income, expenditure and standard of living of individuals and households are well documented in literature. Many of these studies cover different forms of poverty indicators and variables. The methods used in this analysis were mainly econometric models.

The study is concerned with determining the indicators and variables that possibly influence income, expenditure and living standard of households. The objective here is to model the determinants of living standards or poverty status of households. To this end, secondary data were obtained from the Ghana Statistical Service. Some sections of GLSS 3 and GLSS 4 were used to develop the model.

Nine variables were recorded and about 4500 respondents were used for each of the surveys, that is GLSS 3 and GLSS 4. Exploratory data analysis was employed in preliminary stages of the analysis. Logistic regression was used because this modeling technique is considered as the appropriate technique for modeling income and expenditure, since the outcome or response variable is dichotomous.

It was found out that poverty was more prevalent and severe in the rural areas than the urban areas. In determining the poverty status of a household head, that is, whether he or she is poor or not poor; household size, locality, age of head, education and occupation played a significant role. The poverty status model developed was made up of the variables mentioned above. A household status could be determined by substituting the values of the variables in the model. The outcome (response) may be close to one or zero.

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CHAPTER ONE

INTRODUCTION

BACKGROUND

Most recent papers show that the general trend of poverty in Ghana is falling that is poverty is reducing. However the Daily Graphic, 20th October, 2007 points out that poverty in the Greater Accra and Volta Regions is increasing. Report from the Interim Poverty Reduction Strategy Paper (2000-2002) and Ghana Living Standard Survey (GLSS) 3 & 4 (1991/92 and 1998/99), reported that poverty is overall declining in Ghana. However, it also showed that the overall trend during the 1990s has been broadly favorable in Ghana. But when one considers the economic activities in which households are engaged, poverty varied considerably.

Most people are of the view that there are income-expenditure disparities among different sectors of most third world economies. Thus, the rural sectors of these countries in contrast to the urban areas have lower incomes, lower expenditures and as a result, lower standards of living. The difference between rural and urban living conditions has been an important policy issue that has confronted many developing countries. Since most less developed countries rely heavily on agriculture which is rural based, the concept of rural development has gained greater priority, not only as a means to improve the socio-economic life of the rural people, but in the wider sense to enhance growth and development in the

country as a whole. This study was thus based on the concept of rural development with the view of narrowing the rural-urban development gap. According to Okonjo (1998), there are marked inequalities in development in the various sectors of the economy and that major social and infrastructural development have been concentrated in the so called golden triangle enclosed by Accra, Kumasi and Takoradi. Looking at the expenditure components on which Ghanaian households spend their income and considering the expenditure distribution with respect to food, fuel, clothing, etc. it is clear that there exist discrepancies and inequalities in the distribution of these spending variables. Other areas of apparent inequalities among the rural-urban communities include educational facilities as well as health care facilities. In terms of quantity and quality services in these two areas, priority has always been given to the urban areas and the rural areas in a declining order of magnitude. As a result, the urban households spend much more on education and health than the rural households.

Engel, a German Statistician in 1857 conducted a well-known household budget survey among some Belgian families. Engel's major findings have developed into what is called the Engel's law. This law states that as income increases, the percentages spent on food and housing decreases, the percentages on clothing and household expenses remain about constant and the percentages on education, health and recreation increase (Zimmerman, 1999).

The relationship between income and expenditure has always been of considerable interest to analysts and students who research into household expenditure patterns. But research work on income and expenditure distribution

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shows that there were marked inequalities among wage and salary earners in the urban centres as well as inequality between the urban and the rural population in the country. Hence, the launching of a four-year Economic Recovery Programme by the Ghana government in 1983 to redress the economic malaise and foster growth through liberalization. The second phase of economic reforms, namely the Structural Adjustment Programme covered the period of two years 1987 to 1989 and was to tackle the economy's deep-rooted structural imbalances and to build a productive base for the economy. In 1987 the government instituted the Ghana Living Standard Survey (GLSS) to provide data on a regular basis for measurement of living standard of the population and the progress made in raising them, using income and expenditure profiles of households in Ghana. The measure is also based on household consumption expenditure covering food and non-food (including housing). In this study following common practice in many countries, a consumption-based standard of living measure is used. Consumption poverty is specifically concerned with households whose standard of living falls below an adequate minimum wage defined by a poverty line. Poverty line is defined as the budget necessary to acquire the goods and services necessary to achieve some minimum standard of living.

Although the minimum wage offered by the government is proposed as the bench mark for poverty, it is recognized that the adequacy of a minimum wage income has always been challenged, for example, by the trade union congress. However, if a person has to share the minimum wage with others and his or her household does not have any other income, then his income may no

longer suffice to cover the basic needs of the household. Also a household of two persons depending on one minimum wage is considered to be at the extreme poverty and similarly a household of four persons who depends on an income of twice the minimum.

Analysis on household characteristics using a logistic regression model is one of the objectives of the study. This was achieved by using a number of explanatory household variables in deriving a logit model to characterize income level households in Ghana. What is required is the optimum generation of income at the rural level to create wealth coupled with the equitable distribution of income within the shortest possible time to alleviate rural poverty and to bridge the gap between rural-urban income inequalities. Furthermore, family size, educational status, occupation and geographical distribution influence significantly, the standard of living and the level of income of households (Sackey, 2005). The difference between income and expenditure can be illustrated by means of a Lorenz curve, which plots a cumulative percentage of all persons, ranked from lowest to highest in terms of per capita income against their cumulative share of total income. A similar curve can be drawn using the expenditure data. If there were total equality of incomes, the curve would lie on the 45 degree line. See Figure 1, detailed information on Lorenz curve is provided in Appendix.

The extent to which the curve deviates from the 45^0 line indicates the extent of inequality in income distribution. It can be seen that the population is more unequal in terms of income than in terms of expenditure. These inequalities

can be quantified by the Gini coefficient. If there was total equality of income and expenditure for everyone, then the Gini coefficient for each would be zero. From the GLSS 4, the Gini coefficient for income is 0.6 while that for expenditure is 0.43.

STATEMENT OF THE PROBLEM

Despite the relative successes of the Economic Recovery Programmed in Ghana, many individuals remain in acute poverty. Moreover, the process of adjustment by its very nature is likely to cause immediate hardship for certain vulnerable groups. Thus, consumption of market purchased items and that of home produced items as well as food accounts for around two-thirds of the total expenditure of Ghanaian households. What is surprising however is that this figure is certainly higher for poor households compared to non-poor households. Agriculture accounts for 55.8% of the total income in the GLSS sample, this is because majority of Ghanaians livelihoods depend mostly on farming and the major input used in Ghanaian agriculture is land and due to population pressure and reduced fertility of the soil as a result of intensive cultivation (World Bank, 2001). At the national level, around 58 percent of those identified as poor are from households for whom food crop cultivation is the main activity. The effect of large-sized households has also contributed to the high dependency ratio on poverty. Hence the adoption of family planning practices should be encouraged especially in the rural areas. Thus, poverty in Ghana is really a rural phenomenon. The fourth year results of the Ghana Living Standards Survey (GLSS 4), offers

the opportunity for a more detailed and up to date study of the Living Standard of households in Ghana, and confirms that, those in the rural areas have low standard of living than those in the urban areas as it was revealed by the distribution of the expenditure data. Moreover, considering the work that has been done on household income and expenditure or household budget in the country (World Bank, 2005), one may be tempted to think that there is no need for further studies or research on household income and expenditure, but this would indeed be an erroneous idea. Some of the work that has been done on household budget normally uses indicators which defines it in absolute terms and identify some factors that determines the standard of living of households.

However, detailed discussions on household income and expenditure (i.e. Modeling using GLSS 4) has hitherto not been done and research needs to be done, on developing a clearer understanding of the nature and determinants of household income and expenditure in Ghana, and its changes over time.

This study therefore intends to establish a relationship between income and expenditure patterns by developing a quantitative scheme or model for establishing and predicting the extent of income inequality in Ghana. The model can be used as a tool for reasoning about the interactions and feedbacks of the factors that influence the living standards of households in Ghana.

This study would also help to improve our understanding of the unequal distribution of income in the country and provide planners and policy makers with valuable information that would help them to design and implement appropriate income poverty reduction strategies.

The modeling process would help affirm and augment the knowledge already documented about the factors that influence living standards of Ghanaian households.

OBJECTIVES

The main objective of the study is to derive a mathematical representation of the relationship between the standard of living of households and factors that affect it using logistic regression.

The other objectives are:

(1)   to determine the distribution of poverty among Ghanaian households;

(2)   to compare distribution of rural-urban income and expenditure; and

(3)   to classify households by their income and expenditure distribution patterns.

DATA

Sources of Data

The data which were obtained from the Ghana Statistical Service consist of the latest edition of the Ghana Living Standard Survey (GLSS 1991/92 and 1998/99). The Ghana Living Standard (GLSS) is a multi-topic household survey, designed to provide a valuable sources of detailed national data on the various dimensions of the living standards of different categories of people. The study area is the entire country, while the study population is all households in Ghana. It provides data on the social and economic situations of households in Ghana and the

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interactions between these situations. It includes data on demographic characteristics, health, education, economic activities and time used and migration.

The surveys used three types of questionnaires to collect the data: a household questionnaire, a community questionnaire and price questionnaire. The analysis is based on the household questionnaire. The data sources for this study is from rounds three and four of GLSS, which was conducted in 1991/92 (GLSS3) and 1998/99 (GLSS4). GLSS3 has a sample size of 4552 households, spread around the country in 407 small clusters; in general, 15 households were taken in an urban cluster and 10 households in a rural cluster. GLSS4 has a sample size of 5998 households. The households for GLSS3 were selected from approximately (200) 1984 Census enumeration areas (EA) Stratified by urban/rural and ecological zones. The GLSS4 however, used 300 enumeration areas.

Components of Income and Expenditure

Components of income and expenditure at the household level can be classified into six categories of income and six categories of expenditure (Ghana Statistical Service (GSS), 2000). These categories as defined by Ghana statistical service is as follows:

Income categories:

1. Income from employment

2. Household agricultural income

3. Non-farm self employment income

4. Income from rent

5. Income from remittances

6. Other incomes (social security, pension receipts, and educational scholarships)

Expenditure Categories:

1. Food expenditure

2. Housing expenditure

3. Other expenditures (actual)

4. Food expenditure (imputed)

5. Other expenditure (imputed)

6. Expenditure on remittance

Structure of Data

A number of conventional measures relating to household income and expenditure pattern have been used. However income and expenditure dynamics are difficult to measure because reliable sources of data are hard to come by (Meng & Gregory, 2007). The measure used in this analysis includes the Lorenz Curve, the Gini Coefficient, the Sen's Index and the Foster, Greer and Thorbecke (FGT) class of indices.

It is important, however, to note that these measures are all univariate data analysis methods and these methods do not allow us to explain income and

expenditure variables extensively. The GLSS enables us to derive estimates of total income and total expenditure for the entire household surveyed. All the household surveyed were categorized into two groups (poor and non-poor) based on their total expenditure (both actual and imputed).The main monetary measure used in this study was household expenditure because information based on household income is very difficult to capture. It is therefore inevitable that the measures presented in the GLSS somewhat understate the total household income.

The standard of living of Ghanaian households based on their consumption needs was accessed, taking into consideration the cost of living across households, the differences in their sizes and composition as well as the selection of a poverty line. Thus, to establish a relationship between income and other socio-economic variables, we need to resort to modeling. The study therefore considers using logistic regression models to explain income and expenditure patterns.

Statistical Analysis System of Data

The GLSS data used have been organized in a S.A.S and SPSS Format. The main data management and analysis was done in S.A.S and SPSS. This included the descriptive statistics and the estimation of the parameters of the income and expenditure patterns using the logistic regression procedure. The Lorenz curves and the Gini-coefficients were constructed by programming in SPSS.

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OUTLINE OF THESIS

This research is organized into six chapters. Chapter one is the introduction. It deals with the background of the study, statement of the problem, objectives of the study, data, components of income and expenditure, research methodology and general organization of the study. Chapter two covers literature review. Chapter three covers the review of logistic regression model and Lorenz curve and the Gini-coefficient. Chapter four covers the preliminary analysis. Chapter five covers further analysis. Finally, summary, discussion, conclusion and recommendations are in chapter six.

CHAPTER TWO

LITERATURE REVIEW

INTRODUCTION

In Ghana, recent years of substantial economic growth (GDP growth rate) brought prosperity to the nation. The high levels of growth hovering around an average of 5 % annual GDP growth still could not accompany a significant reduction in the poverty headcount ratio and a significant proportion of the total population was below a threshold level of per adult equivalent per month expenditures (World Bank, 2001).

Findings from the Ghana Demographic and health survey (GSS, 2003) suggest that growth alone is not enough to eliminate poverty, there are indeed, other elements of poverty eradication like the creation of jobs, remittances and the investments in social and economic factors like the food subsidy for the poorest, good quality education, opportunities for the neediest, regulation of job markets, and purposively designed social security nets also have significant impact on permanent reduction in poverty. The household surveys conducted at the national level like GLSS 3 and GLSS 4 are aimed at providing estimates on various socioeconomic indicators. These estimates are not only representative at national and provincial level but provide valid estimates for urban/rural localities as a whole and as provincial sub categories. Only Ghana statistical service provides

estimates that are representative on district level but these indicators do not include the information on income/ expenditure. Therefore, the poverty estimates like calculation of the food/ overall poverty line, poverty headcount ratio, poverty gap index and poverty gap index squared (severity of poverty) are drawn from the GLSS. Results from GLSS are supposed to be representative at national level but the provincial level analyses have always been widely criticized.

In Ghana, the existing literature on the determinants of poverty is populous with the models majorly on the national or to some extent on the disaggregated models for urban/ rural regions. The present paper extends the existing literature on poverty in Ghana by modeling and determining the various socioeconomic and demographic household level indicators and factors responsible for the poverty in Ghana.

GENERAL DATA SOURCES AND MODELS USED

Household level determinants of poverty generally rely on the household level data. This cross sectional data can either be one year data or a panel of households surveyed variously over certain period of time. Mostly, these datasets represent the household level information to be collected through government administered agencies for making a household level profile on various socioeconomic indicators. Mok and Zammah (2007) used primary data on the households of urban region of Malaysia, Geda, Jong, Kimenyi and Mwabu (2005) also utilized the household level data of Kenya to be used for poverty analysis. Minot and Boulch (2005) used the primary data on Vietnam for their analysis. Meng and

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Gregory (2007) however utilized the Panel data from 1986 till 2000 (15 year) of China.

In Ghana, the studies based on the household level determinants of poverty are no exception. Primary data from the combined round of GLSS were used by Khalid, Shahnaz and Bibi (2005). These datasets are supposed to be nationally representative. Only Malik (1996) used self collected data on a rural locality. His results were based on a sample of size 100, however this sample size was not a national representative for inference about the determinants of poverty.

Several studies have used different models. Some use categorical data models while some use ordinary least square and some employ both. Meng and Gregory (2007); Minot and Boulch (2005) used both Probit and Log linear OLS models (later used semi log linear model) for determining the factors responsible for the household level poverty. Mok and Zammah (2007); Qureshi and Arif (2001) used Logit model while Geda, Jong, Kimenyi and Mwabu (2005) also used Ordered Logit model in addition to Logit model. Khalid, Shahnaz and Bibi (2005) used multinomial Logit model and Malik (1996) used the log linear regression model for determining the factors responsible for the poverty.

The studies find that the household level determinants of poverty are classified majorly in two groups. One comprising of the head of the Household's characteristics and other consisting of the household level characteristics. There is a need to separately evaluate both of these groups for making our study consistent with that of the existing literature.

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Household Head's Characteristics' as Determinants of Poverty

Age is one of the major determinants of poverty. Households, whose head is in higher age group significantly lowers the possibility of remaining poor households (Malik, 1996; Khalid, Shahnaz & Bibi, 2005; Meng & Gregory, 2007; Qureshi & Arif, 2001). Moreover, years of schooling of the head of the household also significantly reduce the probability of remaining in the poor group (Khalid, Shahnaz & Bibi, 2005; Malik, 1996; Meng & Gregory, 2007; Minot & Boulch; 2005, Mok and Zammah; 2007; Qureshi & Arif, 2001). The other factors like the gender of the household head and the occupation or industry also influence the poverty level. McCulloch and Baulch (1998) in their study, paid attention not only on the poor but differentiated between Transitory and Chronically Poor and model the various factors responsible for each of these two categories. Their findings are interested as they imply that for chronically poor households, the higher dependency ratio leads to higher probability of being poor but for the transitory poor, dependency ratio does not matter.

Geda, Jong, Kimenyi and Mwabu (2005) found that the households headed by males reduce the probability of being poor. Similarly Meng and Gregory (2007) found that household heads by migrant were more prone to poverty. Minot and Boulch (2005) found that the profession of the head of the household as Manager, Professional/ technical and, clerical or service worker are negative and significant for the rural model while the profession of unskilled labor is positive significant in the urban model. Datt and Jolliffe (1997) found a positive relationship for sectors of employment with the per capita consumption. Although

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the employment sector they classified was the type of industry, in which the head of the household was employed. The empirical results suggested that the industry specific employment is necessary for reducing poverty (increased per capita consumption and ultimately per capita food consumption). Justino and Litchfield (2003) in their study also included the determinants related to employment sector. They found that the employment on a White Collar job and in the agriculture sector reduces the probability of being poor in the future.

Household Characteristics' as Determinants of Poverty

The other positive significant variables like family size and dependency ratio (Malik, 1996; Meng & Gregory, 2007; Minot & Boulch, 2005) are positively related with the level of poverty. Agriculture landholding and remittances receipts (Qureshi & Arif, 2001) are the ones that are commonly found in the literature and negatively affect the likelihood of remaining poor. The other variables like ownership of dwelling (Minot & Boulch, 2005) access to credit, financial as well as household tangible assets and nuclear families (Khalid, Shahnaz & Bibi, 2005) are also discussed in literature to be significantly affecting the likelihood of remaining in poor group.

Before the initiation of the Ghana Living Standard Survey in 1987, two comprehensive national household budget surveys had been conducted by the Central Bureau of Statistics in 1962 and 1974. Ewusi (1984) analyzed the income data of the 1974/75 household budget survey and found that for the country as a

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whole, 75% of the sample falls below a poverty line defined as per capita household income of less than US$100.00.

Available evidence from surveys (Ewusi, 1987; Rourke, 2000; Dutta; 1998) also shows that, income in rural Ghana is generally lower than income in the urban areas. These however, bring out the rural urban income inequalities in the country. Ravallion and Bidani (1994) outlined that the food energy intake method define the poverty line by finding the consumption expenditures or income level intake is just sufficient to meet a predetermined food energy requirement, if applied to different regions within the same country. Ravallion and Bidani (1994) conclude that, this method can yield differentials in poverty lines in excess of the cost of living differentials facing the poor line. A similar definition of a poverty line includes the cost of a bundle of goods deemed to assure that basic consumption needs are met and the local cost of a normative food and non food consumption bundle (Lipton & Ravallion, 2002).

Houthakker (1999), confined to a more restricted version of Engel's law which relates only food expenditure to income. In his article celeberate the centenary of Engel's law, summarized 40 surveys from 30 countries, but his analysis was confined to the narrower version of the law, that is functional relationship between food expenditure and income. Morris (2001) provided a useful method of summarizing spatial differences in level of poverty through the use of the Physical Quality of Life Index (PQLI). The PQLI combines infant mortality of the level of literacy and expectation of life at birth.

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Awusabo-Asare (1982) applied the PQLI to indicate that the quality of life in rural Ghana is worse than that in urban Ghana. Recent estimates of the PQLI for the various regions of Ghana by UNICEF indicate that the incidence of absolute poverty measured by this index is highest in the Upper and Northern regions. The World Bank in 1993 employed a poverty line of one US dollar per capital per day US purchasing power parity and this line was developed to enable international comparison of poverty (World Bank , 1995).

At the second World Congress of the Econometric Society held at Cambridge University, Blavi (1995) pointed out in a paper on household consumption patterns that the estimates of income elasticity's are functions of the mathematical specification of the Engel function. Attempts also have already been made to provide estimates of income elasticity's of demand for food in Ghana. From the expenditure survey conducted by the Central Bureau of Statistics, the results were 0.98 for Accra and 0.86 for Kumasi. With this results and considering Blavi's Statement, it can be deduced that the demand for food is highly income elastic.

Ghana covers an area of approximately 23.9 million sq. km and the last population census in the year 2000 estimated the total population to be about 18.4 million. About 68 percent of the population lives in rural communities and the remaining 32 percent lives in urban centers. About 57 percent of the total area of the country is covered by agricultural land. Agriculture is the most widespread occupation in Ghana, accounting between 60 – 70 percent of the labour force. Agriculture lost its leading role as a contributor to Gross Domestic Product (GDP)

in 1991 to the service sector but recovered its leading role in the late 1990's. Agriculture continues to play a major role in growth of the economy both in terms of contribution to GDP, foreign exchange earnings, tax revenue and employment.

In the early 1960s, Ghana's economy was among the strongest in the developing world. Its per capita GDP in 1960 estimated then at US$1,049, was higher than the per capita GDP in Korea. However, the healthy state of the Ghanaian economy could not be sustained. In the late 1960s, the economy went into a very severe recession. The economic decline persisted throughout the 1970s to the early part of the 1980s. By 1983 the GDP had declined by 16 percent cumulatively, representing an annual average decline of about 1.4 percent. Between 1971 and 1983, agricultural output declined by 11 percent, industrial production almost halved while cocoa production declined by 60 percent.

Despite the impressive economic growth in the past two decades or so, the per capita GDP for Ghana's 19 million people remains less than $400. The households survey conducted in 1999 revealed that two out of every five Ghanaians lived below the official poverty line which was estimated at approximately US$376 per annum (based on exchange rate in 1999). According to the Ghana Living Standard Survey (GLSS4, 1998/99), individuals in the poorest 20 percent of the Ghanaian population earned the equivalent of US$69 per annum while an average household in the poorest 20 percent of the population earned US$409 per annum.

The national average household and per capita incomes were US$ 947 and US$220 respectively (see Appendix, Table 1.3).The average daily per capita

income was 65 US cents. Only households in the top 20 percent of the income distribution and those in Accra earned a per capita income of a little over $1.00 per day. Members of the households in the poorest quartile (households in the bottom 25 percent of income distribution) earned an average daily income of 19 US cents (see Table 1.3 in Appendix). The figures show that a household member in the three northern regions of the country earned less than half of the average income in the south (see Table 1.4 in Appendix). Rural incomes remain incredibly low (see Table 1.5 in Appendix).

WHAT IS POVERTY?

In order to measure deprivation/poverty accurately, it is necessary to be precise about the meaning of these terms. Poverty, like evolution is both a scientific and a moral concept. Many of the problems of measuring poverty arise because the moral and scientific concepts are often confused.

There are two basic concepts of poverty in social science: the 'absolute' and 'relative' theories. The 'absolute' concept of poverty is dominated by the individual's requirements for physiological efficiency. However, this is a very limited conception of human needs, especially when considering the roles that men, women and children play in society. People are not just physical beings, they are social beings. They have obligations as workers, parents, neighbours, friends and citizens that they are expected to meet and which they themselves want to meet. Studies of people's behavior after they have experienced a drastic cut in resources show that they sometimes act to fulfill their social obligations

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before they act to satisfy their physical wants. They require income to fulfill their various roles and participate in the social customs and associations to which they have become habituated and not only to satisfy their physical wants (Townsend & Gordon, 2000).

Poverty can be defined as where resources are so seriously below those commanded by the average individual or family that the poor are, in effect, excluded from ordinary living patterns, customs and activities. As resources for any individual or family are diminished, there is a point at which there occurs a sudden withdrawal from participation in the customs and activities sanctioned by the culture. The point at which withdrawal escalates disproportionately to falling resources can be defined as the poverty line or threshold (Townsend, 2002).

In scientific terms, a person or household in Britain is poor when they have both a low standard of living and a low income. They are not poor if they have a low income and a reasonable standard of living or if they have a low standard of living but a high income. Both low income and low standard of living can only be accurately measured relative to the norms of the person's or household's society. Standard of living includes both the material and social conditions in which people live and their participation in the economic, social, cultural and political life of the country. Figure 1 below illustrates this concept of poverty. This relative concept of poverty is now widely accepted (Piachaud, 2003), however, whilst it is not easy to measure poverty directly, it is possible to obtain measures of 'deprivation' These two concepts are tightly linked and there is general agreement that the concept of deprivation covers the various conditions,

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independent of income, experienced by people who are poor, while the concept of poverty refers to the lack of income and other resources which makes those conditions inescapable or at least highly likely (Townsend, 2002).
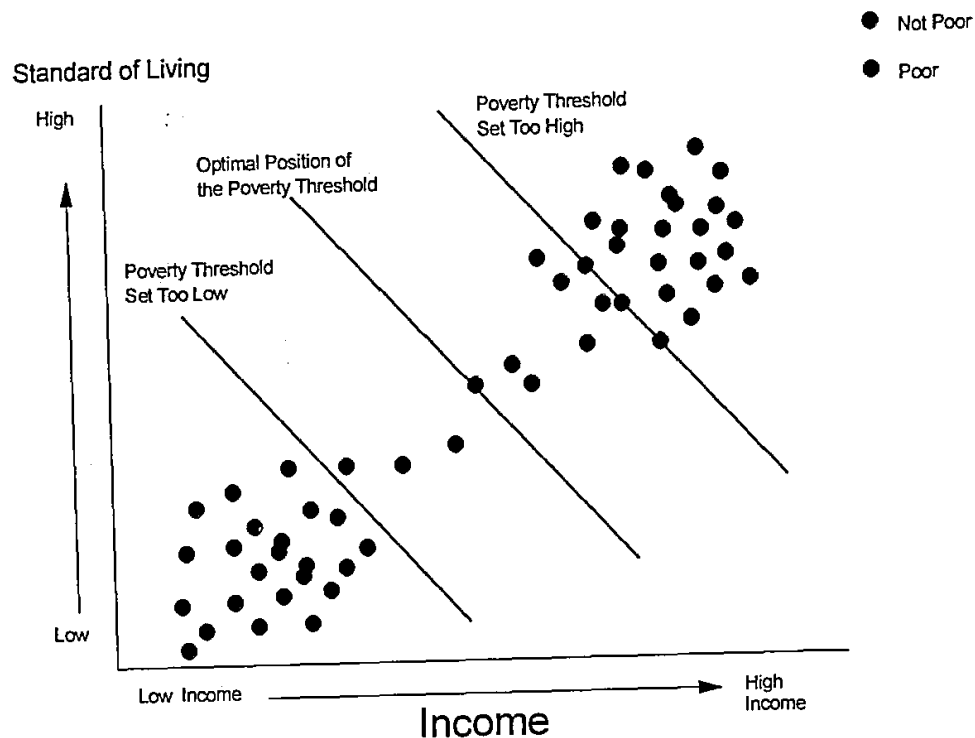
Figure 1: Distribution of Income by Standard of Living

Put simply, a low standard of living is often measured by using a deprivation index (high deprivation equals a low standard of living) or by consumption expenditure (low consumption expenditure equals a low standard of living). Of these two methods deprivation indices are more accurate since consumption expenditure is often only measured over a brief period and is obviously not independent of available income. Deprivation indices are broader measures because they reflect different aspects of living standards, including personal, physical and mental conditions, local and environmental facilities, social

activities and customs. Heating deprivation is often incorporated into the measurement of low standard of living in many specialist poverty surveys.

The issue of poverty has been in the agenda for the developing countries since its inception into the millennium development goals (MDGs). In September 2000, all the 189 member countries of the United Nations signed the MDGs and aimed at meeting these goals by 2015. The goal set for the issue of poverty was to half the proportion of population living on a US$1 per day by 2015. Although, there have already been measures to reduce the number of poor as their population decreased to 1.1 billion in 2001 from a level of 1.5 billion in 1981 (Chen & Ravallion, 2005) yet still a significant proportion of population is still suffering from poverty.

Poverty, as it is viewed is the outcome resulting from the various political, social and economic processes and their interactions, creating deprivation and lowering the living standards of the people (Sackey, 2005). The economic growth is one of the tools to reduce the poverty level that ultimately lowers the incidence of prevailing deprivation but the extent of inequality in the society might mitigate its effects in the presence of the higher inequality (World Bank, 2001).

Global Challenges of Income, Consumption and Poverty Statistics

Poverty reduction and redistribution of income is one of the key objectives of the Development Goals. Paradoxically, a consensus on a consistent approach to identify the poor within and across countries and over time does not currently exist (Komanou, 2006). However, there have been recent advances in

coordination among international institutions in their effort to reduce poverty and to redistribute income in the world particularly developing countries through, for example, the adoption of the Millennium Development Goals that also shows a broader consensus among these institutions on widening the scope for poverty measurements. In fact the Millennium Summit was the first time there was an agreement on a global target of halving the proportion of people living in extreme poverty by 2015, which is the first target of the Millennium Development Goals. Three so called Road-map indicators have been designated to monitor progress on this target: (1) Proportion of people below $1 per day; (2) Poverty gap ratio and (3) Share of poorest quintile in national consumption.

Overview of the World Bank global poverty measure

There should be recognition on the first major attempt to measure global income poverty by the World Bank over the last 2 decades. The Bank's methodology used for the $1 per day estimates encompasses three elements; first, it define someone as poor if he or she lives in a household with a per capita expenditure (whether in cash or in kind) that is insufficient when judged by what poverty typically means in the world's poorest countries. It judges poverty by standards common in South Asia and much of Sub-Saharan Africa, no matter where one actually lives. The equivalent international poverty line in 1993 was $1.08 a day in 1993 prices. This is the median of the ten lowest poverty lines with the same set of countries used by researchers in 1985. Second, purchasing power parities (PPPs) for household consumption expenditures are applied to country data to obtain measurements in

local currencies at purchasing power parities in 1993. Third, this 1993 poverty line is then converted to the prices prevailing at each survey date using the country's official consumer price index (Chen & Ravallion, 2005).

Policy requirements of poverty statistics

The problem of monitoring global poverty is one of the most crucial development issues facing international policy. The challenges are methodological as well as statistical and both are intricately linked. While the World Bank has been the designated to compile/provide the indicators for the three targets of the Millennium Development Goals' Goal1, it is expected that he indicators for monitoring implementation of the Millennium Development Goals will have to be implemented on the basis of established data sources of the national statistical services, which are the ultimate providers of any information basis. Further, it should be noted that the Proportion of Population below Poverty line (PPP)-based international poverty lines is required only to allow comparisons across countries. It is therefore recommended to use national poverty lines in all other poverty related studies (Komanou, 2006).

The development of sound poverty measures to guide national and therefore international policy is a complex exercise, in part due to the multi-dimensional nature and different manifestations of poverty. Clarifications of how poverty is defined is extremely important as different definitions of poverty imply the use of different criteria for measurement leading potentially to the

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identification of different individuals and groups as poor, and the use of different policy solutions to reduce poverty.

Likewise, one fundamental requirement to develop adequate poverty measures is a prior understanding of the objective of the measures, and more specifically, the way(s) the measures would help to inform policy and to address the problem of poverty. Poverty measurements might serve a number of purposes among which:

1. to differentiate the poor individuals or groups from the non-poor;

2. to monitor poverty by comparing poverty rates across different subgroups of the population or across countries;

3. to monitor poverty over time;

4. to develop poverty profiles that describe the characteristics of those in poverty;

5. to define thresholds for public transfers.

There are a number of general questions about how to define and measure poverty and most of them are well known. Some researchers defined poverty base on social exclusion and participatory approach.

The monetary approach to poverty measurement

This is the most commonly used approach to identification and measurement of poverty. It defines poverty with a shortfall in monetary income (consumption) from some poverty line. The following issues are considered when using the monetary approach:

1. valuation of different components of income/consumption in particular subsistence production or public goods.

2. does the shortfall in monetary expenditures (income) encompasses all elements on poverty?

3. validity and justification of the choice of the poverty line.

There have been major methodological advances in the operationalization and standardization of the monetary approach. However, there remain outstanding methodological and empirical challenges that undermine the claim of objectivity of this approach. This includes:

(a) choice if the indicator of welfare: Does consumption or income better approximation of welfare and which of the two is more reliable?

(b) both income and consumption include only private resources and omit social income and benefits (goods and services provided publicly), leading to an implicit bias in policy choices in favor of the generation of private income as against to public goods provision, and likewise, towards the identification of the poor for targeting purpose towards those lacking private income.

(c) choice of the poverty line: Several approach have been suggested of which two methods most widely used are (1) the Nutritional poverty line and (2) the cost of basic needs line or a combination of both. There are important basic principle/assumption that should underlie poverty line but that have been proven difficult to be met in practice and in a consistent manner within and across countries.

Determination of poverty line should take account of deferring metabolic rates, activities, age, gender, in the defining the minimum nutritional requirement. Equivalence scales, defined as the ration of cost of achieving some particular standard of living, given the demographic composition, to the cost of a reference household achieving the same standard of living, is often used to account for age (and sex) differences in household composition. The way resources are distributed within household affects the nutrition levels of individuals-yet poverty lines are often drawn at a household level. Poverty line should be adjusted for differences in costs of living across areas and regions within a country and in particular between urban and rural regions.

Consistency versus specificity of poverty line remains one of the most contentious issues in the specification of poverty lines. By virtue of consistency, the poverty line should be fixed (in real value) across all region and areas. Conversely, specificity requires that the construction of the poverty lines be anchored on a basket of basic needs of the poor and be reflect the consumption pattern in each area and region. This clearly contradicts consistency. Consistency over time requires that poverty line be adjusted over time using true cost of living index. The observed change in poverty line would then be a true change in poverty line, which in other words, would mean that the standard of leaving by the poverty line would not change over time.

The capability approach

In this approach, the focus is on failure of some basic capability of functioning (Sen, 1985). The emphasis in on the outcome measures of well being (achievements), as opposed to the monetary approach by which monetary indicators represent indirect measures of the outcomes. Non-monetary components of poverty measures are also essential to analyze the dynamics of income poverty, whether it is likely to be persistent or not, and thus for the associated policy implications.

The capability approach to poverty evaluation poses three main operational issues, namely definition of basic capabilities, measurement of these capabilities and aggregation. Methods of defining basic capabilities invariably amount to the establishment of a list of sensitive Basic Needs using various fundamental criterion. Most of these techniques have led to similar interpretation of minimal essential capabilities as being constituted by health, nutrition and education. In practice, these basic capabilities and measured through functioning (life expectancy, morbidity, nutrition levels).

The fundamental question in aggregation is whether capability poverty should be presented separately for each capability. It has been argued that aggregation conceals important information, for an analytical and policy perspective. However, the need to reduce the large amount of information is also desirable, e.g. for comparisons. The union approach (by an individual is considered poor if he/she is deprived in any dimension) and the overlapping

approach (individuals are poor only if deprived from all dimensions) have also been suggested-but less implemented empirically.

Sources of data used for poverty evaluations .

Poverty monitoring requires comparisons of poverty profile across time and/or across countries. Such comparisons would be possible and valid only if the data used to construct the poverty profiles are collected in the same way over time and across countries. Thus, any changes in data collection methodology and processing of the data used to define poverty must be considered carefully.

There is a wide consensus that household survey is the only tool that can provide information on income/consumption distribution for the purpose of measuring poverty (Glewwe, 2001). More over surveys (income and expenditures surveys, labor force surveys, demographic and health surveys) provide a wide array of information that could be used to better understand the nature of poverty (Glewwe, 2001).

There have been claimed that National Accounts should be used to estimate poverty (UNTAD, 2002). However, the recent debate on global poverty has raised serious doubts about the use of the national accounts concept of final household consumption (expenditures) for poverty measures. It had been shown, based the conceptual definition and methods of estimation of final household consumption in national accounts, that the national accounts estimate of household final consumption, as used in the current procedures to estimate poverty, is not appropriate for poverty measures

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It is desirable that the international statistical community agrees on a common set of best-practice protocols for household income expenditure surveys, as a parallel to the SNA for the National Accounts. International agencies and other organization should give high priority to develop global standards for harmonised household surveys as a tool that could generate reliable estimates for poverty consistent across countries and across time. Only then global poverty measurement and monitoring would be put a sound basis.

THE EXTENT OF POVERTY IN GHANA

Poverty in Ghana has many dimensions. Poor communities are characterized by low income, malnutrition, ill health, illiteracy and insecurity. There is also a sense of powerlessness and isolation. These different aspects interact and combine to make the Recovery Program, initiated in 1983. It was judged a remarkable success story-until further shocks of public sector wage increases was experienced in 1992 and subsequent events. The GDP growth rate has been maintained at a very reasonable 5 percent per annum over the last decade. This was accompanied by a perceptible decline in poverty. From 1988 to 1992, poverty incidence in Ghana decreased and poverty reduction was accompanied by significant improvement in social indicators. Infant mortality decreased from 77 to 66 per 1000 live births, child mortality decreased from 84 to 57 per 1000, malnutrition rate decreased from 31 to 26 percent and total fertility rate decreased from 6.4 to 5.5 (World Bank, 1995). A survey on the demographic and health conditions of the country conducted in 1988 indicated that high fertility

and low infant and childhood mortality rates account for the fast population growth in Ghana (GSS, 1989).

Despite progresses that Ghana has made, poverty remains a serious and extensive problem. For over 30 percent of the population, or about 5 million people expenditure per capita in 1992 was less than US$25 a month. A further poverty reduction can be assured only if there is a continued economic growth with a reasonable distribution of its benefits. It is pointed out in Country Economic Memorandum (World Bank, 1995) that suitable macroeconomic policies to promote private sector growth, sustainable agriculture sector policies and human capital investments are required if growth is to be sustained and poverty is to be reduced.

The implementation of structural adjustment policies also had its repercussions on regional disparities in poverty in particular, the devaluation of the cedi and the resulting increase in the producer price of cocoa had a significant positive impact on cocoa producers, resulting mainly in increased maintenance plantings and hence increased production. Commander (2004); Alderman (1991) estimates that net payments to cocoa farmers increased form just fewer than 5 billion cedis in 1983/84 to over 13 billion cedis in 1987/88 (in 1985 constant prices).

The ecology of Ghana, however, dictates that such gains will be distributed unevenly across regions with over half of all payments going to the Ashanti and Western regions. In general, the regions that have benefited from rising cocoa prices also benefited from the higher prices for timber and gold. One

can therefore infer that the extreme poor in the rest of the country did not benefit much from this aspect of the structural adjustment programme.

Ewusi (1984) analyzed the income data of the 1974/75 Household Budget Survey and found out that education, occupation and size of household are other variables that seem to affect poverty. Education and occupational status were negatively correlated with poverty, while size of household was positively related illiterate heads of households. Illiterate heads of households have higher poverty rates than literate heads of households. Farmers had higher rates than non-farmers and large-size households had higher rates of poverty than small-size households. The incidence of poverty was slightly higher in households headed by males than those headed by females.

It can therefore be inferred from these studies that poverty is overwhelmingly a rural phenomenon and that the incidence is more in the Northern parts than in the Southern parts of the country. The heads of most poor households are males who are self-employed (agriculture), poorly educated and have large-size households.

Kyreme and Thorbecke (1991) in modeling the determinants of food poverty in Ghana concluded that, income, fertility, maturity indices, age, education and sex significantly explain household calorie gaps. Kyreme and Thorbecke (1991) defined total calorie gap for household (I) as:

$$G(I) = \{R - C(I)Ae(I)\}$$

where R is the Recommended Daily Allowance (RDA) of calories; specifically $2092K$ cals per adult equivalent and $Ae(1)$ is the number of adult equivalents in

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household $\{1\}$. A positive calorie gap $(G\{1\}) > 0)$ means household$\{1\}$ is calorie or food poor, but a negative gap $(G\{1\} < 0)$ means household $\{1\}$ is calorie or food rich. Variables negatively related to the calorie gap, while lower gaps were associated with male-headed households.

Asenso-Okyere, Nsowah-Nuamah and Alverson (1992) in Ghana reached a conclusion that, water and electricity contribute significantly to the odds of not being poor, land availability was found to be associated with lesser poverty, migration status was found to contribute positively to poverty reduction and large-sized households and high dependency ratios contribute positively to increase in poverty.

When human deprivation is considered, out of a population of 15 million Ghanaians in 1990, there were about 5.9 million without access to health services, 6.5 million without access to safe water and 10.4 million without access to sanitation. about10,000 children died before the age of 5 years, about 2.0 million children were not in primary or secondary schools and nearly 4 million adults were illiterate (UNDP, 1991).

The United Nation Development Programme (UNDP) in its Human development report has devised a Human Development Index (HDI), which tries to compare countries in terms of their human development efforts. The index combines efforts in adult literacy, life expectancy and national income to come up with a single index. On a scale of zero to one the HDI for Ghana was 0.311 in 1990 and ranked 121 among 160 counties. In sub-Saharan Africa, 13 countries

placed higher than Ghana either because of a better life expectancy, educational attainment or adjusted real GDP.

Glewwe (1991) investigated the determinants of household living standards in Cote d'Ivoire and deduced that the impact of education on household living standards appeared to be quite strong in urban areas, but rather weak in rural areas. Secondly, there was evidence that the provision of medical facilities in rural areas had a substantial positive impact on consumption levels, to the extent that these facilities reduced days lost to illness. Finally, non-agricultural business assets have a strong positive effect on household living standards in cote d'Ivoire, particularly in rural areas.

We can assess income in two ways: in absolute terms and in relative terms. In absolute terms, we can say incomes in Ghana are low because many households are not able to meet their basic needs with their incomes. An indication of low incomes in absolute terms is the high incidence of poverty mentioned above. The latest household survey (GLSS 4, 1999) revealed that as high as 59 percent of food crop farmers were below the national poverty line. Among export crop farmers the incidence of poverty was recorded among private formal sector employees (11.3 percent). Among informal sector and public sector workers almost 1 out of every 4 was found to be below the poverty line (See Table 1.6 in Appendix).

In relative terms, we can assess incomes in different ways. We can compare current incomes with real incomes in the past (a selected year or period) depending on availability of data or we can compare current incomes in Ghana

with incomes in comparable African countries (countries at the same level of economic development e.g. Sub-Saharan countries). The key question we are trying to answer is: what has happened to real incomes in Ghana over time?

Poverty Line Assessment

In order to assess the welfare level, one might look at the household income data as a possible indicator of the household level welfare level. The use of income data is not preferred because of the fact that the income is often understated and provides biased estimates for the poverty analysis. The use of monthly expenditures instead of income is favorable due to the fact that the expenditures actually represent the permanent income of a household (Arif, 2006). The minimum expenditures required to maintain a specific level of wellbeing is set as a threshold or called poverty line. The assessment of the minimum level of wellbeing is not arbitrary rather the cost of a basket of essential consumption goods is taken as a reference category. To control the poverty line for varying household sizes, the threshold of per capita monthly expenditures is often taken as poverty line.

The second approach is the calorific approach that takes into account both the food and non food items for poverty line determination. The official poverty line of Pakistan is calculated by selecting a basket of food items to meet the minimum required level of calorie intake of 2350 calories per day per person and the cost of such a basket at the prevailing prices is calculated to set the minimum amount required for meeting the recommended nutritious level for a single person

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(Hussain, 2003). This level is scaled up with some pre-specified multiple to obtain the final poverty threshold per capita.

The review of the poverty related literature suggests modeling the different household characteristics and household characteristics as possible covariates to explain poverty. Moreover, regional dummies can also be included for controlling for the region specific variations in the determinants of poverty. The use of Logit or Probit model is a useful technique to be employed while the dependent variable can be defined in multiple ways including the income, expenditure and calorie intake methods. Although the poverty prevalence is a topic of the current era yet little attention is paid on the severity of the poverty. Much of the empirical work and policy analyses are made keeping in view the conditions of the poor for exiting them from the poverty line but little attention has been made on the households that are currently above the poverty line but might fall into this poverty trap. Baulch and McCulloch (1998) name this type of transition as "spell". Over the transitions of poverty, some households come out of the poverty trap while some others get caught into that (Lawson, 2008). The idea of poverty spells is not new. It takes its origin from the Bane and Ellwood (2006), who did their seminal work on poverty and found empirically the "Dynamics of the spells", in USA. The analysis of this type is out of the scope of the study due to the unavailability of the Panel data that had been used for modeling such poverty spells.

The analysis however can be extended to an ordered Logit or multinomial Logit regression model with dependent variable taking the ordinal or nominal

values respectively, for the severity of the poverty. This type of analysis enables the researcher to compare the implications of various policies for all type of poor and non-poor households. The current paper does not include the extended models of multinomial Logit or Ordered Logit and therefore do not provide deterministic values for the different levels of poverty. Future research can be directed taking the poly-chotomous type of dependent variable and possible explanatory variables found relevant in the literature.

CHAPTER THREE

REVIEW OF BASIC METHODS

INTRODUCTION

One important statistical method that has been used extensively in this thesis (see Chapter 5) is the logistic regression model. This method is useful when data to be used is partially qualitative in nature. Owing to the importance attached to it in this thesis, a brief review of the theory behind it is provided in this chapter. Lorenz curve was used to determine poverty line, which we used to determine poverty status of a household. Even though this thesis did not dwell into determining the poverty line, it is important to review the theory behind Lorenz curve. This chapter also has outlined some basic theory of Lorenz curve.

LOGISTIC REGRESSION

The main objective set out in chapter one requires some aspects of modeling, which is to establish a relationship between a set of predictor or explanatory variables and a response variable. These predictor variables are sex, age, ecological zone, locality, health, literacy, occupation and educational status. The response is poverty status that whether a head of household is poor or not poor. Due to the nature of the data set for the analysis, an obvious approach is to employ linear models of the form,

$$Y = X\beta + e,$$

where Y is a matrix of the response variable, X is the matrix of explanatory variables, β is the vector of unknown parameters to be estimated and e is the random error vector assumed to be independent and identically distributed with mean 0 and variance σ^2, that is $e \approx N(0, \sigma^2)$. Linear models are particularly useful in the modeling of most quantitative data. However, when there is evidence that the conditions for linear models are not satisfied, recent advances in statistical theory, provide other useful alternatives, called the Generalized Linear Models (GLM). Situations that make the use of linear models unsuitable, but may require the use of Generalized Linear Models (Dobson, 2000; Chatfield, 1999) include when the response variable is not normally distributed; and when the relationship between the response and explanatory variables is not in the simple linear form. One aspect of GLM, which is of interest in this thesis, is the logistic regression model.

There are three main types of logistic regression. These are the binary logistic regression, in which the response variable is binary without natural order; the ordinal logistic regression, in which the response variable has three or more categories or levels with natural order; the multinomial logistic regression, in which the response variable is nominal without natural ordering. In all these cases the explanatory variables may be qualitative or quantitative.

The discussion of the model in the following sub-section focuses on binary regression, although it would be realized that the most part of it apply to other forms of logistic regression that have been mentioned earlier.

Binary Response Models

A binomial response model was considered more appropriate than a multinomial response model. This was because the response variable which is poverty status was classified under two groups. The groups for the response variables are poor and non-poor. The response data were based on the construction of a statistical model to describe the relationship between the observed response and the explanatory variable. The binomial response model is applied in most disciplines in economics, especially in labor economics for the analysis of micro level data sets. Probit and Logit models are the most widely used in binomial response models.

Logistic regression model deals also with binary or dichotomous outcome variable. In a binary response model, the value of the dependent variable (response variable), say, standard of living (poverty status), y_t can take on only two values, 1 and 0, which indicate whether poor or non-poor When $y_t = 1$, it indicates that, the person is poor and $y_t = 0$ it indicates that the person is non-poor, where t is the standard of living measure for individuals. Let P_t denote the (conditional) probability that a person is poor. Thus a binary response model is really trying to model P_t conditional on certain information set, say Ω_t, that consists of exogenous and predetermined variables. Specifying y_t so that it is either 0 or 1 is very convenient, because P_t is then simply the expectation of y_t conditional on Ω_t:

$$P_t = P_r\left(y_t = 1\Omega\right) = \mathrm{E}(y_t/\Omega_t)$$

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The objective of a binary response model is to model this conditional expectation. From this perspective, it is clear that the linear regression model makes no sense as a binary response model. Suppose that X_t denotes a row vector of length k of variables that belong to the information set Ω_t, including a constant term of the equivalent. Then a linear regression model would specify $E(y_t/\Omega_t)$ as $X_t\beta$. But $E(y_t/\Omega_t)$ is a probability, and probabilities must lie between 0 and 1. The quantity $X_t\beta$ is not constrained and therefore cannot be interpreted as a probability. Nevertheless, a good deal of (mostly older) empirical work simply uses Ordinary Least Squares (OLS) to estimate what is (rather inappropriately) called the **linear probability model**, that is, the model

$$y_t = \Omega_t\beta + u_t$$

Several binary response models that do make sense are available and are quite easy to deal with. To solve the problem of not constrained coefficient, we have to make use of a transformation function $f(x)$ that has the properties

$$f(-\infty) = 0, f(\infty) = 1, \quad and \tag{1}$$

$$f(x) = \frac{\partial f(x)}{\partial x} > 0. \tag{2}$$

Thus $f(x)$ is a monotonically increasing function that maps from the real line to the 0-1 interval. Many cumulative distribution functions have these properties. The binary response models consist of a transformation function $f(x)$ applied to an **index function** that depends on the independent variables and the parameters of the model. Thus a very general specification of a binary response model is

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$$E(y_t / \Omega_t) = f(h(X_t, \beta))$$

where $h(X_t, \beta)$ is the index function. A more restrictive, but much more commonly encountered, specification, is

$$E(y_t / \Omega_t) = f(X_t \beta) \tag{3}$$

In this case, the index function $X_t \beta$ is linear and $E(y_t / \Omega_t)$ is simply a nonlinear transformation of it. Although $X_t \beta$ can, in principle, take any value on the real line, $f(X_t \beta)$ must lie between 0 and 1 by property (1).

Because $f(.)$ is a nonlinear function, changes in values of the X_{ti}'s, that is, the elements of X_t, necessarily affect $E(y_t / \Omega_t)$ in a nonlinear fashion. Specifically, when $P_t \equiv E(y_t / \Omega_t)$, its derivative with respect to X_{ti} is

$$\frac{\partial P_t}{\partial X_{ti}} = \partial F \frac{(X_t \beta)}{\partial X_{ti}} = f(X_t \beta) \beta_i \tag{4}$$

For the transformation functions that are almost always employed, $f(X_t \beta)$ achieves a maximum at zero and then falls as $X_t \beta$ gets farther from zero. Thus equation (4) tells us that the effect on a change in one of the independent variables is greatest when $P_t = 0.5$ and least when P_t is close to 0 or 1.

When binary response models are used in applied work, the linear index function $X_t \beta$ is almost always employed, along with one of the transformation function $f(.)$. The resulting models are called the probit model and the logit model. For the probit model, the transformation function $f(x)$ is the cumulative standard normal distribution function

$$\phi(x) \equiv \int_{\omega}^{x} \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{1}{2}x^2\right) dx.$$

Since $\phi(x)$ is a cumulative density function, it automatically satisfies conditions (1) and (2). The probit model can be written as

$$P_t \equiv E(y_t/\Omega_t) = \phi(X_t \beta).$$

Although, there is no closed-form expression for $\phi(x)$, it is easily evaluated numerically, and its first derivative is of course simply the standard normal density function:

$$\phi(x) = \frac{1}{\sqrt{2\pi}} \exp(-\frac{1}{2}x^2)$$

The probit model can be derived from a model involving an unobserved or **latent**, variable y*$_t$. Suppose that

$$y_t^* X_t \beta + u_t \approx NID(0,1) \tag{5}$$

We observe only the sign of y_t^* which determines the value of the observed, binary variable y_t^* according to the relationship

$$y_t = 1 \text{ if } y_t^* > 0 \text{ and } y_t = 0 \ y_t^* \leq 0. \tag{6}$$

For example, we could think of y_t^* as an index of the (net) utility obtained from some action. If the action yields positive utility, it will be undertaken; if not, then it will not. Since we observed only whether or not the action is undertaken, we observe only the sign of y_t^*. Because of this, we can normalize by dividing y_t^*, β and u_t by σ. this will yield a model observationally identical to the one we started with.

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We can now ask what the probability is that $y_i = 1$. Some straightforward manipulations yield

$$Pr(y_i = 1) = Pr(y_i > 0) = Pr(X_i\beta + u_i > 0)$$

$$= 1 - Pr(u_i \leq -X_i\beta)$$

$$= 1 - \emptyset(-X_i\beta) = \emptyset(X_i\beta) \qquad (7)$$

The last equality in (7) makes use of the fact that the standard normal density function is symmetric around zero. The final result, $\emptyset(X_i\beta)$, is just the probability that we would get by letting $\emptyset(.)$ play the role of $f(.)$ in (3). Thus we have derived the probit model from the latent variable model consisting of (5) and (6). That the probit model can be derived in this way is one of its attractive features that make it easier to deal with.

For the logit model, the function $f(x)$ is the logistic function

$$\lambda(x) = (1 + e^{-x})^{-1} = \frac{e^x}{(1 + e^x)}$$

which has first derivative

$$\lambda(x) = \frac{e^x}{1 + e^x} = \Lambda(x)\Lambda(-x)$$

The later equality here will later prove to be very useful. The logit model is most easily derived by assuming that

$$\log\left(\frac{p_i}{1 - p_i}\right) = x_i\beta,$$

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which says that the logarithm of the odds is equal to $x_t \beta$. Solving for P_t, we find that

$$P_t = \frac{\exp(X_t \beta)}{1 + \exp(X_t \beta)} = \left(1 + \exp(X_t \beta)\right)^{-1} = \Lambda(X_t \beta). \qquad (8)$$

In practice, the logit and probit models tend to yield extreme results. In most cases, the only real difference between them is in the way the elements of β are scaled. This difference in scaling occurs because the variance of the distribution for which the logistic function is the cumulative distribution functions (c.d.f.) can be shown to be $\pi^2 / 3$, while that of the standard normal is unity. The logit estimates therefore all tend to be larger than the probit estimates, although, usually by a factor of somewhat less than $\pi^2 / \sqrt{3^2}$.

ESTIMATION OF BINARY RESPONSE MODEL

To estimate binary response models, maximum likelihood method is mostly used. We restrict our attention to this method and assume, for simplicity, that the index function is simply $X_t \beta$ then, according to the binary response model (3), $f(X_t \beta.)$ is the probability that $y_t = 1$ and $1 - f(X_t \beta)$ is the probability that $y_t = 0$.

Thus, if $y_t = 1$, the contributions to the logarithm of likelihood function for observation t is $log (f(X_t \beta))$, while if $y_t = 0$, that contribution is log $(1 - f(X_t \beta))$. Hence the loglikehood function is

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$$\ell(y,\beta)=\sum_{i=1}^{n}\left(y_i\log(f(X_i\beta))+(1-y_i)\log(1-f(X_i\beta))\right). \qquad (9)$$

The first-order conditions for a maximum of (9) are

$$\sum_{i=1}^{n}\frac{\left(y_i-\hat{f}_i\right)\hat{f}\hat{X}_{ti}}{\hat{f}\left(1-\hat{f}_i\right)}=0,\ i=1,.....,k, \qquad (10)$$

where $\hat{f}_i\equiv f\left(X_i\hat{\beta}\right)$ and $\hat{f}_i\equiv f(X_i\beta)$. With $\hat{\beta}$ denoting the vector of maximum

likelihood (ML) estimates. Whenever the loglikehood function is globally

concave, these first-order conditions define a unique maximum if they are

satisfied at all. It can be verified that logit, probit, and many other binary

response models satisfy the regularity conditions needed for the ML estimate $\hat{\beta}$

to be consistent and asymptotically normal, with asymptotic covariance matrix

given by the inverse of the information matrix in the usual way. In the case of the

logit model, the first-order conditions (10) simplify to

$$\sum_{i=1}^{n}\left(y_i-\Lambda(X_i\hat{\beta})\right)X_{ti}=0,$$

because $\lambda(x)=\Lambda(x)(1-\Lambda(x))$. Notice that conditions (10) look just like the first-

order conditions for weighted least squares estimation of the nonlinear

regression model.

$$y_t=f(X_t\beta)+e_t \qquad (11)$$

with weights given by

$$(f(X_t\beta))(1-f)(X_t\beta)$$

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This makes sense, since the variance of the error term in (11)

$$E\left(e_t^2\right) = E(y_t - f(X_t\beta))^2$$

$$= f(X_t\beta)(1 - f(X_t\beta))^2 + (1 - f(X_t\beta))(f(X_t\beta))^2$$

$$= f(X_t\beta)(1 - f(X_t\beta)).$$

Thus one way to obtain ML estimates of any binary response model is to apply iteratively reweighed nonlinear least squares to (11) or to whatever nonlinear regression model is appropriate if the index function is not $(X_t\beta)$.

Using the fact that ML is equivalent to a form of weighted NLS for binary response models, it is obvious that the asymptotic covariance matrix for

$n^{1/2}\left(\hat{\beta} - \beta_0\right)$ must be

$$\left(\frac{1}{n}X^T \psi(\beta_0)X\right)^{-1}$$

where X is an $n \times k$ matrix with typical row X_t and typical element X_{ti}, and $\Psi(\beta)$ is a diagonal matrix with typical diagonal element

$$\Psi(X_t\beta) = \frac{f^2(X_t\beta)}{F(X_t\beta)(1 - F(X_t\beta))} \tag{12}$$

The numerator reflects the fact that the derivative of $f(X_t\beta)$ with respect to β_i is $f(X_t\beta)X_{ti}$, and the denominator is simply the variance of e_t in (11). In the logit case, $\Psi(X_t\beta)$ simplifies to $\lambda(X_t\beta)$.

This asymptotic covariance matrix can be obtained by taking the inverse of the information matrix. As usual, this is equal to the expectation of minus $n - 1$

times the Hessian and also to the expectation of the outer product of the gradient. The information matrix is simply

$$j(\beta) = \frac{1}{n} X^T \Psi'(\beta) X,$$ (13)

with $\Psi'(\beta)$ defined by (12). For example, from (10) it is easy to see that a typical element of the matrix $n^{-1} G^T(\beta) G(\beta),$, where G ($\beta$) is the CG matrix

$$\frac{1}{n} \sum_{i=1}^{n} \left(\frac{(y_i - F(X_i \beta)) f(X_i \beta)}{F(X_i \beta)(1 - F(X_i \beta))} \right)^2 X_{ii} X_{ij}$$

Wald Test

A Wald test is used to test the statistical significance of each estimated coefficient (β) in the logistic regression model. A Wald test calculates a Z statistic, which is:

$$Z = \left(\frac{\hat{B}}{se\hat{B}} \right)$$

The Wald statistic, on the other hand, would be computed by dividing the estimated coefficient of interest by its standard error and squaring the result. It is approximately a chi-square statistic with one degree of freedom.

$$Wald = \left(\frac{\hat{B}}{se\hat{B}} \right)^2$$

where $\hat{B}$ is the parameter estimate and $se\,\hat{B}$ is the standard error of the parameter estimate.

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Interpretation Using Odds Ratios

A simple transformation of the β's in the logit model indicates the factor change in the odds of an event occurring. The logit model can be written as the log-linear model:

$$\ln \Omega(x) = x\beta \qquad (14)$$

where

$$\Omega(x) = \frac{\Pr(y = 1/x)}{\Pr(y = 0/x)} = \frac{\Pr(y = 1/x)}{1 - \Pr(y = 1/x)} \qquad (15)$$

The equation (15) is the odds of the event given x. In $\Omega(x)$ is the log of the odds, known as the logit. Equation (14) shows that the logit model is linear in the logit. Consequently,

$$\frac{\partial \ln \Omega(x)}{\partial x_k} = \beta_k$$

Since the model is linear, β_k can be interpreted as:

For a unit change in x_k, we expect the logit to change by β_k, holding all other variables constant.

This interpretation is simple since the effect of a unit change in x_k on the logit does not depend on the level of x_k or on the level of any other variable. Taking the exponential of Equation (14)

$$\Omega(x) = \exp(x\beta)$$

$$= \exp(\beta_0 + \beta_1 x_1 + ... + \beta_k x_k)$$

$$= \exp(\beta_0)\exp(\beta_1 x_1)...\exp(\beta_k x_k) = \Omega(x, x_k)$$

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$$= \exp(\beta_0)\exp(\beta_1 x_1)...\exp(\beta_k x_k) = \Omega(x, x_k)$$

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The last equality introduces notation that makes explicit the value of x_k. To assess the effect of x_k, we want to see how Ω changes when x_k changes by some quantity δ. Most often, we consider $\delta = 1$ or $\delta = s_k$. If we change x_k by δ, the odds become

$$\Omega(x, x_k + \delta) = \exp(\beta_0)\exp(\beta_1 x_1)...\exp(\beta_k(x_k + \delta))...\exp(\beta_K x_K)$$

$$= \exp(\beta_0)\exp(\beta_1 x_1)...\exp(\beta_k x_k)\exp(\beta_k \delta)...\exp(\beta_K x_K)$$

To compare the odds before and after adding δ to x_k, we take the odds ratio:

$$\frac{\Omega(x, x_k + \delta)}{\Omega(x, x_k)}$$

$$= \frac{\exp(\beta_0)\exp(\beta_1 x_1)...\exp(\beta_k x_k)\exp(\beta_k + \delta)...\exp(\beta_K x_K)}{\exp(\beta_0)\exp(\beta_1 x_1)...\exp(\beta_K x_K)}$$

$$= \exp(\beta_k \delta)$$

Therefore, the parameters can be interpreted in terms of odds ratio:

For, a change of δ in x_k, the odds are expected to change by a factor exp $(\beta_k \delta)$ holding all other variables constant.

For $\delta = 1$, we have:

Factor change: For a unit change in x_k, the odds are expected to change by a factor of exp (β_k), holding all other variables constant.

If exp (β_k) is greater than 1, we could say that the odds are 'exp (β_k) as large as.' If exp (β_k) is less than1, we could say that the odds are 'exp (β_k) as small as.' For $\delta = s_k = s$, we have:

Standardized factor change: For a standard deviation change in x_k, the odds are expected to change by a factor of exp $(\beta_k \times s_k)$ holding all other variables constant.

Notice that the effect of a change in x_k does not depend on the level of x_k or on the level of any other variable.

We can also compute the percentage change in the odds:

$$100 \frac{\Omega(x, x_k + \delta) - \Omega(x, x_k)}{\Omega(x, x_k)} = 100[\exp(\beta_k \times \delta) - 1]$$

This quantity can be interpreted as the percentage change in the odds for a δ unit change in x_k holding all other variable constant.

MODEL ASSUMPTION AND PERFORMANCE EVALUATION

In using the logit model certain assumptions, which are enumerated below, were made:

(a) observations are independent of each other.

(b) the conditional probabilities are of even occurrence, which are the bases of the Logistic distribution function.

(c) the sample size is so "large", that the asymptotic properties of maximum likelihood estimators are applicable.

(d) no exact liner dependencies exist among explanatory variables.

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There are several statistics, which can be used for evaluating the performance of a model. Discussion will be on the likelihood ratio statistic and the Wald statistic because they are the ones that would be used in this study due to their robustness. The likelihood ratio statistic is a chi-square statistic, which makes use of maximized likelihood values while the Wald statistic makes use of standard error. Both statistic give approximately the same value in very large sample. Nevertheless, in small to moderated samples, the two statistic may give very different results. Statisticians have shown that the likelihood ratio statistic is better than the Wald statistic in such situations. However, the Wald statistic is somewhat convenient to use because only one model, needs to be fit.

The likelihood ratio statistic, which would be used, is

$$\ln LR = (-2 \ln l1) - (-2 \ln l2)$$

where

$l2$ is the value of the likelihood function for the full model as fitted

$l1$ is the maximum of the likelihood function if all coefficients except the intercept are zero. That is the computed chi-square value tests the hypothesis that all coefficients except the intercept are zero. The model chi-square statistic is used to determine if the overall model is statistically significant.

BASIC METHODS OF ANALYZING INCOME AND EXPENDITURE PATTERNS

Lorenz Curve

The Lorenz curve is a graphical representation of the relationship between the cumulative shares of income and the cumulative percentage of the population (see fig 2). A 45 degree line bisecting the angle created by the horizontal and vertical axes acts as a reference line. It represents income that is distributed equally across the population. The greater the income inequality, the farther away the Lorenz curve line from the 45-degree line. Perfect equality fig 1 is represented by a Lorenz curve, which lies along (0, 0) and (0, 1) followed by the vertical section from (0, 1) to (1, 1). This happens when just one person owns all the income. Between such perfect inequality and the diagonal of perfect equality are Lorenz curves representing varying degrees of inequality. The Lorenz curve must lie below the 45 degrees line and must increase at an increasing rate. (i.e. have a convex shape).

Algebraically, the Lorenz curve is defined as follow

$$L(p) = \frac{1}{u} \int_o^P Q\,(q)\,dq \qquad\qquad (16)$$

where $Q(p)$ is the living standard level below which we find a proportion p of the population. $L(p)$ indicates the cumulative percentage of total living standards held by a cumulative proportion p of the population when individuals are ordered in increasing values of their living standards. For instance, if $L(0,5) = 0.3$, then we know that the 50% poorest individual hold 30% of the total living standards in the population.

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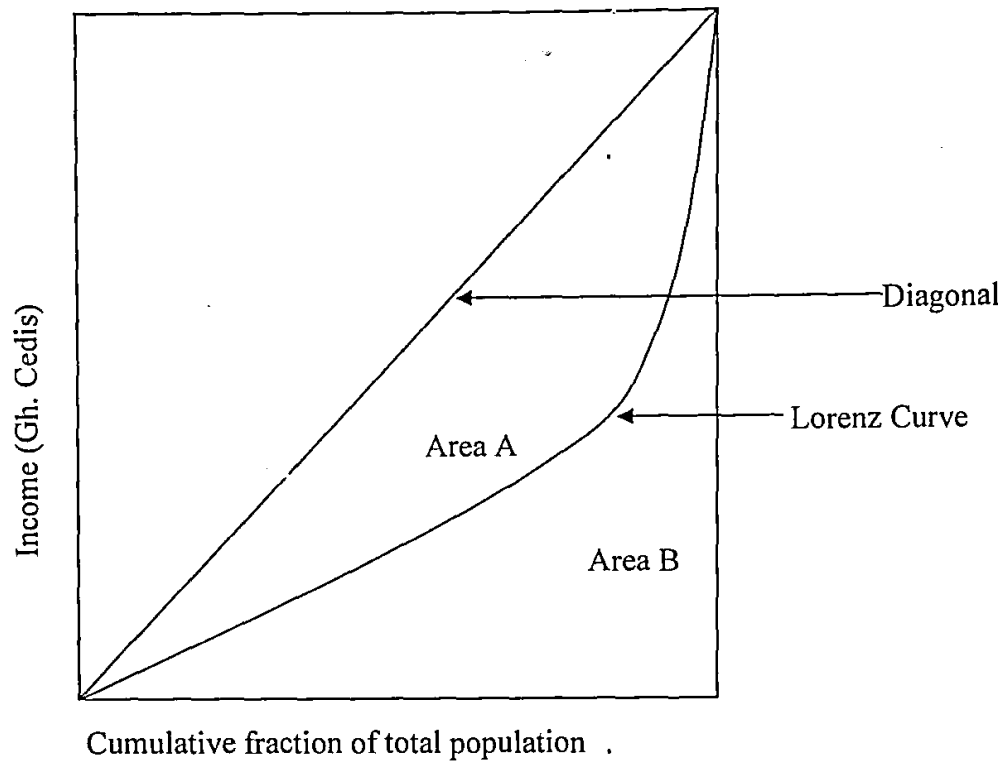
Figure 2: Sketch of Lorenz curve

The Lorenz curve ranges from 0 at $p = 0$, to 1 at $p = 1$. It increases as p increases, since more and more living standards are then added up. It is the most popular graphical display for visualizing and comparing the inequality in living standards. The Lorenz curve also provides complete information on the whole distribution of living standards as a proportion of the mean, thereby providing a more complete description of the relative standards of living than any of the traditional summary, statistics of central tendency and dispersion can give. It represents income that is distributed equally across the population.

The greater the income inequality, the farther way the Lorenz curve lies from 45 degree line. A short coming of the Lorenz curve is that, since it can only

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rank distributions whose curves do not cross, it efforts only a partial ordering of income distributions.

GINI COEFFICIENT OF INEQUALITY

A Gini Coefficient (G) is a measure of income inequality that is based on the Lorenz curve. It varies between zero and one that is ($O<G<1$). It was developed by an Italian statistician Carado Gini in the 1910s. Gini Coefficient is commonly used to indicate some income inequality in a society.

A Gini Coefficient value of zero indicates complete equality of income distributed across the population while Gini-coefficients greater than zero suggests various degrees of income inequality. Graphically, different areas of the Lorenz curve can easily represent the Gini-coefficient. The Lorenz curve maps the cumulative income share on the vertical axis against the distribution of the population on the vertical axis (see Fig. 2). From the Figure 3 below, suppose 60 percent of the population on the horizontal axis obtain 30 percent of total income and each individual had the same income, or total equality, then, the income distribution curve would be the straight line in the graph. There is no direct relationship between the extent of poverty and the Gini Coefficient. While an increase in the Gini Coefficient implies rising income disparity, it does not necessary indicate worsening of the poverty situation. This is because both the rich and the poor may become richer simultaneously. Therefore to understand the poverty situation of a society it is important that other income statistics should be considered in addition to Gini Coefficient.

The Gini coefficient is then calculated as the area A divided by the sum of areas A and B. thus

$$G = \frac{A}{A + B} \tag{17}$$

Where G = Gini – coefficient ,A = Area A and $\dot{B}$ = Area B

Sen defined the Gini Coefficient of the Lorenz distribution of the incomes of the total population as follows

$$G = 1 + \frac{1}{n} - \frac{2}{un^2} \sum_{i=1}^{n} (n+1-i)y_i \tag{18}$$

where

n = number of the total sampled population

u = mean income of the poor and

y_i = Income of the ith person
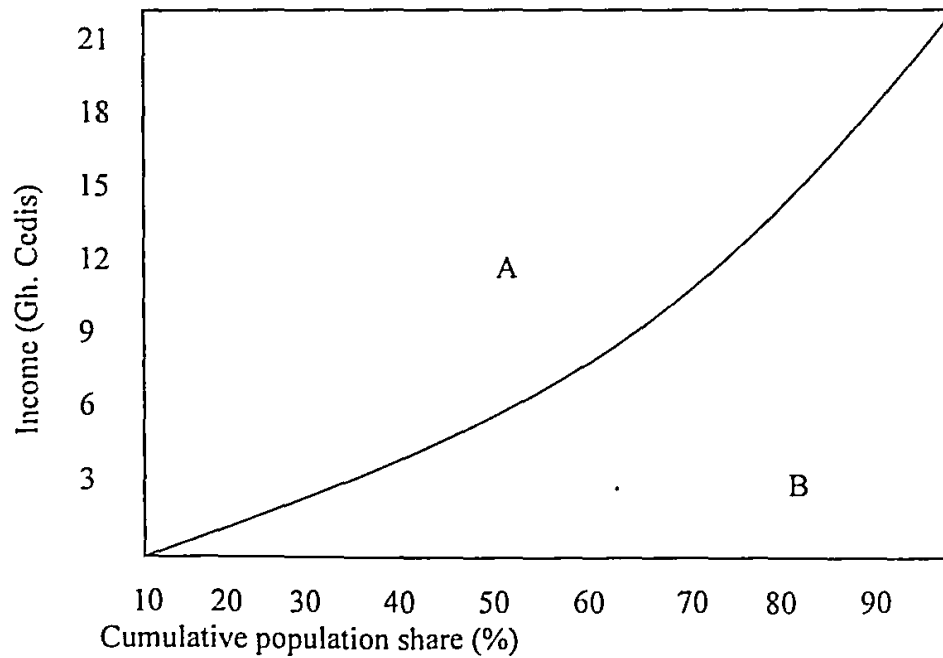
Figure 3: Lorenz curve of income distribution

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Like the Lorenz curve, the Gini coefficient does not give a complete ordering of income distributions. In addition to the problem of providing only a partial ranking of income distributions, the Lorenz curve and the Gini coefficient have other important limitations. Neither of the measures indicates the number of people who fall below the poverty line and they do not indicate the extent of impoverishment (Blackwood & Lynch, 1994)

SEN'S INDEX

One of the best-known absolute poverty measures is the Sen Index (Sen, 1976). At the time of its inception, the Sen Index was the first measure to overcome the shortcomings that were associated with earlier measures. It reflects the number of the poor, the extent of poverty and the distribution of income among the poor. One can therefore compare the degree of poverty among various populations. The Sen Index does this by incorporating the headcount, the income gap, and the Gini coefficient. The Sen Index is written as follows:

$$S = H[1 + (I - 1)G_P] \qquad (19)$$

where

S = Sen index

$I = \Sigma(z - y_i / qz)$; The average income shortfall as a percentage of the poverty line.

y_i = income of the ith poor household

z = poverty line

qz = number of households with incomes < z

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H = q/n; headcount ratio

G_r = Gini coefficient among the poor , where $0 \leq G_r < 1$

The Sen Index of poverty is somewhat biased toward policies that reduce the number of poor. The Sen Index suggests that the most efficient way to reduce poverty is, typically, to help the least needy first and to help the neediest last. This approach would be unacceptable to those who would prefer to reduce poverty by reducing inequality among the poor and to those who would prefer to reduce poverty by assisting the poorest of the poor. In Africa, the poorest of the poor have not always benefited, even when the poor on the average have gained (D. L. Blackwood & Lynch, 1994).

CHAPTER FOUR

PRELIMINARY ANALYSIS

INTRODUCTION

This chapter will focus on the characteristics of the variables of interest. It is important to know how these variables are related. This will help indentify some factors influencing the nature of these variables. This will include age of head of household, gender, marital status, household size, ecological zones (geographical), Locality, education and sources of income.

HOUSEHOLD CHARACTERISRICS BY LIVING STANDARDS

Poverty can be expressed in both monetary and non-monetary terms. In monetary terms, poverty can be measured in terms of households having enough resources or abilities to meet their needs (GSS, 2007). It is based on the income, consumption or expenditure of the households. The identification of the general characteristics of households according to their living standards covering aspects like demographic characteristics, employment, sources of income, and patterns of expenditure, education, health and housing are also of utmost importance when looking at expenditure patterns.

Figure 4 shows the trend in poverty as represented by GLSS3 and GLSS4 by percentages. These are categorized by their poverty status. It can be observed for both survey periods that poverty has reduced over the periods of the two

surveys. The percentage of poor has reduced from 52 percent during the GLSS 3 to 40 percent during the GLSS 4. Adversely the percentages of household heads who are not poor have increased. GLSS 3 recorded 48 percent and GLSS also recorded 60 percent. This illustrates that poverty in the country has reduced considering this two periods of the survey.
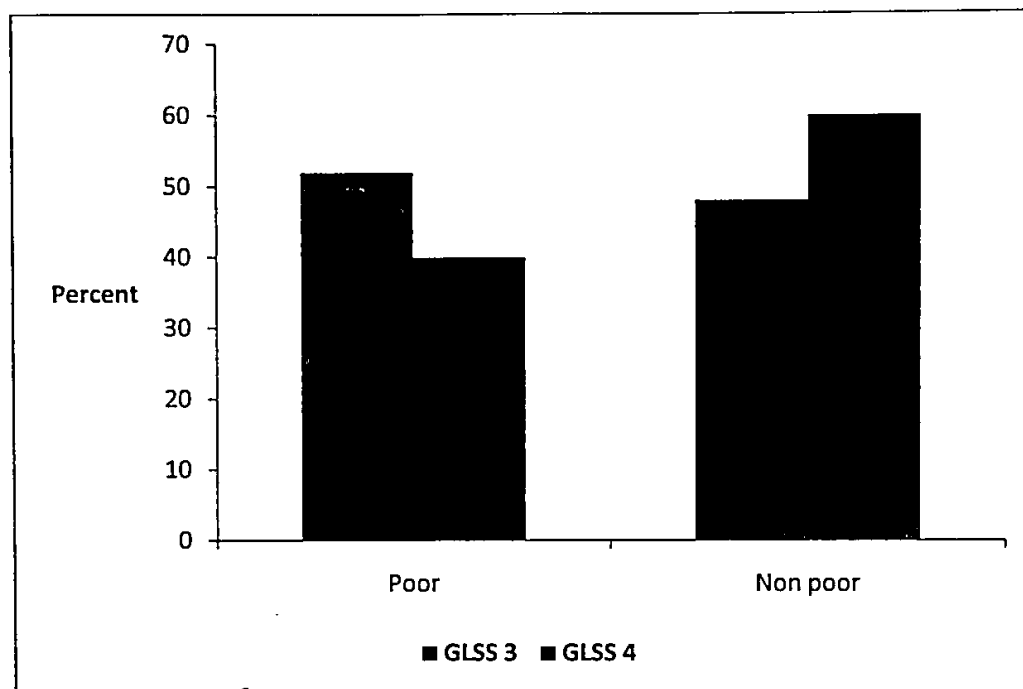
Figure 4: Trend in poverty status

Figure 4 shows an illustration of poverty trend in the country when considering the two periods of survey. Evidently poverty has declined during the second period of survey. The ratio of non-poor has also increased in second period of survey.

According to the Ghana Living Standards Survey for the two survey periods, the trend in poverty during 1990-1999 has really been favorable in the country, and poverty however, will be defined with reference to two separate

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poverty lines, the upper poverty line of 900,000 old cedis per adult per annum, and a lower line of 700,000 old cedis per adult per annum. Taking the upper poverty line of 900,000 old cedis, the percentage of the Ghanaian population defined as poor has fallen from almost 52 percent in 1991-1992 (GLSS3) to just under 40 percent in 1998-1999 (GLSS4).

Age Distribution of Respondents

The age composition of a household is one of the main factors determining its consumption level as well as its level of productivity. Table 1 describes the distribution of heads of household by age and poverty status.

Table 1: Age distribution of heads of households by standard of living (percent)

Age head	1991/1992		1998/1999	
	Poor	Non-poor	Poor	Non-poor
15-24	22.1	77.9	11.3	88.7
25-44	37.5	62.5	28.7	71.3
45-64	45.9	54.1	36.9	63.1
65 and above	42.1	57.9	34.8	65.2

Source: computed from the Ghana Living Standards Survey

From table 1, it can be seen that a household that consists of more children and aged heads (dependent group) is likely to be less productive and as such poorer than a household with more of its members in the economically active group (25-60) years, the independent group. The consumption needs of such households tend to be higher in relation to their resources that are often limited.

In the 1991/92 survey, it can be observed that the largest proportion (45.9%) of heads of poor households fall in the 45 to 64 age bracket. In the same survey it can be observed that an overwhelming number of heads of poor households are 45 years and above. A similar pattern can be observed in 1998/99. The percentage of poor households has reduced over the years. Comparing the two periods, it is evident that percentage poor reduced for all groups.

Gender

Figure 5 shows the distribution of heads of households by gender and their poverty status for the two surveys. This is evaluated in percentages.
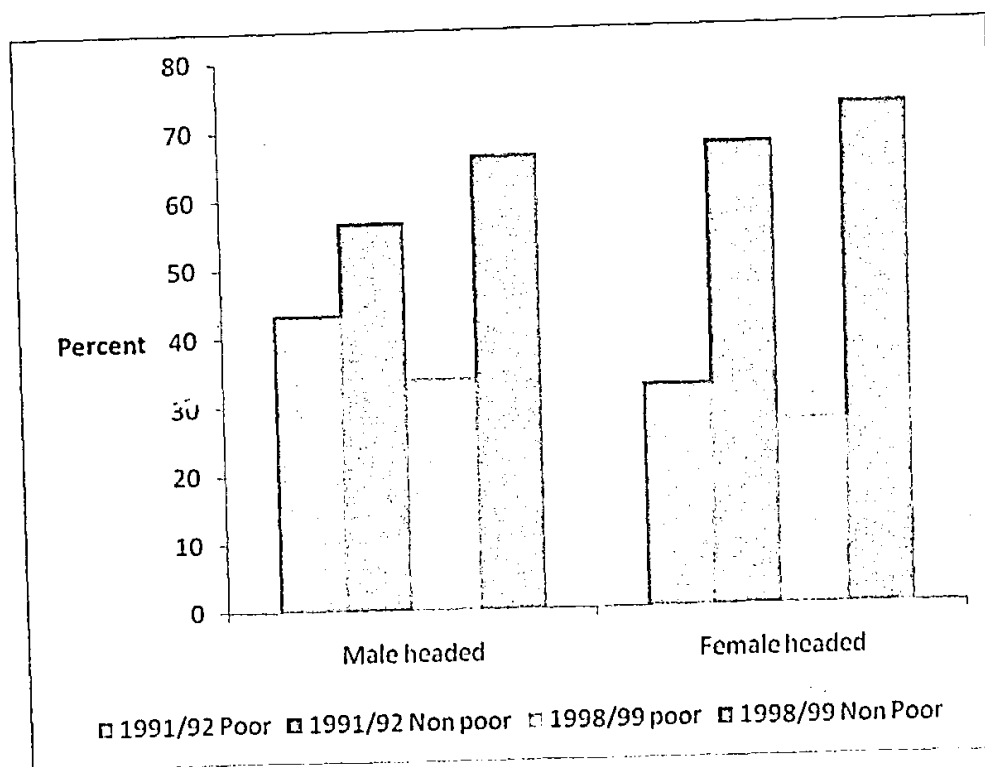
Figure 5: Gender of household head by standard of living

From figure 5, it can be observed that in the 1991/92 survey, there were more male heads in the non-poor category than there were in the poor category.

For the same period, there were more female heads that belonged to the non-poor category. Similar patterns can be observed for 1998/92, where male and female heads in the non-poor category form the majority.

Comparing 1991/92 to 1998/99, it can be observed that poverty levels have reduced. For example, the percentage of male heads classified as poor reduced from 43.3% to 33.9%. Similarly the percentage of female heads classified as poor reduced from 32.5% to 27.2%. These reductions, however, show a sharper reduction in male poverty levels.

Marital Status

The marital status of an individual also determines the poverty status of a household as shown in figure 6. In this study, the marital status consists of two groups, non-couples and couples were considered for the analysis. The non-couples consist of singles, separated and widows or widowers; while the couples consist of married and those living together. Figure 6 shows a graph of heads of households according to their marital status and poverty status. A higher proportion of the non-poor category of heads of households are either married or not married for 1991/92 survey. It is also observed that more couples are poor. The observations made above are also observed for 1998/99 survey. Comparing the outcomes of the two surveys, it is realized that the proportion of poor married and not married heads reduced in the 1998/99 period. The proportion of non-poor married and not married heads on the other hand increased. That is from 84.6% to 93.4% for couples and from 88.2% to 98.2% for non couples.

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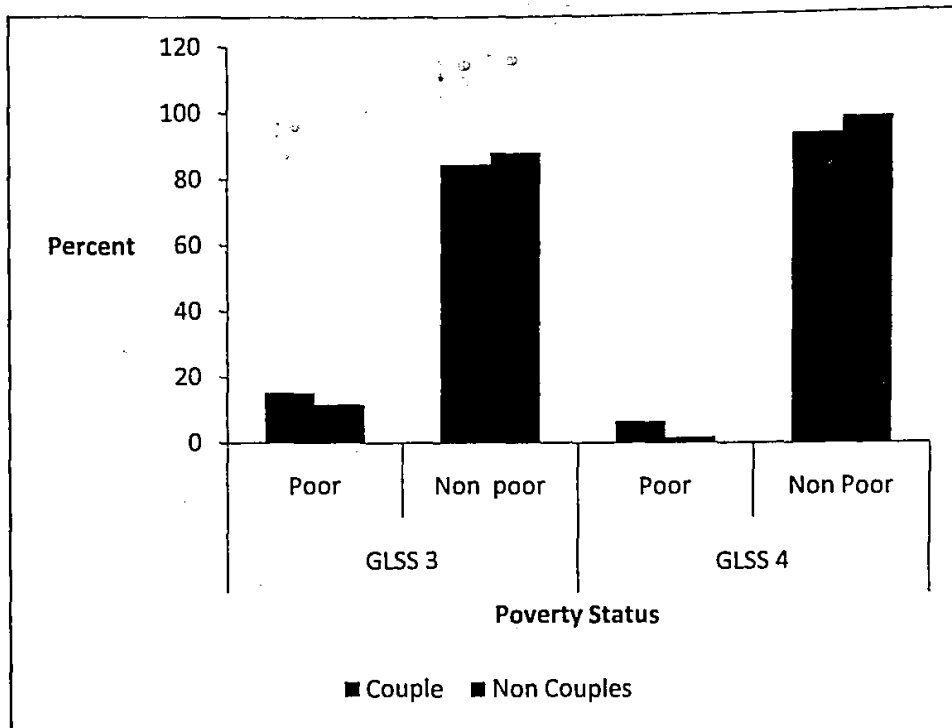
Figure 6: Marital status by standard of living

In 1998/99 (GLSS4), 1.8 percent of non couples and 6.6 percent of couples were poor and 98.2 percent of non-couples and 93.4 percent of couples were non-poor. Therefore, the average standard of living of both groups was above the core poverty line. This generally means non-couples are considered not poor.

Household Size

The distribution of household size by standard of living is shown in table 2. Household sizes are categorized into 3 groups, namely, small, average and large.

Table 2: Distribution of household size by standard of living

Household size	1991/1992		1998/1999	
	Poor	Non-poor	Poor	Non-poor
Small (1-3)	18.5	81.5	14.1	85.9
Average (4-6)	48.2	51.8	39.2	60.8
Large (over 6)	66.7	33.3	55.4	44.6

Source: computed from the Ghana Living Standards Survey

Interestingly enough, table 2 shows that large household is concentrated among the poor; while non-poor households had fewer members in both 1991/92 and 1998/99. The result is consistent with earlier findings by Ewusi (1984) that poor households tend to have large households size. From the table above, in 1991/92 results, smaller household sizes of between 1 and 3 were mostly associated with the non-poor. Whereas large household sizes of over 6 was associated with the poor. About 66.7% of the poor have large household size of 6 and over. The same trend is shown in the 1998/1999 survey, but percentages are better distributed. Comparing the two surveys, the proportion of poor households reduced in GLSS 4. This may be due to family health education and sensitization organized in the country.

Ecological Zones

Figure 7 shows how poor and non-poor are distributed over the three ecological zones. These zones are: Coastal, Forest and Savannah. Five regions are located exclusively in a single zone: Greater Accra is in the Coastal zone; Ashanti is in the Forest zone; and Northern, Upper West and Upper East regions

are located entirely in the Savannah zone. Three regions cut across two zones: Western and Central regions are partly in the Coastal zone and partly in the Forest zone; and Brong Ahafo is partly in the Forest zone and partly in the Savannah zone. Finally, there are two regions, Eastern and Volta, which straddle all three ecological zones.
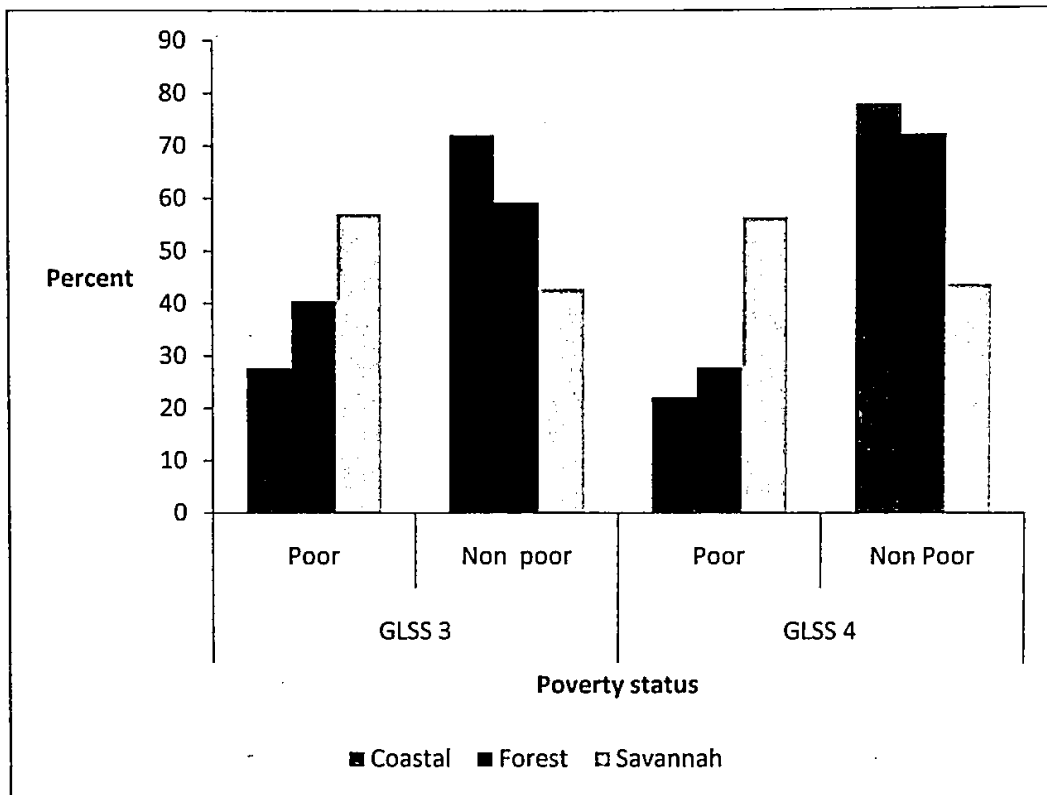
Figure 7: Distribution of household over the ecological zones by standard of living

The distribution of household over ecological zones in Figure 7 shows that, there are three broad zones in the country, the Coastal, Forest and Savannah. These ecological zones are mainly influenced by the soil type and rainfall distribution pattern. About 35 percent of the sampled population lives in the coastal areas, 45 percent in the forest zone and 20 percent in the savannah zone.

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Figure 7 also shows that a greater percentage of poor household live in the forest and savannah zones harboring about 40 and 57 percent in 1991/92 and 30 to 56 in 1998/1999. It is also revealed that households in the Savannah areas are relatively poorer than other areas in the country. This might be due to the fact that, people in the Savannah areas are predominately less formally educated and are more engaged in agricultural self- employment activities than in other zones. The forest zone has the largest reserves of natural resources, including forest and minerals but this zone has a lower standard of living because majority of them are farmers as compared to those in the coastal zones.

Interesting enough coastal zone harbours the highest proportion of the non-poor households about 70 to 80 percent. This is because of a higher percentage of educated people and available jobs in the area. Comparing the two surveys, incidence of poverty reduced from 1991/92 to 1998/99 in all the zones.

Locality

Figure 8 describes the data according to locality. There are two main types of localities, they are the urban and the rural. The two surveys conducted in 1991/92 and 1998/99 confirm that 83 and 81 percent households live in the rural areas as compared to 17 and19 percent in the urban areas respectively. Figure 8 indicates that a greater percentage of the poor households live in the rural areas, this shows that poverty in general is serious in the rural areas compared to the urban areas. It also confirms the usual notion that poverty in Ghana is mainly a rural phenomenon (Ewusi, 1976; Boateng, 2000). A higher percentage of non-

poor live in the urban areas for the two periods surveyed. The results of the study also show that, the percentage of urban households increases as the standard of living increases and the percentage of the rural household decreases as the standard of living increases.
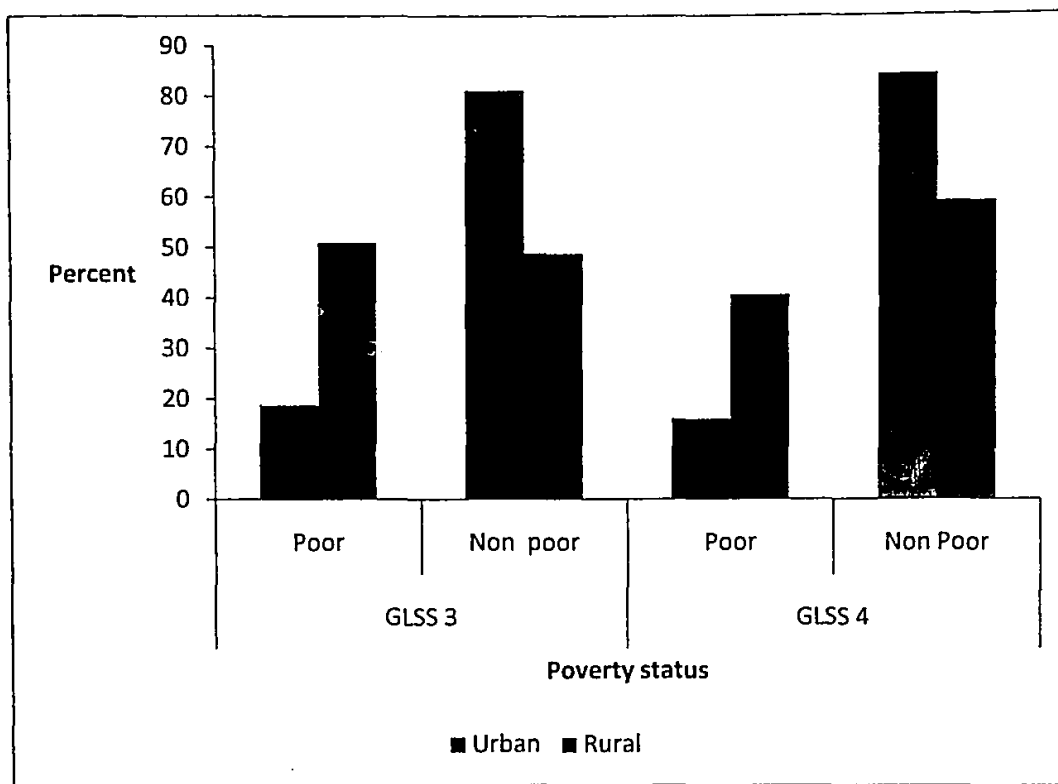
Figure 8: Household by locality and standard of living

For the country as a whole, the average age of a household head is estimated to be 44.9 years. Household heads in the rural areas tend to be older than those in the urban areas, including Accra. From Figure 8 poverty in the rural areas reduced in the case of the GLSS 4 survey as compared to GLSS 3 survey.

Table 3: Distribution of standard of living across Ghana, 1991/92 and 1998/1999

Region	1991/1992 Poverty Status		1998/1999 Poverty Status	
	Poor	Non-poor	Poor	Non-poor
Western	44.9	54.5	19.2	80.8
Central	32.4	67.6	38.4	61.6
Greater Accra	18.5	81.5	4.5	94.9
Eastern	37.6	62.4	41.4	58.6
Volta	46.7	53.3	31.6	68.4
Ashanti	32.3	67.7	24.9	74.5
Brong-Ahafo	52.4	47.6	26.7	73.3
Northern	53.8	46.2	60.0	40.0
Upper West	83.6	16.4	77.5	22.5
Upper East	60.0	40.0	84.6	15.4

Source: computed from the Ghana Living Standards Survey

Table 3 reveals that Ashanti, Central, Eastern, Western, Volta, Brong-Ahafo and the three Northern regions harbour most of the poor households in Ghana, each account for 30 to 80 percent in 1991/92 and 25 to 75 percent in 1998/99. It is not surprising that Greater-Accra harbors the smallest proportion of the poor (5 percent) and the highest proportion of the non-poor households (95 percent). Comparison of the standard of living between the two periods, suggests that the number of poor decreased over time while non-poor increased in most of the regions.

Education

Table 4: Net enrolment in primary school by locality, gender and standard of living 1991/1992 and 1998/1999

Locality	Gender	1991/1992 Poverty Status			1998/1999 Poverty Status		
		Poor	Non-Poor	All	Poor	Non-Poor	All
Accra	Male	86.2	93.3	91.3	88.5	94.3	94.2
	Female	77.25	90.7	87.4	72.25	87.3	85.9
Urban coastal	Male	77.15	89.9	85.0	83.083	89.2	87.0
	Female	74.7	85.3	82.6	84.15	89.7	87.8
Urban forest	Male	82.25	92.9	90.1	93.3	96.1	94.9
	Female	65.2	89.5	82.5	95.65	87.7	88.9
Urban savannah	Male	76.6	85.0	81.1	95.75	95.2	94.9
	Female	67.5	73.6	66.7	91.4	89.7	90.1
Rural Coastal	Male	78.7	85.7	80.1	75.75	94.0	83.5
	Female	64.0	80.4	70.3	80.65	90.0	84.6
Rural forest	Male	82.8	89.1	84.7	88.25	93.5	91.1
	Female	81.69	87.4	91.8	83.95	92.1	88.3
Rural savannah	Male	50.45	60.9	51.3	73.2	62.7	66.0
	Female	44.9	51.3	45.6	63.6	64.4	61.1
All	Male	72.2	85.7	76.5	80.9	90.6	84.9
	Female	65.65	81.1	71.5	77.75	87.2	81.9

Source: computed from the Ghana Living Standards Survey

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Education is an important aspect of basic needs to improve living standard in any society or country as whole. Households whose members have relatively high levels of education are almost and always better off in terms of higher standard of living than those with little or no educational background (Chen & Ravallion, 2005). Tables 4 and 5 examined the attendance rate of children at primary and secondary school in terms of net enrolment. This was expressed in terms of percentage of those in the age range of attending primary or secondary school.

Tables 4 and 5 indicate that net enrolment rate for girls at the primary level are slightly lower than those for boys even though the rates for both boys and girls show an increment from 1991/1992 to 1998/1999.

The results further indicate that net enrolment rates in primary schools do not vary much among the various localities except in the rural savannah where enrolment rates are much lower than the rest of the zones. In each of the localities the net enrolment rates for girls are below those for boys except in the coastal zone where both rural and urban enrolment rate for girls are slightly over that for boys.

The results also show that for both genders, enrolment rate in primary school increased in each of the localities from 1991/1992 to 1998/1999. Among the poor households net enrolment rates increased slightly faster over the two periods than among the non-poor households. Hence the differential between rates for the poor and non-poor households minimized over this period. This reflected in both the urban and the rural areas.

At the secondary school level, net enrolment rate are much lower than those for primary school (see Table 5). In 1998-1999, the enrolment rate at the secondary school level was 40.7 percent which is less than that of the primary school level of 83.4 percent. Thus, a more pronounced urban-rural inequality is obvious at the secondary level than at the primary level, in favour of the urban areas and non-poor households.

At the secondary school level, net enrolment rate for boys are higher than for girls. The difference between enrolment for boys and that for girls reduced over the two periods. However, between 1991/1992 and 1998/1999 net enrolment rates for girls increased by 6% at the national level, with increases in all the localities especially in Accra and Rural Coastal.

This suggests that, there may now be no additional discrimination against girls at the secondary and tertiary levels as it used to be in the years gone by. The results further indicate that, education is negatively correlated with standard of living, where a high proportion of non-poor households send their children to school and even to better schools.

There is little denying the fact that investing in human capital is one of the most effective means of reducing poverty and encouraging sustainable development. Yet, women in developing countries usually receive less education than men. More so, women in general enjoy far less employment opportunities than men the world over. Any claims and efforts then, to remove poverty, can show results only if they address the issue of gender inequality.

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Table 5: Net enrolment in secondary school by locality, gender and standard of living 1991/1992 and 1998/1999

Locality	Gender	1991/1992 Poverty Status			1998/1999 Poverty Status		
		Poor	Non-Poor	All	Poor	Non-Poor	All
Accra	Male	54.5	54.5	54.3	47.45	61.3	60.5
	Female	36.25	38.6	37.9	35.7	54.4	53.7
Urban	Male	49.1	57.1	54.2	52.7	54.0	53.0
coastal	Female	42.4	43.8	43.3	29.5	50.4	47.3
Urban	Male	40.1	51.1	47.2	42.25	52.5	49.5
forest	Female	26.05	44.2	39.3	45.25	43.6	43.8
Urban	Male	32.7	28.4	28.1	50.6	44.2	47.8
savannah	Female	38.0	38.3	36.0	46.4	43.5	44.4
Rural	Male	42.9	45.0	42.6	39.4	43.3	40.6
Coastal	Female	31.95	28.7	29.6	30.1	39.5	35.0
Rural forest	Male	42.65	45.6	44.0	41.15	45.7	43.3
	Female	33.6	36.4	35.4	34.6	43.5	39.9
Rural	Male	26.55	30.6	25.8	26.7	30.2	24.6
savannah	Female	22.8	25.3	22.1	25.35	23.4	21.5
All	Male	38.85	46.3	40.9	38.05	48.4	42.4
	Female	31.2	37.6	33.7	32.55	44.0	39.0
All		32.3	41.7	37.5	35.6	46.1	40.7

Source: computed from the Ghana Living Standards Survey

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It is observed that the relationship between education and standard of living in 1991/92 was similar to that of 1998/99. This indicates that there was probably no significant improvement in the general standard of education between the two periods under consideration.

Comparing Living Standards

Inequalities in income among households reflect in Table 6, where the urban households had a higher Gini-coefficient than the rural households in 1991/1992. Table 6 also indicates disparities in income between rural-urban households with urban households having a higher standard of living. The Ghana living standard survey, 1998/1999 indicates a higher Gini-coefficient for both urban and rural populations compared to that of 1991/1992. Table 6 shows a higher standard of living in both areas in 1998 /1999 than in 1991/1991. Moreover, the Lorenz curves in 1991/92(see Appendix) show that 50 percent of the poor households had almost 30 percent of the income share, whiles for 1998/1992, 50 percent of the poor household had just 20 percent of the income shares.

Per capita expenditure is computed as total household expenditure divided by total number of persons in the household. The results show that the standard of living in 1998/1999 was higher than 1991/1992 even though income inequality in 1998/1999 was higher than that of 1991/1992. Income in 1998/1999 was therefore more skewed in favor of the non-poor.

Table 6: Per capita expenditure (¢) and Gini coefficient

	1991/ 1992		1998/ 1999	
	Percapita	Gini coefficient	Per capita	Gini coefficient
National	167,415	0.35	963,255	0.40
Urban	206,430	0.34	1,373,950	0.36
Rural	147,941	0.33	758,469	0.37

Source: computed from the Ghana Living Standards Survey

Tables 7 and 8 show how household income and expenditure correspond to the standard of living measure in Ghana. In all, three groups of people were considered: the poor, the non-poor and all Ghanaians. In Table 7, the rows represent all the different sources of income, while the columns represent the poor, non-poor and all Ghanaians. Looking at the pattern of income for the poor, employment income accounts for 13 percent in 1991/92 and 8 percent in 1998/99, while the comparable figures for the non-poor is 25 percent and 21 percent. The opposite is true for household agriculture income, 52 and 58 percent of poor households income come from agriculture for the 1991/92 and 1998/99 respectively, while the figure is 25 and 36 percent for non-poor households. It is worthy to note that nonfarm self–employment income accounts for a smaller fraction for poor households (26%) than for non–poor households (38%). The observation is also true for 1998/99.

Table 7: Distribution of household sources of income by standard of living (percentage)

Source of Income	1991/1992			1998/1999		
	Poor	Non-poor	All	Poor	Non-poor	All
Employment	13.1	25.0	21.8	7.9	21.4	20.0
Household agro	52.4	25.2	34.7	58.3	35.8	38.3
Self employment	26.2	38.2	35.4	20.0	29.3	28.2
Imputed rental	2.1	1.2	1.5	3.4	1.8	1.9
Remittances	4.4	6.5	6.0	8.7	9.7	9.6
Other income	1.8	3.9	0.6	1.8	2.0	2.0

Note: poor correspond to all those below the poverty line and (non-poor) to those above the poverty line.

Agriculture is one of the most important sources of income in Ghana, accounting for 35 and 38 percent of the total income in Ghana for the 1991/92 and 1998/99 periods, respectively. The next most important category is non-farm self-employment income, which accounts for 35 and 28 percent of total income for all the households in 1991/92 and 1998/99 respectively. Thus self-employment income (agricultural and non-agricultural) accounts for 70 and 67 percent of total income. Hence, any strategy for economic growth in Ghana or poverty alleviation must pay particular attention to these sectors. Employment income accounts for 22 and 20 percent of all household income in 1991/92 and 1998/99 respectively, while the next biggest category is remittances received. Six and 10 percent of the average Ghanaian's income is accounted for by remittances.

For the analysis of expenditure components in Table 8, the columns represent the poor, non-poor and all Ghanaians; the rows also represent different categories of expenditure. The first row represents food expenditure (actual) while the second represents imputed food expenditure (home produced food items). The third and forth rows comprise of housing expenditure and other expenditure (actual) respectively. The values of these expenditures are imputed in Table 8.

A further category of expenditure is distinguished with the frame work of the household current accounts taking care of remittances paid out and other expenditure (imputed) form the fifth and sixth rows of Table 8. The seventh row represents total expenditure. The figure for food expenditure (actual) in the first row in Table 8 accounts for 40 and 44 percent of the total expenditure for poor households in 1991/92 and 1998/99 respectively, while the non-poor household, it accounts for 43 and 44 percent.

Another important household expenditure is other non-food expenditure (actual). This comprises of household utilities, educational items and miscellaneous expenses. For other non-food expenditure, poor household's accounts for 31 percent for both 1991/92 and 1998/99, while non-poor households also accounted for 37 and 35 percent of the total household expenditure. Expenditure on housing contributes significantly to the total household expenditure. Table 8, indicates that poor households spend a higher percentage of their total household expenditure on housing in both periods than non-poor households. This confirms the fact that majority of non-poor household are

putting up their own buildings as compared to the poor who keeps on struggling for accommodation.

The same is true for food. Food is the dominant item of consumption in Ghana. Food expenditure (actual and imputed) accounts for 55 percent of the total expenditure of Ghanaian households for both periods. However, there is a slight difference between poor and non-poor households with regard to total expenditure on food. On these figures, the Engel curve in Ghana seems to be remarkably flat. Thus, disaggregating total food expenditure into its two components does reveal a difference. For the poor, consumption of home-produced food (imputed food) accounts for 21 and 18 percent in 1991/92 and 1998/99 respectively, while for the non-poor the figure are 9.6 and 10 percent. Clearly, this shows that, the poor rely mostly on market purchases of food more than the non-poor. However, the poor are by no means isolated from market conditions.

Besley and Kanbur (1998) concluded that, for many purposes what is important is not the budget share of a particular commodity but the fraction of the total consumption of a commodity accounted for by the poor.

Comparing the composition of income and expenditure among households, the importance of agricultural self-employment income is even more apparent for poor households than the non-poor, on average in Ghana, (with a share of 50 to 60 percent). Poverty in Ghana is not only rural but it is also largely agricultural in phenomenon. More than 60 percent of Ghanaians live in agricultural household contributing as much as 83 percent to income in the

country. A minority of 25 to 40 percent of the non-poor household also depends on agriculture.

Income levels decrease steadily over the income classes, the non-poor however still depends on farm income for more than 20 percent. It is further significant to note that, the dependence on agriculture increases between the two periods for non-poor household, but the poor remained dependent on agriculture. About 2 percent of the poor depend on other income (service sector) while 20 to 26 percent are found in non-farm employment income (industry). Employment incomes are much less important for the poor and contribute only 13 and 8 percent in 1991/92 and 1998/99, respectively, while non-poor households account for 25 and 21 percent.

For the economically active group in 1991/92, the percentage of people decreased with increasing standard of living; while in 1998/99 the percentage of household increased with increasing standard of living. These results indicate an improvement in the standard of living of the dependent and independent groups in the period between the two surveys.

Figure 9 presents some basic information on ill or injured personnel in Ghana and the extent to which the ill or the injured consulted well qualified health personnel's. The distribution is made across Ghana by locality and standard of living. The results indicate that the percentage of ill or injured individuals who consulted a doctor, nurse or midwife, medical assistant, pharmacist and other medical practitioners varies with standard of living within urban and rural areas.

From Figure 9, the percentage of those who consult a doctor or pharmacist in the urban areas is higher than in the rural areas.

Sixty five and 64 percent of all ill or injured Ghanaians live in urban areas consulted health personnel, in 1991/92 and 1998/99, respectively. For rural dueling Ghanaians, 40 and 30% of the ill or injured consulted health personnel. The proportion is not different among poor and non-poor households, thus the percentage of non-poor household who visit the doctor is around 70 percent in the urban areas and 46 percent in the rural areas, while the corresponding number for poor household is 58 and 37 percent.

Table 8: Distribution of household expenditure pattern by standard of living

| Expenditure components | 1991/1992 | | | 1998/1999 | | |
| | Poverty Status | | | Poverty Status | | |
	Poor	Non-poor	All	Poor	Non-poor	All
Food (actual)	40.3	42.9	42.2	44.3	44.3	44.3
Food (imputed)	21.1	9.6	12.6	18.0	10.0	10.7
Housing	2.4	2.1	2.2	2.7	1.9	2.0
Non-food (actual)	30.6	36.5	34.9	30.6	34.9	34.5
Remittance	1.4	1.9	1.7	1.7	2.9	2.8
Non-food (imputed)	4.2	7.0	6.4	2.7	6.0	5.7

Source: the Ghana Living Standards Survey

Figure 9 further confirms that a higher percentage of poor households in both urban and rural areas consult medical assistant and other medical practitioners more than the non-poor households, while it is true that in urban

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areas the number of ill or injured consulting a nurse or mid wife has increased slightly and in rural areas the proportion who consult a nurse or mid wife has increased between 1991/92 and 1998/1999. It is observed that ill or injured Ghanaian households who are likely to consult well qualified health personnel from the two periods period, while an increasing numbers are not consulting any one at all, especially in the rural areas.
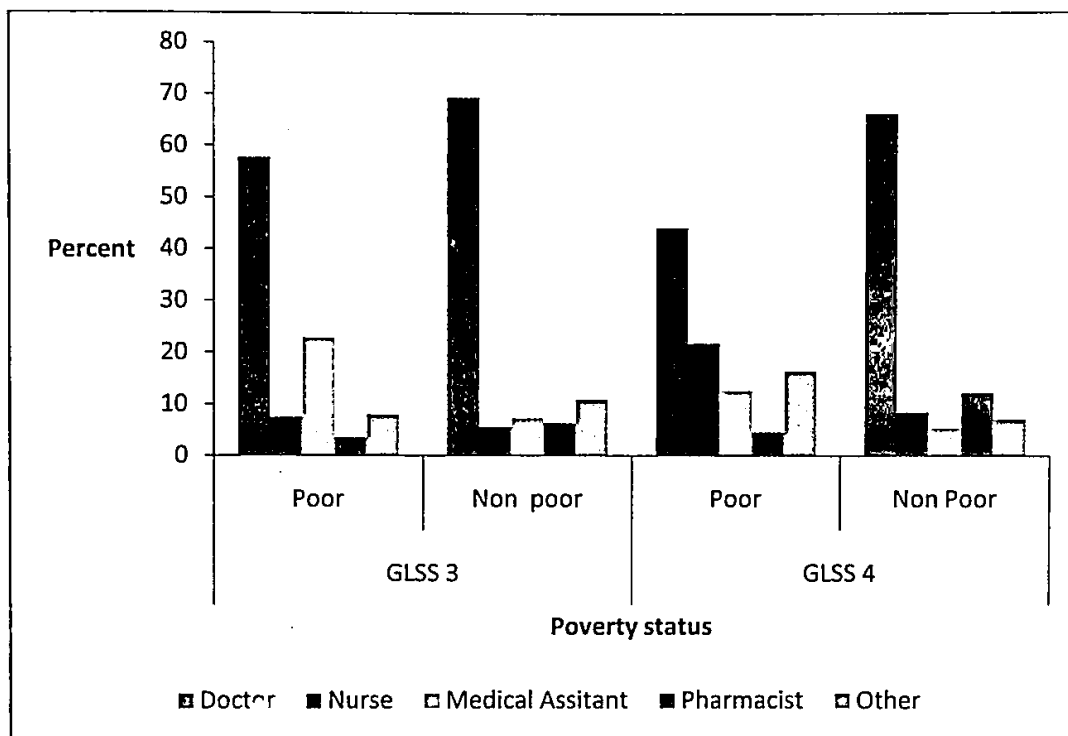
Figure 9: Type of consultation by ill/injured household by urban locality and standard of living (1991/1992&1998/1999)
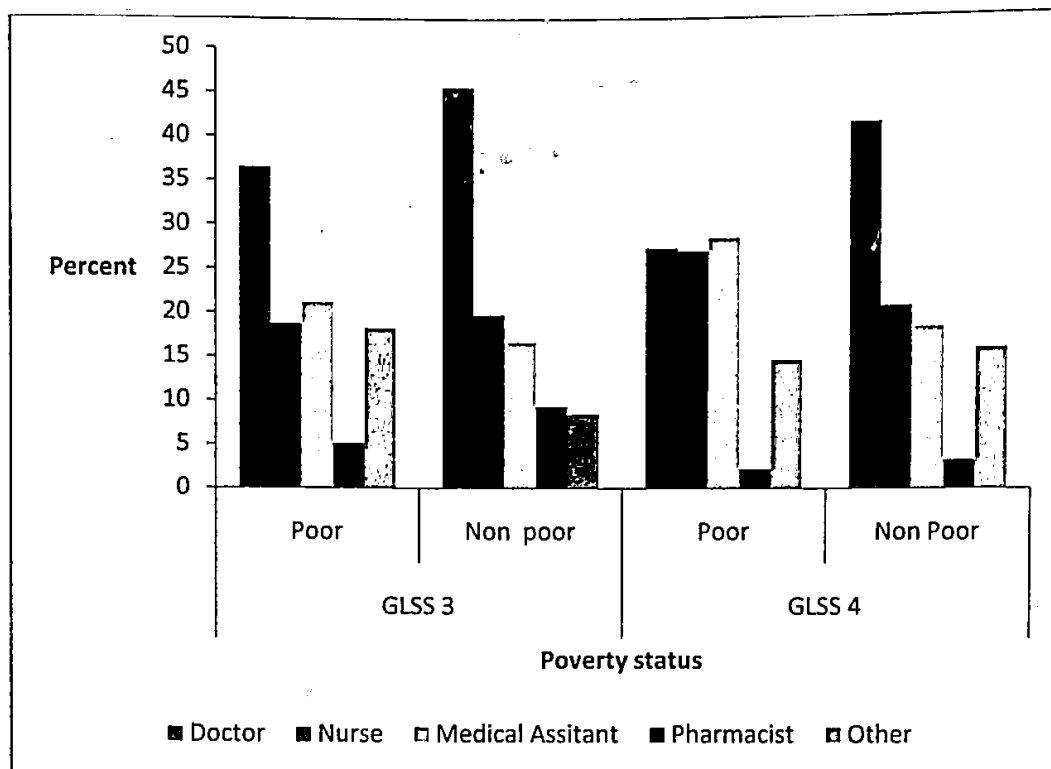
Figure 10: Type of consultation by ill/injured household by rural locality and standard of living 1991/1992&1998/199

SUMMARY

In this chapter, we discussed the variables of interest: age distribution, gender, marital status, household size, ecological zones, locality, education, income and expenditure. This discussion was done in relation to poverty status of heads of household. The discursion is important because, these variables will be used as determinant factors of poverty status in the next chapter. The discussion showed that poverty is mostly associated with the aged. Older age group tends to be poorer than younger age group. Couples also tend to be poorer than non couples. Females are generally poorer that males. The respondent in southern zone tends to be less poor than those in the northern sector. Poverty increases as one move towards the northern part of the country. Education plays a significant

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role in poverty. The data shows that more educated heads are found to be less poor than the less educated. The higher you climb the academic ladder the less likely you are to become poor. Conditions have improved positively as the years goes by. The second survey reveals a reduction in poverty as a result of improvement in conditions of these variables. There is favorable trend in the general poverty status of the respondents.

Since it is established that these variables affect poverty, the next chapter will further define a model. The model will be used to determine the poverty status of a household if you know the values of the variables

CHAPTER FIVE

FURTHER ANALYSIS

INTRODUCTION

In the previous chapter, discussion focused on preliminary analysis of both GLSS 3 and 4 data. This involved the comparison of poverty status by age, sex, occupation, household size, educational background, ecological zone, and literacy level. The chapter also dealt with distribution of expenditure patterns, household income by standard of living, household expenditure patterns by standard of living and education. Based on this preliminary analysis a number of observations were made.

However, the main objective of the study is to model poverty status using these variables. Hence the chapter now focuses on modeling of poverty status using the variables specified in Table 9 which are categorical variables. The response variable is also a categorical variable with two options. These options are either; a household head is poor or not poor. Subsequently the standard regression model approach is not suitable as discussed in Chapter 3. A more suitable approach is the logistic regression technique.

Table 9 shows the nine explanatory variables involved in the modeling. In the table, X_3 to X_9 are categorical variables; hence they were recoded into dummy variables for the purpose of regression. For example X_3 (sex) has two categories, that is male and female; hence it is coded as dummy variable S.

Table 9: Description of explanatory variables used to model poverty

X_1	Hhsize	Household size
X_2	Age Y	Age head
X_3	Sex	$S = \begin{cases} 1, \text{ Male} \\ 0, \text{ Female} \end{cases}$
X_4	Ez	$E_1 = \begin{cases} 1, \text{ Coastal} \\ 0, \text{ Otherwise} \end{cases}, E_2 = \begin{cases} 1, \text{ Forest} \\ 0, \text{ Otherwise} \end{cases}$
X_5	Locality	$L_1 = \begin{cases} 1, \text{ Urban} \\ 0, \text{ Otherwise} \end{cases}, L_2 = \begin{cases} 1, \text{ Rural} \\ 0, \text{ Otherwise} \end{cases}$
X_6	Consulted	Consulted health personnel: Yes=1, No=2 $C = \begin{cases} 1, \text{ Yes} \\ 0, \text{ No} \end{cases}$
X_7	Sch ever	Ever attended school: Yes=1, No=2 $Sc = \begin{cases} 1, \text{ Yes} \\ 0, \text{ No} \end{cases}$
X_8	HAgric	Occupation of head is Agric: Yes=1, No=2 $A = \begin{cases} 1, \text{ Yes} \\ 0, \text{ No} \end{cases}$
X_9	HLitt	Can write in English (head): Yes=1, No=2 $H = \begin{cases} 1, \text{ Yes} \\ 0, \text{ No} \end{cases}$

On the other hand, X_4 has three categories; hence it has two dummy variables, E_1 and E_2. Similarly X_5 has three categories; hence its dummy variables are L_1 and L_2. The "Ecological Zone" consists of coastal, forest and savannah zone. The category "Coastal Zone" consists of Greater Accra, "Forest Zone" is Ashanti and Northern, Upper West and Upper East regions are located entirely in the Savannah zone.

Three regions cut across two zones: Western and Central regions are partly in the Coastal zone and partly in the Forest zone; and Brong Ahafo is partly in the Forest zone and partly in the Savannah zone. Finally, there are two regions, Eastern and Volta, which straddle all three ecological zones. The locality consists of Accra, Urban and Rural. The category "urban" includes localities with a population of 5,000 or more and "Rural" is localities with a population of less than 5,000. Poverty status is determined using expenditure of household. If head of household expenditure is below 90 Ghana cedis then the head of household is classified as poor. If expenditure is above 90 Ghana cedis then the head of household is not poor.

The Logistic Regression Model

Define poverty status as:

$$Y = \begin{cases} 1, & \text{if the head of household is poor} \\ 0, & \text{if the head of household is not poor} \end{cases}$$

The logistic regression model based on the variables in Table 9 is of the form:

$$Y = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \cdots + \alpha_9 X_9$$

where $\alpha_0, \alpha_1, \ldots \ldots \ldots \ldots \ldots, \alpha_9$ are coefficients

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or equivalently

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 S + \beta_4 E_1 + \beta_5 E_2 + \beta_6 L_1 + \beta_7 L_2 + \beta_8 C +$$

$$\beta_9 Sc + \beta_{10} A + \beta_{11} H$$

Preliminary Model

Table 10 shows the output based on GLSS 3 and Table 11 the output based on GLSS 4. Each table gives estimated values of the coefficient $\beta_0, \beta_1, \beta_2, \beta_3, \cdots \beta_{11}$, corresponding to the specified variable in column 1. It also gives the odd ratios and corresponding p-values for the variables. Here, the regression coefficient β_j estimates the change in the odds of household is not poor for a one-unit increase in the model. These parameters are estimated by the maximum likelihood estimation method.

Table 10: Results of logistic regression analysis of the determinants of household standard of living (1991/92)

Variables	Characteristics	β	p-value	Exp(β)
X_1	Hhsize	0.340	0.000	1.404
E_1	Ez (1) coastal	-0.504	0.000	0.604
E_2	Ez (1) forest	-0.304	0.008	0.738
L_1	Loc 3 (1) Urban	-1.366 .	0.000	0.255
L_2	Loc 3 (1) Rural	-1.158	0.000	0.314
C	Consult (1)	-0.066	0.610	0.936
X_2	HAge (y)	0.000	0.893	1.000
S	Sexhead (1)	0.219	0.550	1.245
Sc	Schever (1)	-0.048	0.691	0.953
A	HAgric (1)	-0.661	0.010	0.380
H	Litrate (1)	0.990	0.321	1.104
	Constant	-0.968	0.000	0.380

The factor by which the odds change when the jth independent variable increases by one unit is given by Exp (βj). If the independent variable is dichotomous, then the odds ratio Exp (βj) approximates how much more likely (or unlikely) it is for the outcome to be present among those with $X = 1$.

From Table 10, it can be observed that household size, Ecological zone, Locality and household agric occupation are the significant variables, taking the significant level as 0.05. Similarly in Table 11, Hsize, ecological zone, Locality,

Table 11: Results of logistic regression analysis of the determinants of household standard of living 1998/99

Variables	Characteristics	β	p-value	Exp(β)
X_1	Hhsize	0.317	0.000	1.373
E_1	Coastal (1)	-0.469	0.000	0.625
E_2	Forest (2)	-0.921	0.000	0.398
L_1	Urban (1)	-2.036	0.000	0.131
L_2	Rural (2)	-0.230	0.520	0.795
X_2	HAge (y)	0.005	0.046	1.005
C_1	Consult (1)	0.416	0.001	1.516
S	Sexhead (1)	0.064	0.485	1.066
Sc	Schever (1)	0.340	0.010	1.405
A	HAgric (1)	-0.457	0.04	0.633
Hl	Literate head(1)	0.193	0.035	1.213
	Constant	-2.038	0.000	0.130

Hage, Consult, Schever and Litracy are the only significant variables, since their p-values are less than 0.05. This means that these are the variables that significantly explain changes in poverty status.

The final model will therefore be a regression of poverty status for these specified variables for each data. This model will be developed in the next section.

Final Model for GLSS 3

It can be observed that all the p-values are less than 0.05, implying that the selected variables are all significant at 5% significant level. This is evident in the SPSS output result shown in Table 12.

Table 12: Reduced results of logistic regression analysis of the determinants of household standard of living (1991/92)

Variables	Characteristics	β	p-value	$Exp(\beta)$
X_1	Hhsize	0.340	0.000	1.405
E_1	Ez (1) coastal	-0.507	0.001	0.602
E_2	Ez (1) forest	-0.308	0.007	0.735
L_1	Loc 3 (1) Urban	-1.348	0.002	0.260
L_2	Loc 3 (1) Rural	-1.155	0.000	0.315
A	Agric (1)	-0.655	0.001	0.519
S	Sexhead (1)	0.223	0.048	1.250
	Constant	-1.006	0.000	0.366

Accordingly the model to adopt for GLSS 3 is:

$$\hat{Y} = -1.006 + 0.340X_1 - 0.507E_1 - 0.308E_2 - 1.348L_1 - 1.155L_2 - 0.655A$$
$$+ 0.223S$$

where $\hat{Y}$ is estimate of poverty status

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X₁ is household size

X_1 is household size

E_1 is Ecological zone: coastal

E_2 is Ecological zone: forest

L_1 is Locality: urban

L_2 is Locality: rural

A is Occupation: Agric

S is Sex of Household

A hypothetical example is given below using the following information about a typical household in the data. A household head is identified by household ID, NH and Pid . Suppose a household head has the following information: Household $ID = 3647$, $Nh = 7, Pid = 1, Sex = 1$, $Household\ size = 1$, Eclogical zone =forest, Locality=rural, and Occupation=1. Substituting the values into the equation above, the result is given as 0.98, which is approximately one. This indicates that this household is poor. Based on this final model the variables needed to predict poverty status are household size, ecological zone, locality, occupation and sex of household.

Table 12 comprises coefficients of the various variables (β) and their corresponding odd ratio Exp (ß). These coefficients indicate how changes in each of the variables affect standard of living. An odd ratio gives an estimate of the magnitude of the association between the variables being compared. In this, an odd ratio of 1.0 indicates no difference in the variable and poverty status. A ratio below 1.0 indicates a negative association between the variables and poverty status. An odd ratio above 1.0 indicates a positive association. In Table 12, an odd

ratio for household is 1.405. This suggest that for every individual added to the household, the odds of being poor is 1.405 as large as not poor, holding all other independent variables constant. This implies that larger households are poorer than smaller households. The odd ratio of ecological zone is 0.602 and 0.735 for coastal and forest zones respectively. The result suggest that households living in Savannah zone are 0.602 and 0.735 as more poorer than those living in the coastal and forest zones respectively, holding other variables constant. The odds ratio associated with locality are 0.260 and 0.315 for households living in urban and rural areas respectively. This suggests that, for household living in Accra the odds of being poor is 0.253 and 0.314 times greater than those living in urban and rural areas. The odds ratio associated with agric occupation is 0.519 this means for every individual that has agriculture as his occupation is 0.519 time not poorer. It means that household with their heads taking agriculture as their primary occupations are poorer than those with other occupation. This explanation flow through for the rest of the variables

Final model for GLSS 4

It can be observed that all the p-values are less than 0.05 implying that the selected variables are all significant at 5% significant level. This is evident in the SPSS output result shown in Table 13.

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Table 13: Reduced results of logistic regression analysis of the
Determinants of household standard of living (1998/99)

Variables	Characteristics	β	p-value	Exp(β)
X_1	Hhsize	0.314	0.000	1.369
E_1	Coastal (1)	-0.460	0.000	0.631
E_2	Forest (2)	-0.912	0.000	0.402
L_1	Urban (1)	-2.035	0.000	0.131
L_2	Rural (2)	-0.228	0.049	0.796
X_2	HAge (y)	0.005	·0.000	1.369
C	Consult (1)	0.414	0.010	1.513
Sc	Schever (1)	0.346	0.010	1.414
A	HAgric (1)	-0.452	0.005	0.637
H	Literate head(1)	0.192	0.035	1.212
	Constant	-2.023	0.000	0.132

Accordingly the model to adopt for GLSS 4 is:

$$\hat{Y} = -2.023 + 0.314X_1 - 0.460E_1 - 0,912E_2 - 2.035L_1 - 0.228L_2 + 0.005x_2$$

$$+ 0.414C + 0.346Sc - 0.192A + 0.192H$$

where $\hat{Y}$ is estimate of poverty status

X_1 is household size

E_1 is Ecological zone: coastal

E_2 is Ecological zone: forest

L_1 is Locality: urban

L_2 is Locality: rural

X_2 is Age of household head

C is Health

A is Occupation: Agric

H is Literacy level

A hypothetical example is given below using the following information about a typical household in the data. Suppose a household head has the following information: household $ID = 2046$, $nh = 5, pid = 3, Sex = 1$, household size $= 6$, Eclogical zone $=$forest, Locality$=$rural, and occupation$=1$. Substituting the values into the equation above, the result gives 0.12 which is closer to 0. This means that house hold head is not poor.

In 1998/99, that is GLSS 4 data, Table13 indicates that, the odds ratio for household size coefficient is 1.369. This suggests that for every individual added to the household, the odds of being poor is 1.369 times bigger, holding constant the other eight independent variables. This means that, large households are more likely to be classified as poor than small households. The odds ratio associated with ecological zones are 0.631 and 0.402 for households living in Coastal and Forest zones respectively. The results suggest that households, who are living in the Savannah zones, are 0.631 and 0.402 times more likely to be classified as poor than those living in the Coastal and Forest zones respectively, holding constant the other seven independent variables. The odds ratio associated with locality is 0.131 and 0.796 for households living in. Accra and other urban areas respectively. This suggest that households living in the rural areas, the odds of being not poor is 0.131 and 0.796 times less than those living in Accra and other

urban areas, holding constant the six other independent variables. Similarly, the odds ratio for age head is 1.005. This means that for every additional year, age of household head is 1.005 times more likely to be classified as poor, holding all other independent variables constant. This implies that, as age of head of households increases the odds of being poor also increases. The "odds ratio" associated with households who consulted a health personnel is 1.513. This suggests that, for every individual who did not consult health personnel, the odds of being poor is 1.513 times greater than those who consulted health personnel, holding all other variables constant. This implies that those who did not consult health personnel are poorer than those who consulted. In Table 13 the results also indicate that, the odds ratio associated with households who ever attended school is 1.414. This shows that those who never attended school are 1.414 times more likely to be classified as poor than those who ever attended school, holding all other independent variables constant. Furthermore, the odds ratio for literate head coefficient is 1.?12; this suggests that household heads, who are illiterates, are 1.212 times more likely to be classified as poor than literate heads, holding constant the other independent variables. This implies that as the numbers of years spend in school decreases the odds of being poor increases, this why illiterate head of households are poorer than literate heads.

For the two models, that is, the GLSS 3 and GLSS4, there are some variables that were significant in both. These are household size, ecological zone, locality and agric. They all have more considerable influence in the GLSS 4 than

the GLSS 3. Since GLSS 4 is more current than the GLSS 3, it is more appropriate to use the model based on GLSS 4 for any prediction.

In 1998/1999 the odds ratio for household size was 1.373 less than that of 1991/92, and among the ecological zones, the odds ratios in 1998/99 is 0.625 and 0.398 greater than that of 1991/92. The results also indicate that households who consulted health personnel in 1998/99 are 4.1516 greater than those who consulted in 1991/92. The result further reveals that, almost all the variables entered in the model for 1998/99 are significant at 5% level while in 1991/92 only five variables were significant.

CHAPTER SIX

SUMMARY, DISCUSSION, CONCLUSIONS AND

RECOMMENDATIONS

SUMMARY

The main purpose of this thesis was to formulate a logistic regression model that establishes a relationship between poverty status and some variables of interest. Other objectives includes: to determine the distribution of poverty among Ghanaian households, to compare distribution of rural-urban income and expenditure, and to classify households by their income and expenditure distribution patterns. This chapter discusses the findings based on the above objectives, Implications usefulness and some recommendations.

The Human Development Report, UNDP (1991), observed that in spite of the progress that Ghana has made, poverty remains a serious and extensive problem. Over 30 percent of the populations have per capita expenditure less than US$25 per month. In Ghana a high proportion of those in the poor income group are found in the rural areas. In both survey periods, the per capita expenditure levels of the urban population were 20% higher than that of the rural households. The rural population also had a lower Gini coefficient than the urban households which further indicate disparities in income between rural-urban households with rural households having a lower standard of living. In addition, there are groups of households within the rural and urban areas in both periods that have relatively

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low standards of living compared to the rest of the households. These low income groups include young and old dependent people, poorly educated household heads, with large household size, illiterate household heads and households whose primary occupation is agriculture. The poor also prefer self-medication rather than consulting well-qualified health personnel. This results into relatively lower productivity as compared to non-poor households who consult well-qualified health personnel when they fall ill or sustain an injury.

Poverty was also linked to ecological zones. For instance, the savannah zone in the northern part of the country was found to be the poorest geographical zone harbouring about 65.8 percent of the poor; while the coastal zone (being the richest) harbors about 75 percent of the non-poor households. According to Ghana Statistical Service (1995), poverty is more common in the rural savannah with a poverty incidence of 72 percent.

The forest zone covers about one-third of the country and supports almost two thirds of the entire population in the country. It is the second poorest zone after the savannah zone. Most of the economic activities in the country (cocoa, oil palm, mining, rubber and timber) are obtained from this zone. The coastal zone covers a small portion of the country and poverty rate is generally low. This might be as a result of the service sector in this zone, which has improved their standard of living. However, lack of any perceptible changes in poverty within the periods 1991/92 and 1998/99 may be probably due to the fact that the relatively high information rate during the period may erode any gains made by the corresponding increase in mean expenditure per capita. Poverty status in the

country has improved between 1991/92 and 1998/99 with a decrease in the percentage of people grouped under poor and non-poor using the poverty lines in the two survey results. With generally lower percentages in 1998/99 compared to 1991/92, the marginal improvement in the poverty status may be due to increased access to education, health facilities and some social amenities at the rural areas. These results are further supported by Canagarajah, Mazumdar and Xiao (1998), who noticed that improvement in inequality in the rural areas of Ghana contributed substantially (over 30 percent) to the overall poverty reduction in the country between 1988 and 1992. They also noted that rural areas performed much better over the period 1988 and 1992 both in terms of mean income and expenditure per capita and its distribution.

These studies show that in order to substantially reduce the incidence of poverty in the country, the government should probably focus on the rural areas where a unit input of resources tends to give much higher returns on investments as far as reduction of the incidence of poverty is concerned. The locality in which households live also shows that the incidence of poverty is significantly higher in rural areas than in the urban areas. It can therefore be inferred that, generally households living in the rural areas are much more likely to be poorer than those in the urban areas and that poverty in Ghana is overwhelmingly a rural phenomenon. This may be attributed to the fact that in Ghana the difference in the relation between food energy intake and total spending between rural households and urban households are very high. Apart from differences between rural and urban areas, the location of residence was also found to influence poverty status

of households. For example, it was observed in this study and a study by Ghana Statistical Service (GSS, 1999) that poverty difference between the administrative regions is significantly different even within rural and urban areas of these regions.

DISCUSSION

To determine the standard of living among households the study focused mainly on the explanations of some household characteristics which define their poverty status and some other materials, which are of greater sociological importance. The basic premise of this approach is that the causes and reasons for poverty and the poor are mainly due to economic, social and political reasons. These social factors consist of a set of thresholds, which determine a family's poverty status.

According to Meng and Gregory (2007), increasing concerns about the weaknesses in the current official determinants of poverty have been expressed due mainly to the fact that firstly, current determinants of poverty do not accurately portray trends in economic poverty or differences among population groups and geographic areas of the country. Secondly, current income measures do not reflect the effects of key government policies that alter the disposable income available to families and hence, their poverty status. Thirdly, the current poverty thresholds do not adjust for rising income levels and standards of living. Again, the current determinants of poverty do not take into account variation in expenses that are necessary to hold a job and to earn income expenses that reduce

disposable income. Moreover, the current determinants of poverty do not take into account variation in medical costs across population groups, which are a function of differences in health status and insurance coverage.

The current poverty thresholds use family size adjustments that are anomalous and do not take into account important changes in family situations, including payments made for children's educational support. Finally, the current poverty thresholds do not adjust for geographic differences in the cost of living across the nation, although there are significant variations in prices across geographic areas.

This study did not address the enumerated problems above because these issues are not easy to evaluate in the development of models. In view of these major constraints to the use of appropriate poverty modeling, Asenso-Okyere, Nsowah-Nuamah and Alverson (1992) strongly recommend the use of household variables in the analysis of the determinants of poverty. The authors further used a number of explanatory household variables in deriving a logistic model to characterize poor people in Ghana. This is based on the premise that, the kind of living conditions associated with levels of standard of living can be examined in the light of some household characteristics. This study adopted a similar approach using nine explanatory variables namely; household size, age of household head, education, sex of household head, occupation, the locality in which households live, ecological zone, literate head of household and health status were used as determinant of poverty using binomial logistic model.

Sex of household head, literate head, occupation and age of household head were the variables, which were not significant in the model for 1991/1992. This may be due to inadequate information during the data collection in 1991/19992 survey. Family size, educational status, occupation and geographical distribution however, influenced significantly, the standard of living and the level of poverty. For the 1998/99 survey, almost all the variables are significant except for sex of head of household. Several studies in Ghana (Ewusi, 1984; GSS 1989), Cote d'Ivoire (Glewwe, 1991) and in Mauritania (Coulombe & Mckay, 1996) have noted the correlation of these standards of living variables with poverty. For example, education and occupational status were negatively correlated with poverty, while size of household was positively related with poverty.

Of these household variables, it appears that lack of education (especially at the primarily level) and high levels of dependency are clearly major constraints for many households and are therefore key contributor causes of poverty. Numerical results from Kakwani (1989) study show that education (up to senior high school) of the household head has an important bearing on poverty. In fact, even education up to elementary school level can significantly and substantially reduce poverty. Even though small families had better standards of living in this study, Kakwani (1989) observed that in some instances larger households tend to have higher incomes because such households probably have on the average a greater number of people in the workforce. According to Kakwani (1989), the question of the effect of family size on standard of living needs to be seriously

addressed due to the close association between government poverty reduction programmes and the number of dependent people in the society. Access to social amenities such as water and electricity are also important determinants of poverty. This is because manufacturers and industrialist needs these facilities for the creation of more jobs. Asenso-Okyere, Nsowah-Nuamah and Alverson (1992) also observed that water and electricity contribute significantly to the odds of not being poor.

The models with examples are clearly stated in Chapter five. These models are useful tools for determining the status of a household knowing all the values that are assigned to the variables. This model can be used to determine whether a household is needy or not. It is a very important tool for planning purposes.

CONCLUSIONS

The model has been developed and is now possible to predict the status of any household knowing the values of the variables that make up the model. From the analysis done in this study, the following deductions were made: large household sizes are mostly identified with poverty and because majority of the poor households live in the rural areas, it is obvious that the poor are very much disadvantaged because of their large-sized households. Households in the savannah zone of Ghana have low standards of living. The type of occupation in which individual households engaged in have an effect on poverty, and this cannot be over-emphasized. Agricultural households have been found to be

amongst the poorest and these are mainly in the rural areas. Number of years of education is also an important determinant of the standard of living of households.

Poor households were found to be illiterates. The locality in which households live was also found to have an effect on poverty. Rural households were found to be generally poor compared to urban households and significant differences were found between the urban poor and rural poor. Staying healthy is essential in ensuring a better standard of living. Hence it was a significant determinant of poverty in 1998/99. Size of household, locality and education, age of household head, health, illiterate heads, ecological zone and occupation were found to be the most significant determinants poverty in 1998/99. However sex of household head was the only independent variable which was not significant determinants of poverty in both periods 1991/92 and 1998/99.

RECOMMENDATIONS

The model developed is aimed at predicting poverty status of household. The data gives us the general impression that poverty is most prevalent among Ghanaians. This means that for any prediction that the model will be used to make, it is most likely that the result will turn out to be poor. In order to improve upon these predictions, that is for it to skew positively to non-poor, it is important that the following recommendations are considered.

Educational programmes should be organized to educate the public on the importance of having small sized households. This would enhance poverty reduction, improved standard of living and importance of having small sized

households. The government has to encourage low interest credit facility groups especially the banks to give soft loans to the poor households especially those in the rural areas to set up small scale industries to increase their income. This will help in improving their standard of living and narrow the gap between poor and non-poor households. Health and educational facilities such as clinics and schools should be established in the rural areas to reduce death rates and to increase child enrolment in schools. This will reduce child slavery and bring street children back into the classroom. Electrification and water projects should be established in the rural communities to enhance their level of productivity and increase their standards of living. Government policies on agriculture should be reviewed to encourage more people including the rural poor to engage in agriculture since it is the most widespread occupation in the country. The government should therefore make farming very attractive by providing the following:

i. more modern farming implements should be provided and made accessible to farmers.

ii. improve storage and marketing of crops and animal products so that they do not go waste.

iii. expand cottage industries to create more jobs for the communities to enhance households' purchasing power as well as improve standards of living.

iv. to encourage eco-tourism aimed at creating more jobs at the rural areas.

v. ensure easy access to money capital to start or support larger scale farming.

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APPENDIX

Table 1.1 Components of household and per capita income, and estimates of total annual household income.

Income component	Mean annual household income (cedis)	Mean annual per capita household income (cedis)	Estimated total annual income (billion cedis)	Percentage distribution
Wage income from employment	516,000	120,000	2,099	22.8
Household agricultural income	838,000	195,000	3,406	37.0
Non-farm self-employment	709,000	165,000	2,882	31.3
income	46,000	11,000	186	2.0
Rental income (actual & imputed)	108000	25,000	441	4 ?
Net remittance*	50,000	12,000	204	2.2
Other income				
Total	2,267,000	527,000	9,218	100.0

Note: Net remittance = Income from remittance – expenditure on remittances.
Source; GLSS 4

Table 1.2 Components of household and per capita expenditure, and estimates of total annual household expenditure

Expenditure component	Mean annual household income (cedis)	Mean annual per capita household income (cedis)	Estimated total annual income (billion cedis)	Percentage distribution
Food expenditure (actual)	1,927,000	448,000	7,835	45.4
Food expenditure (imputed)	437,000	102,000	1,778	10.3
Expenditure on housing	84,000	20,000	342	2.0
Other non-food expenditure (actual)	1,534,000	357,000	6,237	36.1
Other non-food expenditure (imputed)	262,000	61,000	1,065	6.2
Total	4,244,000	987,000	17,256	100.0

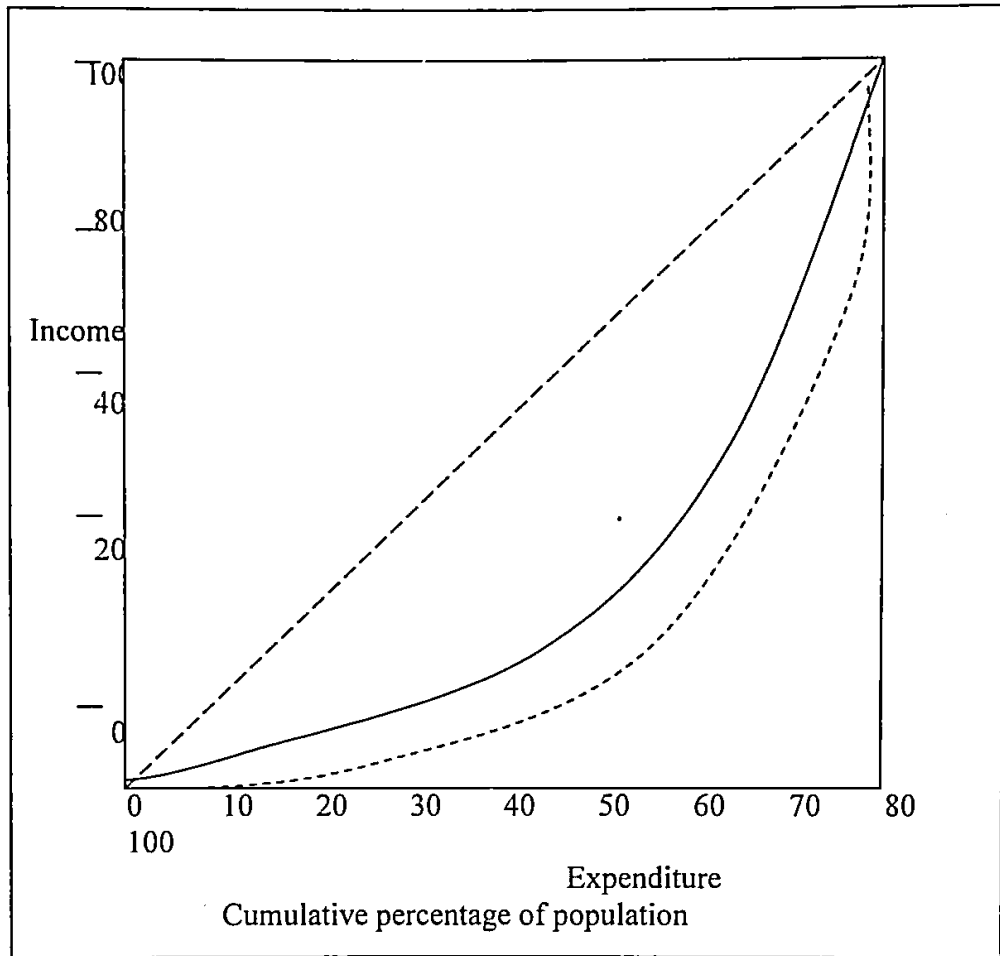Note: Expenditure on housing includes both actual and imputed elements.
Source; GLSS 4

Figure 1 Lorenz Curve

Table 1: 3 Average Annual Household and Per capita Income (National) 1999

Average annual household and Per capital income (National) 1999	US Dollars
Mean Annual Household Income	$947
Mean Annual Per Capital Income	$220
Mean Daily Household Income	$2.59
Mean Daily Per capita Income	$0.60

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Table 1:4 Household and Per Capita Incomes by Region (1999)

Region/ Zone	Mean Annual Household Income (US$)	Mean Annual Per Capita Income (US$)
Western	1116	237
Central	612	185
Gt.Accra	1402	389
Eastern	858	173
Volta	815	220
Ashanti	1065	260
B.Ahafo	962	229
Northern	648	88
U.West	602	86
Upper East	604	130
Zone		
North	618	101
South	976	242

Source: Ghana Living Standard Survey, Table 9.18,p.102
Figures are averages of the regions in the North and South where the North comprises the three savannah regions (U.East, U. West and Norhtern Regions) and the South comprises the seven remaining regions.

Table1:5 Household and Per Capita Incomes by Locality (1999)

Locality	Mean Annual Household income (US$)	Mean per Capita Income (US$)
URBAN	1128	289
Accra (the capital city)	1462	406
Other urban	994	249
RURAL	843	196
Rural coastal	675	165
Rural Forest	983	218
Rural Savanna	744	146
GHANA	947	220

Source: Ghana Living Standard Survey, GLSS 4.

Table 1:6 incidence of poverty by Socio-Economic Groups (1999)

Group	Incidence of poverty (%)
Public Sector Employees	22.7
Private Formal Employees	11.3
Private Informal Employees	25.2
Export Crop Farmers	30.7
Food Crop Farmers	59.4
Non-farm Self-Employed	28.0
Non-Working	20.4
Ghana	39.5

Source: Ghana Poverty Reduction Strategy, p. 11 Figure 3.2

UNIVERSITY OF CAPE COAST

LOGISTIC REGRESSION ANALYSIS OF HOUSEHOLD INCOME AND EXPENDITURE PATTERNS IN GHANA

By

ERNEST NYARKU

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