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## **Household Risk Coping Strategies for Improving Food Security.**

The Case of Montserrado and Margibi Counties, Liberia.

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## **Abstract**

*Food security has for a long time been an area of concern in most Sub-Saharan Africa nations such as Liberia. A number of factors influence the food security situation of most rural households. In this study, I investigate the types of shocks, how households cope with them as well identify the factors that determine the coping strategies the households engage in. I also investigate the effects of the various shocks on food expenditures and consumption. Factor and cluster analysis as well as econometric methods of analysis were used. The findings suggest crop losses, illness and death as the common shocks. In coping with the shocks, most of the households adopt an asset based strategy while others engage in the food based or mixed strategy. The coping strategies are associated with households aspects such as size, age and sex of the household head; land, livestock and other household assets. Exploration of the effect of shocks on food expenditures and consumption indicates that crop losses increased expenditures on food while illness reduced consumption of rice particularly. Occurrence of death caused a weak positive effect on consumption of rice for children in the household. Unemployment although not very significant among the reported shocks profoundly increased the consumption of other foods compared to rice. These findings bare implications and require interventions through research and agricultural support institutions to improve crop performance at household level. Likewise with illness and death, up scaling of health services in the communities will be vital.*

**Key words:** Food security, shocks, coping strategies, food consumption, Liberia

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## CHAPTER ONE

### 1.0. Introduction

#### 1.1. Background

Food security has for a long time been an area of concern in most Sub-Saharan Africa nations such as Liberia. A number of factors play an influential role in determining the food security situation for most rural households. Important among the influencing factors is the occurrence of risks and shocks. In effect to this, there has been an increasing concern on the risks and shocks that rural households face, their effects and the ability of rural people to cope with them (Dercon and Krishnan 2003). Dercon mentions that rural households in developing countries are faced with substantial idiosyncratic and common risks and shocks. Due to the riskiness of the environment they live in, rural households have been able to develop sophisticated management and coping strategies (Dercon and Krishnan 2000). Empirical evidence shows that risk is one of the causes of poverty thereby affecting growth and the extent to which the poor can take part in the growth of an economy (De Weerd and Dercon 2006). This finding shows the importance of understanding approaches and strategies used in rural communities.

Liberia is one of the poorest countries in Africa with an estimated population of 3,441,790 people of which about 80% were estimated in the year 2000 to be living below the poverty line. The country's economy was destroyed by mismanagement of government and many years of civil war and has GDP per capita estimated at US \$190 (IMF 2008). Like most of the developing countries, agriculture plays a significant role in the economy, contributing almost 76.9% of the country's GDP.

For this study, emphasis is placed on exploration of common shocks and the coping strategies used by households in relation to food security. The different risks faced by the households are caused by a range of factors that may be attributed to climate and economic fluctuations among others. Liberia in this case is unique given the years of political turmoil that the country went through. It is therefore important to understand the contexts of household food security in the occurrence of some shocks. Korf (2003) in his paper described livelihoods of rural households in areas that are or were affected by war as distressed because they experience a dramatic increase in risk and uncertainty of different forms. The households in Liberia just like others in

developing countries do face risk and shocks of different kinds and this forms the major focus of this study.

## **1.2. Problem Statement and Relevance of Study**

Following the two decades of political conflict, the Government of Liberia among so many issues seeks to improve the livelihoods of its people with agriculture continuing to be at the centre of the country's reconstruction and development effort (FAO et al. 2007). It was also indicated in the same report that the government among its several objectives for agricultural development sought to enhance food security of smallholders through improved production, marketing and value addition in agriculture. The food security profiles that were developed by CFSNS showed that most rural households in Liberia were food insecure. To achieve its strategic objective of food security, the role of disaster mitigation, risk reduction and early warning of food security issues was given significant importance and considered to be critical (IMF 2008).

Despite this clear vision of enhancing food security and increasing incomes of smallholders, rural households in Liberia face a number of constraints among which includes different types of shocks. Being communities that are still recovering from civil conflict and political turmoil, some of the households are still reconstructing their livelihoods. Previous studies show that households affected by war may be forced to adopt very risky coping strategies that tend to reinforce their vulnerability to shock and risk (Bruck 2003). Dercon on the other hand mentions that risks such as climatic risks, economic fluctuations and a number of individual specific shocks make rural households vulnerable to serious hardship in their livelihoods (Dercon and Krishnan 2000).

In order to enhance the agricultural productivity of rural households and improve their food security status, there is a need for an understanding of the types of shocks the households face. A systematic exploration into the strategies used to deal with the different stresses and the factors that determine these coping mechanisms becomes imperative. In this perspective, the purpose of this study is to identify the shocks that rural households face and determine the strategies that they adapt to cope with them. The knowledge generated from the study will contribute to development of appropriate interventions for poverty reduction and enhance achievement of the overall strategic objective of improving food security and nutrition.

### **1.3. Study Objective and Research Questions**

The main objective of this study is to understand the common shocks faced and the strategies that households use to cope with the shocks

To achieve the above objective the following research questions are addressed;

1. What are the most common types of shocks and how do they affect household food consumption.
2. How do the households cope with the different shocks and what are the determinants of these coping strategies.

## CHAPTER TWO

### **2.0. Conceptual and Theoretical framework**

#### **2.1. The Concept of Food Security and Livelihoods**

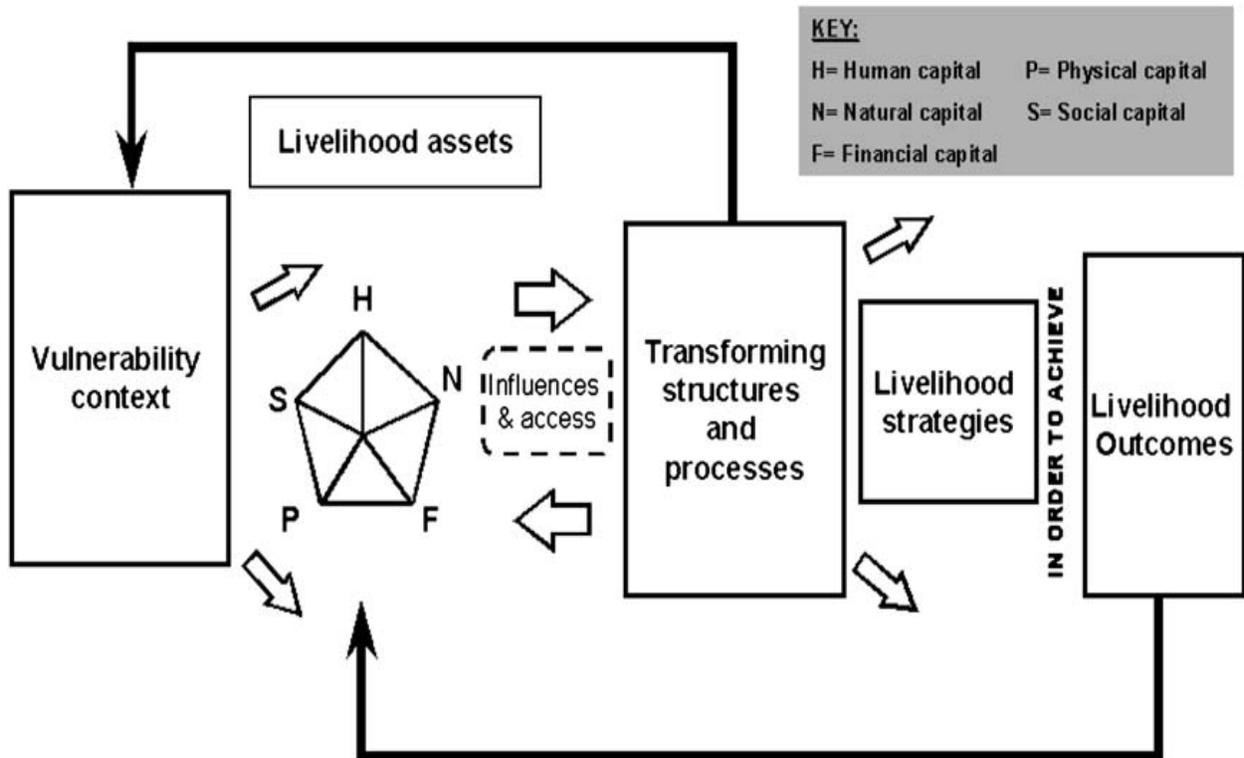
As a concept, food security covers a wide range of areas, cutting across the physical supply and availability of food, the macro and micro social systems that determine entitlement to food, the nutritional value as well as the capacities of people to use food (FAO 2003). The World Bank in the same way defines food security as a concept that consists of the three pillars of food availability, accessibility and utilization (Reutlinger and Others 1986). Where food availability has to do with sufficient quantities of food being available on consistent basis; food accessibility referring to having sufficient resources to obtain appropriate foods for a nutritious diet; and food utilization means having an appropriate use of food based on knowledge of basic nutrition and care as well as adequate water and sanitation. Food security is therefore known to exist when people have access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (Shah and Strong 2000).

(Chambers and Conway 1991) define livelihoods to comprise of people, their capabilities and means of living including food, income and assets.' Livelihood activities have a direct influence on the food security situation of a household. Understanding the livelihoods concept is therefore important as its integrally linked to household food security (Buechler and Devi 2003). The concept of livelihoods also provides a detailed picture of how rural households cope with a variety of shocks that affect them in meeting their basic needs (Adekoya 2009).

#### **2.2. The Sustainable Livelihoods Framework**

The sustainable livelihoods approach (depicted in Fig 1) has increasingly been used in rural development. In different perspectives, the framework has been used to understand the capabilities of households to cope with crises such as droughts, floods and plant and animal diseases (Allison and Ellis 2001). The approach focuses on the ways in which poor people earn a living. It provides a framework for analyzing the risks to which poor people are vulnerable as well as the strategies they adopt in order to achieve their desired livelihood outcomes (Ahmed, Allison, and Muir 2008). The approach involves understanding how households access

resources, the diversity of livelihood strategies and the relevant factors at micro, intermediate and macro levels that influence the household's choices.



**Figure 1: The Sustainable Livelihoods Framework**

(source: DFID 1999).

Understanding the nature of shocks and coping mechanisms is an important aspect of sustainable livelihoods. ‘A livelihood is sustainable when it can cope with and recover from stresses and shocks, and maintain or enhance its capabilities and assets both now and in the future without undermining the natural resource base’ (Scoones 1998). With this perspective, the livelihoods framework helps to generate an understanding of the strategies that rural households use to cope with shocks and risks. Coping strategies are determined by a combination of livelihood assets, whose access is modified by factors such as social relations, institutions and organizations, trends and shocks (IBID). Subsequently, the strategies taken up by households lead to outcomes which explain the overall status of the households in relation to food security in the case of this study.

For this study, specific attention is paid to three aspects of the framework; the vulnerability context, the assets of rural people and how different patterns of assets influence the ability of households to withstand shocks and their outcomes. Vulnerability in this case is defined as a high degree of exposure to risks, shocks, stress and proneness to food insecurity (Allison and Ellis 2001). The authors as well as (Chambers and Conway 1991) describe vulnerability as having a dual aspect of external threats to livelihood security due to risk factors including climate, markets and sudden disasters. They stress that internal coping capabilities are determined by assets, food stores, support from kin or community and/or government safety net policies among others.

### **The vulnerability context**

The context of vulnerability frames the external environment in which people live. For this study, vulnerability is particularly looked into with respect to the effect of shocks in rural households. The basis of the vulnerability context of a livelihood is about risk, uncertainty and lack of security in consideration of the probability of a given shock, trend or seasonal variation occurring (DFID 1999).

The livelihoods and assets of people are often affected by different types of shocks of which they often have limited or no control upon (DFID 1999). Shocks such as floods, drought, storms and civil conflict can directly destroy assets or force people to abandon their home areas or even dispose off their assets such as land in a bid to cope with the shocks (IBID). A central concept for sustainable livelihoods is the ability to cope with and recover from stresses and shocks. This forms a basis for future adaptation of a livelihood and its coping mechanisms (Scoones 1998). Households that are unable to cope or adapt often become vulnerable and unlikely to achieve sustainable livelihoods (IBID). In carrying out analysis, common shocks and the ways the households reduced their negative impacts was judged based on their responses during the survey.

### **Livelihood assets**

Assets are considered the building blocks for a sustainable livelihood. By building up assets, households develop their capacity to cope with challenges that they encounter to sustainably meet their needs (DFID 1999; Ellis 1998). The Sustainable Livelihoods Framework illustrates

how different types of assets contribute to sustainable livelihoods. The assets categories include physical capital, natural capital, human capital, financial capital and social capital.

Physical capital includes things like infrastructure, machines, livestock as well as other household equipment. Natural capital includes natural resource assets like aspects of land and human capital on the other hand embodies people's knowledge and abilities. Human capital can be in form of peoples levels of education and their work experiences. The financial capital entails liquid assets a household may possess such as access to credit and savings. Social capital refers to the capital that's embedded in social relations such as trust and participation in networks. Assets are important in understanding how households respond to shocks. They influence the vulnerability context of a household in that, they can use them to store wealth, buffer shocks thereby reducing their vulnerability to poverty (DFID 1999).

### **Transforming structures and processes**

The policies, institutions and processes in a given place influence the vulnerability context of the households. They determine the livelihood options people choose by influencing access to assets and opportunities that result in the achievement of desired outcomes. For example, government policies and institutions may directly or indirectly promote investments in forms of physical, human or social capital that will affect the abilities of farmers to handle constraints such as shocks (Pender et al. 2004).

### **Livelihood strategies**

These refer to a combination of activities that households choose to undertake in order to achieve specific livelihood outcomes (Ellis 2000). They can be natural resource or non-natural resource based and are influenced by access to assets and policies, institutions and processes to enable attainment of the desired livelihood outcomes.

### **Livelihood outcomes**

Livelihood outcomes refers to what people seek to achieve through their livelihood strategies. The outcomes result from the interaction of the household capital endowments together with the mediating processes and in turn may help households become less or more able to manage and or cope with shocks (Ellis 2000).

This study sought to understand the type of shocks faced by households and how they responded to them. The overall analytical framework is that, the use of various assets in the households along with influences to the household strategies from intermediary processes like policies and institutions determine the livelihood outcomes. In this case the outcome was reduced vulnerability to shocks leading to attainment of food security in the households.

### **2.3. Risk, Shocks, Coping Strategies and Household Wellbeing**

The term risk refers to the possibility that an undesirable state of reality may occur due to natural events or human activities thereby causing physical harm to humans or ecosystems (Renn 1992). Similar to risks, shocks on the other hand can also be defined as impacts that are sudden, unpredictable and traumatic and may include such things as wars, civil violence, droughts, storms, floods, fires, famine, epidemics of plants, animal and human diseases and market failures (Chambers and Conway 1991). Omobowale (2008), further classifies risks by their levels of occurrence and the nature of event behind them. He classifies them into three categories of micro, meso and macro shocks based on Fafchamps earlier work (Fafchamps and Gubert 2007). The micro shocks refer to idiosyncratic shocks (that is household level specific) while meso shocks are those that affect groups of households that make up a community and the macro shocks occurring at national or international level (Omobowale 2008).

In microeconomics theory, households are assumed to be able to insure their consumption against idiosyncratic shocks better than with covariate shocks. This is derived from the hypothesis that mutual insurance to mitigate correlated shocks across communities tend to breakdown due to information asymmetries and enforcement limitations (Günther and Harttgen 2009). However, previous studies on the relative importance of shocks on household consumption indicate that covariate shocks have a more significant impact than the idiosyncratic shocks (Harrower and Hoddinott 2004; Christiaensen and Subbarao 2004; Dercon and Krishnan 2000).

Risks and shocks affect production capacities of households as well as the overall performance of the agricultural sector in a country and is therefore a factor that does not favor economic growth as its found to contribute to poverty. For example, Dercon in his paper finds that risk forces people to engage in activities that are not profitable thereby reducing their incomes

(Dercon, Hoddinott, and Woldehanna 2005). Risks are also found to motivate farmers to apply less productive technologies in exchange for greater stability (Sarris and Karfakis 2006).

Due to the multitude of risks faced and based on the available options and their characteristics, households will develop strategies that comprise of *ex-ante* risk management and *ex-post* recovery strategies (Corbett 1998; Dercon, Hoddinott, and Woldehanna 2005). According to Rungruxsiriworn (2007), the *ex-ante* risk management strategies deal with income smoothing and *ex-post* risk management strategies deal with consumption smoothing. Income smoothing is often achieved by choosing safer but often less profitable production choices and income generating activities such as crop and income diversification; while consumption smoothing is achieved often by borrowing and saving, selling and accumulating assets, adjusting labor supply and employing formal and informal insurance arrangements.

Research findings provide that households adopt strategies of different forms in order to secure a basic livelihood and the nature of the shock has influence on their ability to cope with its consequences (Dercon, Hoddinott, and Woldehanna 2005). One characteristic of human behaviour when faced with risky situations is adaptation through recourse to various coping strategies at individual and sometimes community levels. Coping strategies may be especially apparent in the case of poor households and literature suggests that in some cases short term coping behavior may be the precursor of long term harmful consequences for human development that may only become obvious later (Dercon and Krishnan 2003; Skoufias 2003).

Literature shows that risk coping strategies among rural households may involve self insurance through precautionary savings and informal group based risk sharing. In order to deal with consequences on income risk for example, households can insure themselves by accumulating assets such as savings during the good years so as to deplete them during the bad years as a consumption smoothing strategy (Dercon and Krishnan 2000). Dercon further on finds that members of extended family networks, same ethnic groups, or neighborhood groups in rural communities can form groups in which they support each other during times of hardship. This has been seen and empirically proven among some communities like ICRISAT villages in India (Townsend 1994). In his paper, Dercon further reports that risk coping strategies may also involve people attempting to earn extra income whenever any form of hardship occurs. For

example in which people in ICRISAT villages were found to increase the supply of labour (Townsend 1994).

In his paper, Adekoya (2009) mentions that households in times of food crisis may have two options of either to protect or modify consumption. Where protecting consumption means households have to employ strategies to ensure food availability and modifying consumption by reducing and diversifying its consumption or reducing the size of the household. He also suggests that a food insecure household will often reduce and modify its consumption simultaneously. Coping strategies may be considered positive or negative given the consequences. For instance, to mitigate effects of food shortages, households employ positive strategies such as off-farm employment, savings that can be relied upon and family networks for sharing. The negative strategies often tend to have long detrimental effects and include mechanisms such as severe reduction of food consumption, selling productive assets, reducing expenditures on basic services like health and education, and abnormal migration (IBID).

#### **2.4. Determinants of Coping Strategies.**

Elicit a number of factors that determine coping strategies in post war areas. Household characteristics such as household size and level of education attained are mentioned to affect the comparative advantage, optimal degree of specialization and available labour resources in a household (Bruck 2003; Bozzoli and Bruck 2009). The age of a household head is also found to be an important factor in that older household heads for example are found to be more engaged in risk diversification and subsistence production due to the fact that they have less prospects to participate in intensive market transactions and migration (Ellis and Freeman 2004). Moreover, when gender of household head is considered, female headed households are seen to possess more skills that are suitable for production and with less diversification into farm production (Brück and Danzer 2007).

Another factor that determines the type of coping mechanism by a household is the type of shock. Households may be exposed to idiosyncratic risks like illness, farm related risks of soil quality and storage pests but also risks that are common to everyone living in the same environment with them for instance natural risks like drought and unstable markets (Brück and

Danzer 2007). In addition, the authors also theorize that the existence of thin markets in a community for instance can cause high price volatilities due to the different transaction costs involved thereby rendering the economic market activities to become risky to undertake. As a result the authors state that households in such situations evade a market based economy and will be forced into subsistence strategies which they may find to be less risky.

The asset endowment of a household plays a key role as productive inputs and self insurance mechanisms in risky environments (Bozzoli and Bruck 2009). Asset endowment refers to household assets and social capital which are often considered key determinant of off- farm activities such as social exchange and donations from NGO's. Given the surrounding environment and nature of livelihoods in rural areas, the type and level of endowments owned by the households may influence the portfolio of activities that are undertaken to deal with shocks. The type of institutions in a community does play a role in the type of coping strategies adopted by a household. For instance, social institutions, property rights and markets do influence the diversification of incomes at household level in areas that face uncorrelated risks (Abdulai and Delgado 1999). Wars or armed conflict tend to affect the existence of formal and informal credit markets in that they may totally cease to exist due to the high costs of gathering information, reduced ability to enforce contracts and the high degree of risk covariance in an area (Brück and Danzer 2007).

## CHAPTER THREE

### 3.0. Scope and Methodology

#### 3.1. Research Area

##### Liberia

Liberia is one of the poorest nations in the world with a GDP per capita of US\$ 190 (IMF 2008). As a country that is emerging from two decades of civil conflict and political turmoil, the government seeks to rebuild its shattered economy. It seeks to improve the livelihoods of its inhabitants many of whom were displaced during the conflict. Food insecurity is prevalent in the country and is evident in the poor nutritional status of the population. In the Comprehensive Food Security and Nutrition Survey (CFSNS) carried out in March (2006) 11% of households in rural and semi-urban areas of the country are food insecure. And 28 % of the food insecure areas were most affected by the war and displacements (IMF 2008).

Further on, the IMF paper indicates that about 80% of the rural population in the country is either moderately vulnerable (41%) or highly vulnerable (40%) to food insecurity with only 9% being food secure and 11% food insecure. Chronic malnutrition rates by the year 2006 had reached 39% for children under five years. 32% of the households had access to improved water sources and other basic services were still limited for many (LRDC 2009). With regard to the different livelihood profiles of the rural population, varying degrees of food insecurity are observed. The most food insecure and highly vulnerable groups were involved in production of oil palm (64%), followed by hunters and contract labourers (61% and 58% respectively). The producers of cash crops and food crops together with the moderately vulnerable groups (37%) are considered to be more food secure as well as the groups that do petty trade and have employment (44%) (LRDC 2009).

Despite everything, Liberia is a country with a great potential for economic growth given its rich natural resource base which includes fertile soils and land for agriculture and tree crops, forestry resources and a vast range of minerals (IMF 2008; Richards 2005). Combined with infrastructural development, the agriculture sector in particular plays a crucial role in the economy. It creates employment and income opportunities for most of the population as well enhance the food security situation in the country (IMF 2008). However, the performance of the

agricultural sector is limited by a number of constraints ranging from structural constraints, poor policies and armed conflict among others.

The government of Liberia in its Poverty Reduction Strategy paper set three strategic objectives through which it will realize the expected economic growth. Among the strategic objectives is the objective to Improve food security and nutrition in the country. To achieve this, the role of disaster mitigation, risk reduction and early warning of food security issues was given significant importance and considered to be critical (IMF 2008). In relation to this, it is the purpose of this study to identify the various shocks and risks that rural households face and determine the strategies that they use in order to cope with them. The knowledge generated will contribute to the development of programs or interventions for livelihoods and poverty reduction. The programs will strengthen household abilities to cope with shocks and risks thereby enhancing the achievement of the overall strategic objective of improving food security and nutrition.

### **Montserrado county**

Montserrado county is located in the northwestern part of Liberia. Its bordered by the Atlantic ocean in the south, Bomi county to the west with Bong and Margibi counties to the north and east respectively. The county forms the foundation of the country with the Monrovia, the most populous city in the nation and also the capital being located in it. Montserrado has a land area of 1,909 square kilometers and a population of 1,144,806 people which is approximately 33% of the country's population (LRDC 2009).

With an average household size of 6.4 persons, 10% of the county's population is considered to be food insecure, 35% as highly vulnerable, 43% as moderately vulnerable and only 13% being considered food secure as of the year 2006. A large part of the rural population is engaged in subsistence agriculture and mainly producing crops like cassava, rice, sweet potatoes, sugar cane, rubber, hot pepper and plantains. However, the farmers are unable to produce sufficient amounts of food for the households due to problems associated with extension service delivery and access to production inputs. A number of non government organizations working in the county are increasing their efforts to improve agricultural production at household level in some parts of the county by providing basic production inputs.

The rubber industry holds a significant presence in some parts of the county with the presence of big rubber production and processing companies such as Firestone, MARCO (Morris American Rubber Company) and Liberia Resources Corporation. These companies provide employment opportunities for many people especially those coming from the districts where they are located. However given its post-conflict status where livelihoods of many people got disrupted, about 80% of the population has no access to formal employment.

### **Margibi county**

Margibi county one of the newest counties created prior to the civil war is located in the central part of Liberia with the southern part stretching along the Atlantic ocean and close to the capital Monrovia. Its bordered by Montserrado county from the east, Bong county from the north and northeast and Grand Bassa county from the west. It has a total land area of approximately 2,866.67 square miles, with a hot and humid climate.

According to NRC- Liberia 2007 report, the county's population was estimated to be 240,996 people and should be more than this now. Margibi was negatively affected by the civil war which destroyed infrastructure that was in place and caused disruption of livelihoods as people were forced to flee thereby making the population extremely vulnerable. At the moment, the way of life is still rural based with a majority of the population living as subsistence farmers with other activities being, rubber tapping and charcoal production. Rubber plantations owned by large companies such as firestone and Salala among others occupy about 118,000 acres of the total land area and are therefore important in providing employment to part of the county's population. Like Montserrado county, food production within the households is still low due a number of constraints including access to agricultural extension services and production inputs. See Figure 2 for map of study area.

### **3.2. Sampling and Data**

Data from the baseline survey conducted in march 2010 in Margibi county, Liberia was used. The survey had a range of questions some of which included a section on risks, shocks and how households coped with the various shocks they faced. Two questionnaires were used during the survey, one for households and the other the community. For this study, focus is mainly on households as they form the major unit of research.



**Figure 2: Map of Liberia**

A two stage random selection procedure was used to pick respondents for the study. In the first stage, 52 communities were randomly selected based on a specific criteria. The criteria required that the selected communities had at least 20 households, should be at least 5km apart and had not been ZOA- SGP program beneficiaries. The second stage of randomization involved two waves of data collection. The first wave was carried in March and April 2010 in which 16 household representatives in each community were randomly selected. A public lottery system of selection was used whereby with the help of the town chief, households were given numbers and a child was asked to draw 16 households. This ensured fair and transparent selection of respondents and was done in the attendance of all villagers. The second wave of data collection

was in November and December 1020. Households that were selected during the first wave were revisited and an additional number of households were selected. Overall, 20-30 household representatives were selected in each community.

### **3.2. Methods and Empirical Framework**

In order to answer the research questions on the types of shocks and coping strategies used by the households, I employ factor analysis which is subsequently followed by clustering of factors generated. I then use the multinomial logit was used to model the determinants of household coping strategies. I also use regression techniques to determine the effect of the shocks on household wellbeing.

#### **3.2.1. Factor analysis**

This is a multivariate statistical technique used to reduce the number of variables in a data set to a smaller number of variables with minimum variance. The method creates linear combinations of variables such that maximum variance is extracted by transforming data into a new set of variables which are linear composites of the observed variables (Kim and Mueller 1978). Factor analysis creates uncorrelated components from an initial set of variables with the new set of components being a linear weighted combination of the initial values (Vyas and Kumaranayake 2006).

In determining the number of meaningful factors to retain, I use the eigenvalue-one criterion, also called Kaiser criterion. The basis for this criterion is that each observed variable contributes one unit of variance in the data set and any component displaying an eigenvalue greater than one is accounting for a greater amount of variance than had been contributed by one variable (Kaiser 1960). While on the other hand, eigenvalues less than one account for less variance than had been accounted for by one variable. This criterion enables one to retain components that account for more variance for all observed values. The resulting Principal Component loadings define the factors whereby, loadings greater than 0.50 compared to other variables were considered significant and thus defining the factor.

I use factor analysis to identify the most common shocks among the households. The highest loadings given the variables used in factor analysis define the type of shocks represented by the

created factors. The same procedure is used to identify coping strategies among the households given the occurrence of shocks. The respective factors are henceforth used in cluster analysis from which common shocks and coping strategies used by different households are derived.

### **3.2.2. Cluster analysis**

This is a statistical technique that sorts observations into similar sets or groups (Ketchen and Shook 1996). It aims at sorting different objects into groups in a way that the degree of association between them is maximal if they belong to the same group and minimal otherwise. Households that are characterized by similar patterns as described by the principal component indicators developed during factor analysis are identified. I specifically opt for this method of analysis due to the absence of clearly dominant or very significant observations of shocks and coping mechanisms observed in the data set. Moreover, households also differ in the level of resources they own as pertains food security and mitigation of shocks. Clustering will therefore create distinct groups of households in which specific shocks and coping strategies are observed.

To identify the common shocks and coping strategies, I conduct a two step cluster analysis procedure. This involved hierarchical clustering of retained factors (from factor analysis) followed by the k-means clustering. The k-means analysis is a non-hierarchical method used to partition data into a predetermined number of groups (Brown et al. 2006; Jansen et al. 2006). This process resulted in the grouping of households into defined clusters representing common shocks and coping strategies.

The clusters representing shocks distinctly portray pattern of shocks and are thereby named based on the prevalent shocks. Given that households will employ an array of mechanisms to deal with shocks, the coping strategies are named based on the nature and relatedness of the coping mechanisms mentioned.

### 3.3.3. Econometric model specifications

#### Determinants of coping strategies

The theoretical basis for modeling household behaviour which in this case the choice for coping strategy is the random utility theory. The random utility model is often used to study choices among discrete alternatives and incorporates uncertainty to the utility function (Haab and Hicks 1997; Tongruksawattana, Waibel, and Schmidt 2010). For instance in the case of coping against shocks, the utility that individual  $i$  is associated with coping strategy  $j$  is given as;

$$U_{ij} = \beta'X_{ij} + V_{ij}$$

Whereby;

$\beta'X_{ij}$  is the deterministic part of the model with  $X_{ij}$  representing explanatory variables and  $\beta'$  set of parameters

$V_{ij}$  is the non deterministic part (random disturbance term)

$U_{ij}$  is the utility derived by the  $i^{th}$  individual from choosing the  $j^{th}$  coping strategy

If option  $k$  is chosen, then  $U_{ik} > U_{ij}$  for all  $j \neq k$ .

I use the multinomial logit regression model to identify the determinants of household coping strategies. When used to model choices, the multinomial logit relies on the assumption of Independence of Irrelevant Alternatives (IIA) and this is often a major drawback for this method (Hausman and McFadden 1984). The IIA assumption requires that the introduction of irrelevant alternatives should not have impact on the relative probabilities of choosing among relevant alternatives (Haab and Hicks 1997). However, the model allows one to analyze decisions across several categories, thereby enabling the determination of different choice probabilities (Maddala 1993; Wooldridge 2002).

The model is estimated as;

$$prob(y_i = j) = \frac{e^{\beta_j' x_i}}{1 + \sum_{k=1}^j e^{\beta_k' x_i}} \dots \dots \dots \text{for } j=1,2,\dots,j$$

And;

$$prob(y_i = 0) = \frac{1}{1 + \sum_{k=1}^j e^{\beta_j' x_i}}$$

In this study, the focus is on household choices for coping strategies when faced with different types of shocks. Based on maximum likelihood, I estimate coping strategy to be dependent on a range of household specific characteristics such as household size, gender and educational level of household head among other factors. Specifically I categorize the explanatory variables to represent capital aspects of human, physical and natural capital. For human capital; household size, age, gender and years of education of the household head are considered. The number of livestock units, size of land and other assets are also included as physical and natural household capital. I also include variables of factors representing shocks that were identified during factor analysis. The coefficients of the explanatory variables represent the likelihood of a household to choose a particular coping strategy relative to choosing no strategy.

### **Effect of shocks on expenditures**

Regression techniques are also used to determine effects of various shocks on food consumption. An OLS model whereby expenditures on food is estimated against a set of explanatory variables that include the earlier identified shocks with household characteristics and assets owned as control variables.

The model is given by;

$$E_i = \beta_1 S_i + \beta_2 X_i + \varepsilon_i$$

Where  $E_i$ ,  $S_i$  and  $X_i$  respectively represent real household expenditure on food, a set of shocks and capital factors as control variables.  $\beta_i$  and  $\varepsilon_i$  represent the model parameters and error term. The model explains the net effect of the shocks on household expenditures holding all other factors constant. This will provide some insight on the extent of food consumption smoothing among the households.

## Effect of shocks on food consumption

I hypothesize that illness shock has a negative impact on household food consumption. Given that food consumption in this study is a count variable, I estimate a linear poisson regression model. Food consumption is measured as number of rice meals and other meals consumed per day by adults and children. The explanatory variables are dummies of the factors earlier identified in factor analysis of shocks. In estimation of the model, I also include capital factors such as human, natural and physical assets of the household as control variables given that they have a direct influence on household consumption.

The model is estimated as;

$$C_h = \beta_0 + \beta_1 Shocks + \beta_2 X_i$$

Where  $C_h$  is food consumption (number of meals per day) of the  $h^{\text{th}}$  household,  $Shocks$  being a vector of dummy variables for shocks,  $\beta_i$  represents model parameters and  $X_i$  household control variables.

### 3.3. Hypotheses

Following the theoretical and methodological framework, I hypothesize that;

1. The level of asset endowment (land, livestock and other assets) in a household significantly influence type of coping strategies adopted by the household.
2. The type of coping strategies adopted by households depend on specific household characteristics.
3. The occurrence of illness shock in a household significantly leads to a decrease in food consumption.

### 3.4. Description of variables used in the analysis

A description of the variables used through all the analysis is provided in table 1.

**Table 1: Variables used in the analysis**

Variable name	Variable label	Measurement
Age of household head	number of years	as reported by respondent
Sex_male_01	dummy variable: 1=male, 0=female	sex of household head
Literacy (attended school)	dummy variable: 1=yes, 0=no	as reported by respondent
No schooling	dummy variable: 1=yes, 0=no	as reported by respondent
Some elementary schooling	dummy variable: 1=yes, 0=no	as reported by respondent
Completed elementary school	dummy variable: 1=yes, 0=no	as reported by respondent
Some high school	dummy variable: 1=yes, 0=no	as reported by respondent
Completed high school	dummy variable: 1=yes, 0=no	as reported by respondent
Vocational education	dummy variable: 1=yes, 0=no	as reported by respondent
Some university education	dummy variable: 1=yes, 0=no	as reported by respondent
Completed university education	dummy variable: 1=yes, 0=no	as reported by respondent
Education years	number of years of schooling attained	as reported by respondent
Livestock units	number of livestock owned	tropical livestock units
Land	size of land owned	size of land in acres
Other household assets	other assets owned	index of other assets
Any shock	dummy variable: 1=yes, 0=no	as reported by respondent
Shock1_crop losses	Scores for factor 1 shocks	scores from factor analysis
Shock2_unemployment	Scores for factor 2 shocks	scores from factor analysis
Shock3_death	Scores for factor 3 shocks	scores from factor analysis
Shock4_illness	Scores for factor 4 shocks	scores from factor analysis
Any coping mechanism	dummy variable: 1=yes, 0=no	as reported by respondent
household expenditures	total household expenditures	actual value in Liberian dollars
Rice_adults	number of rice meals consumed by adults in the household	number of meals consumed per day
Othermeals_adults	number of other meals consumed by adults in the household	number of meals consumed per day
Rice_children	number of rice meals consumed by children in the household	number of meals consumed per day
Other meals_children	number other meals consumed by children in the household	number of meals consumed per day
Any livelihood_activities	dummy variable: 1=yes, 0=no	as reported by respondent

## CHAPTER FOUR

### 4.0. Results and Discussion

#### 4.1. General Description of Households

The study population comprises of slightly more female headed households (48% male) with an average of persons which is within the national average size as of the 2008 population and housing census (LISGIS 2008). Across the sample, the average age of the household head is 42 years. The households on average own 2 acres of land with less than 1 unit of livestock. The livestock includes cattle, goats, sheep, pigs and chicken and are derived using the Tropical Livestock Units of estimation (Thornton et al. 2002). For other assets that comprise of machinery, equipment and household utensils, the households own an average of 1.5 units. The level of education among the household heads is relatively low. A majority has not attended school at all (66.8%). About 11.3% household heads had some elementary schooling while about 6% completed elementary school. 10% heads had some high school education with only 4% having completed high school. Less than 1% of all the household heads attained either vocational education (0.7%) or university level of schooling. Overall, the average years spent in school is 2 years. The summary of asset distribution is presented in table 2.

**Table 2: Descriptive summary of asset distribution**

Assets	Mean	Standard error
<b>Natural capital:</b>		
Land size (acres)	2.299	0.348
<b>Physical capital:</b>		
Livestock units	0.086	0.008
Other assets	1.486	0.019
<b>Human capital:</b>		
Household size	5	0.064
Age	42.368	0.428
Sex (male)	0.484	0.014
Literacy	0.311	0.285
Education levels:		
- No schooling	0.668	0.013
- Some elementary schooling	0.113	0.009
- Complete elementary school	0.060	0.007
- Some high school	0.100	0.008
- High school	0.040	0.006
- Vocational study	0.007	0.002
- Some university education	0.008	0.003
- Completed University	0.002	0.001
- Years of schooling	2.447	0.115

## 4.2. Identification of Common Shocks

The households reported a number of shocks. The reported shocks included drought, floods, loss of harvest due to pests and diseases, house destruction, bushfires, unemployment, illness, death of household member, conflict, theft of household assets and others. A general overview of the occurrence of these shocks across the households is presented in table 2. The most common shock was illness (32%), followed by death of a household member (20%) and crop losses attributed to pests and diseases at 16%. The rest of the shocks had low occurrence rates of less than 5% (see Table 3).

**Table 3: Overview of shocks occurrence over a 12 month period as reported by households**

Type of shock	Mean	Standard Error
Drought	.0400	0.006
Floods	.0440	0.006
Crop losses due to pests and diseases	.1620	0.010
House destroyed	.0400	0.006
Bushfire	.0050	0.002
Unemployment	.0430	0.006
Illness	.3190	0.013
Death of household member	.2000	0.011
Conflict	.0270	0.005
Theft of household assets	.0330	0.005
Others	.0250	0.004

*Shocks presented as dummy variables; Mean = mean of dummy variable*

Factor analysis resulted in four common factors that represent crop losses, unemployment, death and illness shocks (see Table 4). Cluster analysis of these factors resulted in four clusters of households with each representing the most common shock experienced. The clusters reveal illness, death and crop losses as common shocks among the households. It should be noted here that unemployment which was one of the factors no longer features as common across the clusters. This is can be explained by its low occurrence compared to crop losses, death and illness. Cluster one comprises of 334 households in which illness was the most common shock among the households. Cluster two had 208 households and death was the most common shock while cluster three comprised of 174 households where crop losses were the most prevalent. The largest number of households do not report common occurrence of any shock and they form

cluster four (527 households). A detailed description of variables used in the analysis is presented in Table 5.

**Table 4: Factor analysis of shocks**

<b>Variable</b>	<b>Factor 1 Crop losses</b>	<b>Factor 2 Unemployment and others</b>	<b>Factor 3 Death</b>	<b>Factor 4 Illness</b>
Weather shocks	0.4319	0.2751	0.3754	0.0275
Crop losses to pests	<b>0.7624</b>	0.0122	-0.0246	0.0474
Crop losses to diseases	<b>0.7070</b>	-0.0253	-0.1319	-0.1668
Theft of assets	-0.0900	0.0430	0.4929	-0.4480
Illness	-0.0735	0.0212	0.0164	<b>0.8344</b>
Death	-0.1129	-0.0648	<b>0.7244</b>	0.0421
Unemployment	0.1347	<b>0.7553</b>	0.1801	0.2189
Other shocks	-0.1510	<b>0.6989</b>	-0.3153	-0.2707

*Method: principal-component factors; Rotation: orthogonal varimax; LR test: independent vs. saturated:  $\chi^2(28) = 173.64$  Prob> $\chi^2 = 0.0000$ ; Variance: 0.5733*

**Table 5: Summary statistics of clusters and factor analysis variables for shocks**

<b>Variable</b>	Cluster 1 <u>Illness</u>		Cluster 2 <u>Death</u>		Cluster 3 <u>Crop losses</u>		Cluster 4 <u>No shock</u>	
	N= 334 <b>Mean</b>	<b>Std Err</b>	N=202 <b>Mean</b>	<b>Std Err</b>	N=174 <b>Mean</b>	<b>Std Err</b>	N=527 <b>Mean</b>	<b>Std Err</b>
Weather shocks	0.042	0.011	0.302	0.032	0.161	0.028	0.002	0.002
Crop losses to pests	0.015	0.007	0.084	0.019	<b>0.741</b>	<b>0.033</b>	0.002	0.002
Crop losses to diseases	0.000	0.000	0.015	0.009	<b>0.471</b>	<b>0.038</b>	0.000	0.000
Theft of assets	0.000	0.000	0.193	0.028	0.006	0.006	0.002	0.002
Illness	<b>0.967</b>	<b>0.009</b>	0.074	0.018	0.316	0.035	0.004	0.003
Death	0.147	0.019	<b>0.649</b>	<b>0.034</b>	0.040	0.015	0.002	0.002
Unemployment	0.093	0.016	0.059	0.017	0.046	0.016	0.004	0.003
Other shocks	0.009	0.005	0.005	0.005	0.017	0.009	0.046	0.009

*Std Err. = Standard Error*

Depending on the type of shock, the shocks herewith identified can have diverse effects on food security in the household. Illness for example affects the productivity of human capital thereby rendering them unable to produce or provide food for the household. Illness also increases expenditures on health care thereby affecting expenditures on food or food production and others especially in case of low income households. Similar to this, a household survey in the year 2008

found illness as one of the common shocks and it showed that most people in the rural areas of Liberia lacked financial and physical access to quality health care (LISGIS 2008).

Death on the other hand can as well have adverse effects on the food security situation of a household especially when the persons lost played a vital role in making food and income available. This may be more worse in the case of unexpected deaths and for households that buy rather than produce their food. Twine and Hunter had similar findings in a related study on food insecurity (Twine and Hunter 2008).

Despite the efforts to produce their own food, agricultural productivity is hampered by pests and diseases in Africa. The communities in Margibi and Montserrado counties are no exception to this. Crop failures result in food shortages especially for households that rely greatly on agricultural food production. A national report for a baseline survey conducted in 2006 indicated lack of inputs and knowledge on adequate pest control as one of the underlying causes of food insecurity in Liberia (Liberia 2006). The results concur with this finding and suggests the problem still occurs as one of the root causes of food insecurity.

#### **4.3. Identification of Coping Strategies**

Following the identification of shocks, a similar procedure was done to identify the strategies the households employed to cope with the shocks. Generally, there is no dominant coping mechanism and almost 65% households have no specific coping mechanism for coping with the shocks. However, results indicate coping mechanisms include: hiring out land (13%), spend savings (11%) and borrow food (10%), selling other household assets (8%), borrowing money (6%) and selling land (5%). More or less 3% of the households buy cheaper/less preferred food, reduce expenditures on health and education, seek for employment outside their communities among other less common mechanisms (See Table 6).

**Table 6: Overview of coping mechanisms as reported by households**

Variable	Mean	Standard Error
Cheaper food	.031	.005
Borrow food	.098	.009
Purchase food on credit food	.017	.004
Reduce number of meals per day	.014	.004
Seek for work outside community	.019	.004
Reduce expenditures on health/education	.005	.002
Spent savings	.112	.009
Sell household assets	.082	.008
Help by relatives	.011	.003
Borrow money	.059	.008
Hire out land	.133	.010
Sell land	.052	.006
Send children to work	.006	.002
Send children to relatives	.009	.003
Others	.032	.005
No strategy	.648	.014

*Coping mechanisms presented as dummy variables; Mean = mean of dummy variable*

Factor analysis of coping mechanisms resulted in seven common factors represented as;

Factor 1: sale of other assets and hiring out land;

Factor 2: selling land and other mechanisms;

Factor 3 use of child labour;

Factor 4 cheap/less preferred food;

Factor 5: eat less and work more;

Factor 6: relatives support and

Factor 7: reduce human capital expenditures.

The factors are presented in Table 7.

**Table 7: Factor analysis of coping mechanisms**

Variable	Factor1 Asset sales and land renting	Factor2 Land sales and other mechanisms	Factor3 Child labor	Factor4 Cheap food	Factor5 Eat less, work more	Factor6 Relatives	Factor7 Reduce human capital expenditures
Cheap/less preferred food	0.0373	-0.0458	0.0835	<b>0.8692</b>	0.0665	0.0394	0.1202
Borrow/buy food on credit	0.2552	0.0622	-0.2712	<b>0.4424</b>	-0.2776	-0.0876	-0.4725
Reduce meals	0.1174	-0.0704	0.0170	0.0141	<b>0.7655</b>	0.0296	-0.0092
Seek for employment	0.1453	0.2439	-0.2271	0.1212	<b>0.5744</b>	-0.0694	-0.2374
Reduce expenditures on health/education	0.1124	0.1280	-0.1430	0.1716	-0.1197	-0.0301	<b>0.8035</b>
Sold household assets	<b>0.7246</b>	-0.0371	-0.1105	-0.2106	0.1619	-0.0553	0.2271
Help from relatives	0.2166	0.0361	-0.1625	-0.1306	-0.2267	<b>0.6668</b>	-0.1727
Rent out land	<b>0.7668</b>	-0.0350	0.2628	0.0494	-0.0428	-0.0247	-0.1109
Sell land	0.0635	<b>0.8930</b>	-0.0875	-0.0137	0.0092	-0.0081	0.0812
Send children to work	0.0993	0.1081	<b>0.8719</b>	0.0675	-0.0405	-0.0130	-0.0798
Send children to relatives	-0.1158	-0.0421	0.0815	0.1259	0.1359	<b>0.7755</b>	0.0900
Other mechanisms	0.0743	<b>0.7738</b>	0.4777	-0.0328	-0.0047	-0.0120	0.0063
Not do anything	<b>-0.7709</b>	-0.3053	-0.0294	-0.2567	-0.1073	-0.0886	-0.0163

*Method: Principal Component Factors; Rotation: orthogonal varimax; LR test: independent vs. saturated:  $\chi^2(78) = 2096.66$ ;  $Prob > \chi^2 = 0.0000$ ; Variance = 0.7044.*

The subsequent clustering of the factors led to the formation of four clusters of households each representing a coping strategy. Cluster one represents no strategy (904 households), cluster two (170 households) comprises of households using asset based coping strategy. This strategy involves use of mechanisms such as hiring out land (74%) and selling household assets like livestock and other items. Cluster three (56 households) comprises of households that use a food based strategy to directly increase food availability. This includes buying cheap or less preferred food (70%) and borrowing or buying food on credit. Cluster four (107 households) comprises of households that employ a mixed strategy that includes use of asset based coping mechanisms of selling and renting out land as well as seeking for employment opportunities and other

mechanisms. The details of these clusters and variables used is presented in table (details in Table 8).

**Table 8: Summary statistics of clusters and factor analysis variables for coping strategies**

Variable	Cluster 1 N= 904 <u>No strategy</u>		Cluster 2 N=170 <u>Asset based strategy</u>		Cluster 3 N=56 <u>Food related strategy</u>		Cluster 4 N=107 <u>Mixed strategy</u>	
	Mean	Std Err	Mean	Std Err	Mean	Std Err	Mean	Std Err
Cheap/less preferred food	.000	.000	.000	.000	<b>.679</b>	<b>.063</b>	.000	.000
Borrow/buy food on credit	.000	.000	.000	.000	<b>.375</b>	<b>.065</b>	.000	.000
Reduce meals	.000	.000	.035	.014	.018	.018	.093	.031
Seek for employment	.000	.000	.012	.008	.071	.035	.159	.036
Reduce expenditures on health/education	.000	.000	.024	.012	.018	.018	.009	.009
Sold household assets	.000	.000	<b>.512</b>	<b>.038</b>	.071	.035	.103	.029
Help from relatives	.000	.000	.018	.010	.018	.018	.093	.028
Rent out land	.000	.000	<b>.735</b>	<b>.034</b>	.304	.062	<b>.206</b>	<b>.039</b>
Sell land	.000	.000	.012	.008	.054	.030	<b>.551</b>	<b>.048</b>
Send children to work	.000	.000	.000	.000	.018	.018	.065	.024
Send children to relatives	.000	.000	.000	.000	.018	.018	.093	.028
Other mechanisms	.000	.000	.006	.006	.018	.018	<b>.355</b>	<b>.046</b>
Not do anything	<b>.877</b>	<b>.011</b>	.000	.000	.000	.000	.075	.026

*Std Err. = Standard Error*

Within the strategies, the role of land appears to be common among the households with about 13% and 5% renting out or selling their land respectively (shown in table 6). However contrary to this results, related studies found most households would avoid to rent out or sell their high value productive assets like land when faced with food insecurity unless in worse situations (Corbett 1998). This study suggests the households engage in it and would imply a probably worse food insecurity situation. However, the sample villages are located in a region that is considered to have moderate levels of food insecurity in the country (LISGIS 2008). More so, a significant number of households reported no shocks. Therefore, this could be explained by the fact that Montserrado and Margibi counties are located near greater Monrovia, the capital city of the country where there is a likelihood for existence of established land markets given the development activities and population size. This may be more enhanced by the presence of an established rubber industry with companies such as Firestone operating in the area.

#### 4.4. Comparison of Shocks and Coping Strategies Clusters

For a more clear understanding of the relationship between shocks and coping strategies adopted across the households, a comparison of the clusters is made. From table 9, it can be seen that occurrence of shocks and the number of households affected varies across clusters. More than 50% households with no coping strategy did not report any shock while almost the same percentage of households that use the asset based coping strategy had illness as most common of all shocks. The proportion of households more or less reduces in all the clusters as per type of shock. The trend of occurrence of shocks is almost the same in all the clusters with illness being most common and crop losses the least.

Important in this results is the fact that households that report no coping strategy show a sizeable existence of shocks. It suggests the households may be unable to cope for a number of reasons. One possible reason is they may be fairly wealthy households with diverse sources of income and are therefore not as food insecure as other households in the area or they are in a state of extreme distress that they are simply unable to do anything.

**Table 9: Cross tabulation of shocks and coping strategies**

Shocks	<u>Coping strategies</u>							
	<u>No strategy</u>		<u>Asset based strategy</u>		<u>Food based strategy</u>		<u>Mixed strategy</u>	
	Frequency							
Illness	200	22%	80	47%	19	34%	35	33%
Death	127	14%	34	20%	18	32%	23	21%
Crop losses	96	11%	30	18%	14	25%	34	32%
No shock	481	53%	26	15%	5	9%	15	14%
<b>Total</b>	<b>904</b>		<b>170</b>		<b>56</b>		<b>107</b>	

#### 4.5. Asset Distribution Across Coping Strategies Clusters

In the description of asset distribution, I maintain the categorization of households into clusters based on their coping strategies. As earlier mentioned, cluster one has households with no strategy, cluster two with households that use the asset based strategy, cluster three households using the food based strategy and cluster comprising of households that use a mixed strategy of coping with the shocks.

The households with no strategy of coping (cluster one) did not largely report common occurrence of shocks. This is the largest cluster of all the four clusters and the households do not own substantial numbers of assets. They typically have on average 1.6 acres of land, 0.07 livestock units and an index of 1.5 units of other household assets. Compared to others, the cluster has households with fewer persons (4 persons) with a close to average distribution of female-male headed households (48% male heads). Similar to other clusters, education levels are equally so low. The average number of years spent in school for a household head in the cluster is only 2.5 years.

The households that use the asset based strategy of coping (cluster two) are more or less equally distributed across the gender of household heads (52% male heads) and have 5 persons household. As would be expected, these households own more physical and natural assets compared to the households in other clusters. They have average of 4 acres of land, 0.2 units of livestock and an index of 1.6 other assets. More or less like other clusters of households, the education levels are low with an average of 2 years.

Cluster three is the smallest cluster (56 households) comprising of households that used food based strategy of coping with the shocks. They own the least size of land among others (less than 1 acre). Compared to other clusters, household size is also 5 persons but they have the oldest household heads (48years) with more male headed households (54%). They own slightly more units livestock (0.13) and other household assets (1.5 index).

Cluster four comprises of households that employ the mixed coping strategy. When compared to other clusters, these households own the biggest sizes of land (6 acres) and have the smallest size of livestock units (0.05 units). This offers some explanation why most of them choose to sell or rent out some of their land (refer to table 8). Most notable among these households is that they have more female headed households (45% male heads). There are no significant differences from other clusters in regard to other assets. A detailed descriptive summary of asset distribution is presented in Table 10.

**Table 10: Summary of asset distribution across the clusters**

Variables	Cluster 1 N= 904 <u>No strategy</u>		Cluster 2 N=170 <u>Asset based strategy</u>		Cluster 3 N=56 <u>Food based strategy</u>		Cluster 4 N=107 <u>Asset based and others strategy</u>		Chi <sup>2</sup> value
	Mean		Mean		Mean		Mean		
<b>Natural capital:</b> Land (acres)	1.589	(0.232)	4.302	(1.090)	0.913	(0.183)	5.869	(3.057)	283.749***
<b>Physical capital:</b> Livestock units	0.070	(0.008)	0.174	(0.039)	0.132	(0.042)	0.049	(0.010)	295.971***
Other assets	1.455	(0.023)	1.612	(0.052)	1.528	(0.093)	1.520	(0.066)	2.0e+03*
<b>Human capital:</b> Household size	4	(0.074)	5	(0.173)	5	(0.383)	5	(0.213)	78.868***
Age	42	(0.505)	41	(1.120)	48	(2.099)	42	(1.337)	232.041
Sex (male)	0.477	(0.017)	0.524	(0.038)	0.536	(0.067)	0.453	(0.049)	2.143
Literacy	0.309	(0.015)	0.288	(0.035)	0.411	(0.066)	0.321	(0.046)	3.055
Education (years)	2.450	(0.135)	2.335	(0.304)	2.429	(0.537)	2.613	(0.405)	65.107*

*Standard errors in parenthesis; \*, \*\*, \*\*\* = significant at 10%, 5% and 1% level respectively*

The chi square tests reveal existence of statistical differences in ownership of land, livestock and household size. There exists weak differences between households on the amount of other assets owned and the years spent in school among the household heads as would be expected given the general low levels of education observed (as shown in Table 2). This results also show that there is no statistical difference in the ages and sex of the household heads in the study population.

## **4.6. Econometric Results**

In this section, I present the results of the estimated econometric models earlier described in chapter three. The models estimate the determinants of coping strategies and the effects that the identified shocks have on food consumption.

### **4.6.1. Determinants of Coping Strategies**

The results presented on table 10 show existence of associations between the coping strategies adopted by the households and the different household characteristics and asset endowments. These results suggest that households with more livestock, land and other assets are more likely to engage in the asset based coping strategy. Moreover, the choice for this strategy is strongly associated with the occurrence of crop losses, death and illness shocks. The findings also indicate that male headed households are more likely to engage in the asset based strategy while older household heads in the community are less likely to take it up. The likely reason for men to choose this strategy lies in the traditions of some communities in Africa where men may have more power over the decisions to hire or sell productive assets such as land. This is can be seen with the fact that there are slightly more male headed households (52%) in the cluster. However, when age is considered, older household heads may not want to sell off these productive assets as tradition may require them to pass them on to their children. It may also be that, they already passed on the land rights to their children and no longer have the power to take decision on its disposal. As already mentioned, the decision to adopt the asset based strategy is strongly associated with occurrence of crop losses, death and illness shocks. This may suggest that the households in this cluster may be in a distress situation forcing them to sell their productive assets or they simply own more and can afford to sell or hire out their assets. These households actually own more of these productive assets compared to others (observed in the significant positive estimations on land, livestock and other assets).

Households with more land are less likely to engage in the food based strategy. These households on average own the least amount land compared to other households. They however on the other hand own significant livestock units. The livestock clearly play a role in facilitating borrowing and buying of cheaper or less preferred foods. The households with older and educated household heads are however more likely to take up the food based strategy. One possible explanation could be attributed to the fact that most household heads are educated and

may therefore earn income from employment. The household heads that have had some education may engage in forms of contract or non contract labour activities thereby enabling them earn some income. On the other hand the older household heads may have limited sources of income and are therefore forced to borrow or buy much cheaper foods which may often be less preferred. Like the asset based strategy, the food based strategy is also strongly associated with the occurrence of crop losses, illness and death.

Larger households with more land are more likely to engage in the mixed strategy while households with more livestock are less likely to take it up. Again the role of livestock in coping with food shortages. The households clearly derive food and income from the animals reared and may not so much engage in other coping mechanisms if large numbers of livestock are owned. Significant among the shocks affecting these households are crop losses and illness. It is possible that the degree of crop losses and illness faced is more severe thereby driving the people to engage in a number of coping mechanisms.

For all the three strategies, the livestock and land have a significant impact on all the strategies the households engage in. The role of livestock in enhancing food security is far more important for the communities in this study. They can be a source of nutrition through consumption of animals and their by-products. Income can also be generated from sale of animals and their related products. Land on the other hand enhances food security depending on the tenure system. In general terms, the findings in this study show a small proportion of households engage in selling and hiring out of land suggesting some existence of a land market. A crucial observation in this results is the link between the coping strategies and the different shocks. With the exception of the mixed strategy (death not significant), the same shocks significantly occur across coping strategies. This implies the choice for coping does not necessarily depend on the type of shock but rather on other factors like capital assets in the household.

In consideration of the significant estimates, this findings partly confirm the hypothesis that coping strategies adopted by households depend on specific household characteristics. Household size significantly influences the choice for a mixed coping strategy. The age of the household head on the other hand influences the choice for asset based and food based coping strategies. In the same way, the second hypothesis that physical and natural asset endowments

determine type of coping strategy is partly confirmed depending on the strategy. The size of land, livestock units and other assets owned significantly influence the coping strategies.

**Table 11: Multinomial logit regression: Determinants of coping strategies**

Explanatory variables	Dependent variables: Coping strategies					
	<u>Cluster 2</u>		<u>Cluster 3</u>		<u>Cluster 4</u>	
	<u>Asset based strategy</u>		<u>Food based strategy</u>		<u>Mixed strategy</u>	
	Coefficient	Std Err	Coefficient	Std Err	Coefficient	Std Err
<b>Human capital</b>						
Household size	0.033	0.040	0.060	0.063	0.139***	0.043
Sex of household head (male)	0.383*	0.201	0.112	0.342	-0.207	0.230
Age of household head	-0.013**	0.007	0.021**	0.009	-0.001	0.008
Literacy	-0.126	0.343	1.379**	0.499	-0.146	0.396
Education (years)	-0.035	0.039	-0.138**	0.062	0.033	0.048
<b>Natural capital</b>						
Size of land	0.019*	0.010	-0.166**	0.030	0.026***	0.010
<b>Physical capital</b>						
Livestock	0.657**	0.319	0.696*	0.396	-1.213*	0.644
Other household assets	0.282**	0.128	0.034	0.204	0.126	0.159
<b>Shocks</b>						
Fac 1 (crop losses)	0.339***	0.099	0.552***	0.124	0.654***	0.084
Fac 2 (unemployment/others)	0.142	0.108	0.031	0.198	0.116	0.118
Fac 3 (death)	0.379***	0.093	0.547***	0.135	0.086	0.137
Fac 4 (illness)	0.509***	0.107	0.488**	0.168	0.276**	0.130
Intercept	-1.987***	0.355	-4.382***	0.590	-3.036***	0.414
Number of observations	170		56		107	
Wald chi <sup>2</sup> (33)	= 169.52					
Prob > chi <sup>2</sup>	= 0.0000					
Pseudo R <sup>2</sup>	= 0.1048					

*No strategy (n = 904) made base strategy; \*, \*\*, \*\*\* = significant at 10%, 5% and 1% level respectively. The coefficients and standard errors are robust for heteroskedasticity*

#### 4.6.2. Effects of Shocks on Food Consumption

Food consumption is measured using expenditures on food and the daily consumption of rice and other foods. An aggregate sum of household expenditures for food is computed over a two weeks period and does not include own food expenditures. The households on average spent 2,286 Liberian Dollars with a minimum of zero expenditures in some households. For both rice meals and other meals, one meal is on average consumed per day (see Table 12 for details).

**Table 12: Descriptive summary of expenditures and consumption of food**

Variable	Mean	Std. Dev.	Min	Max
Expenditures on food (Liberian Dollars)	2,285.994	1,802.673	0	19,115
Rice meals (adults)	1.177	0.503	0	3
Other meals (adults)	0.964	0.607	0	3
Rice meals (children)	1.133	0.609	0	3
Other meals (children)	1.015	0.671	0	4

#### 4.6.3. Effects of shocks on food expenditures

The OLS regression results (presented in table 13) show only crop losses significantly increased household expenditures for all the households and more for those engaged in the asset based coping strategy. In general terms, occurrence of crop losses increased the bi-weekly food expenditures by about 144 Liberian Dollars. The increase is even more (284 Liberian Dollars) among households using the asset based coping strategy. This findings suggest the households mainly engage in subsistence production. This is evidenced by the fact that food crop production is the leading livelihood activity among the households (see table 15). Severe crop losses will imply increased expenditures on food items as they will have to be purchased more often rather than consume food produced on the farm. The increased effect on expenditures can also be attributed to low market supply of food items given that crop losses is a covariate shock thereby resulting in high food prices. A related study on shocks and household expenditures in Bangladesh had similar findings (Quisumbing 2007).

Other shocks do not show any significant relationship with household expenditures despite their occurrence. It is worth noting here that despite being reported as common, the trend of occurrence of these shocks across the households does not show a very high or dominant presence. This probably explains the not so profound effect on food related expenditures.

**Table 13: OLS regression; Effect of shocks on food expenditures**

<b>Dependent variable: Food expenditure</b>						
	<u>Total sample</u> <b>N= 1237</b>	<u>No strategy</u> <b>N=904</b>	<u>Asset based strategy</u> <b>N=170</b>	<u>Food based strategy</u> <b>N=56</b>	<u>Mixed strategy</u> <b>N=107</b>	
<b>Explanatory variables</b>	<b>Coefficient</b>	<b>Coefficient</b>	<b>Coefficient</b>	<b>Coefficient</b>	<b>Coefficient</b>	
Factor 1 (crop losses)	143.724** (51.267)	60.539 (62.781)	284.331** (137.637)	317.741 (438.566)	-124.637 (200.071)	
Factor2 (unemployment)	-4.337 (51.446)	-78.700 (53.834)	-50.047 (146.709)	332.848 (437.901)	283.443 (225.371)	(227.286)
Factor 3 (death)	17.585 (52.055)	55.398 (53.729)	-18.959 (173.895)	-38.912 (436.596)	-176.412 (225.371)	
Fac 4 (illness)	64.538 (51.806)	42.142 (54.079)	-101.467 (162.794)	623.938 (456.619)	63.837 (258.796)	
<b>Control variables</b>						
Household size	22.532 (23.521)	7.816 (22.993)	40.329 (82.041)	227.086 (162.219)	-153.061 (124.968)	
Age of household head	-2.508 (3.529)	-0.037 (3.378)	-4.283 (12.374)	-13.561 (30.593)	-24.415 (18.789)	
Sex (male)	-155.679 (112.987)	-79.414 (109.833)	-300.783 (366.336)	-662.513 (884.403)	409.189 (645.899)	
Literacy	235.374 (194.925)	183.788 (191.205)	453.447 (673.844)	-463.667 (1288.105)	-917.213 (1155.205)	
Education years (head)	10.316 (22.570)	9.493 (21.997)	72.793 (79.635)	101.898 (175.127)	5.662 (120.263)	
Land	8.053 (4.271)	-4.971 (7.039)	18.874 (16.181)	342.383 (338.380)	7.707 (8.627)	
Livestock	29.024 (182.973)	-93.346 (208.389)	-192.754 (459.716)	-94.690 (1457.103)	3616.646 (2398.447)	
Other assets	-33.181 (76.784)	-78.483 (72.872)	97.293 (284.026)	-527.769 (772.830)	186.797 (403.572)	
Intercept	2289.734*** (211.338)	2242.457*** (198.704)	1995.72*** (753.353)	2723.628 (2050.458)	4308.127*** (1261.277)	

\*, \*\*, \*\*\* means significant at 10%, 5% and 1% level respectively; Standard errors in parenthesis.

#### **4.6.4. Effects of shocks on food consumption**

The results in Table 14 and 15 show the effects of shocks on consumption of rice compared to other foods. With the exception of illness, there is no significant effect of shocks on rice consumption. The occurrence of illness reduces the number of rice meals consumed by both adults and children in the household. In the same way as with rice, the consumption of other foods by children is also negatively affected by illness. As earlier mentioned, a common occurrence of illness implies increased expenditures on medical services thereby affecting and cutting down income available for food consumption. This can become worse in the scenario where the ill person is the main income earner of the household. Illness also negatively affects paid labour supply from the household thereby reducing the income earned. This forces the household to cut down on consumption of some foods more especially when they cost much more. This finding is in line with a related study in Ethiopia by Dercon and other authors (Dercon, Hoddinott, and Woldehanna 2005). A similar study in rural Malawi also found health shocks negatively affected current food consumption but in a short term (Davies 2010). These findings confirm the hypothesis that illness shocks have a negative effect on food consumption.

The results also indicate that the consumption of other foods children increases when death occurs in a household, though the observed association is weak. In general terms food consumption tends to increase for the time when death occurs in a household. Food requirements during funeral ceremonies tends to increase especially when large numbers of people are involved. Furthermore and despite the not so common occurrence, unemployment significantly increases the consumption of other foods by both adults and children. This is typically a substitution effect created when the price of rice is higher relative to other foods. With the reduced household incomes, it is logical that they resort to purchase the more cheaper and affordable food.

**Table 14: Poisson regression; Effect of shocks on consumption of rice**

Explanatory variables	<u>Independent variables</u>			
	<u>Adults</u>		<u>Children</u>	
	Coefficient	Standard error	Coefficient	Standard error
Factor 1 (crop losses)	0.013	0.013	0.005	0.015
Factor 2 (unemployment)	-0.003	0.011	-0.007	0.014
Factor 3 (death)	-0.011	0.012	-0.013	0.015
Factor 4 (illness)	-0.023*	0.012	-0.024*	0.015
<b>Control variables</b>				
Household size	-0.002	0.006	0.029***	0.007
Age of household head	0.000	0.001	-0.002	0.001
Sex (male)	0.009	0.026	0.023	0.032
Literacy	-0.052	0.054	0.106*	0.061
Education years (head)	0.000	0.006	0.016**	0.007
Land	0.000	0.001	0.000	0.001
Livestock	-0.034	0.031	-0.052	0.035
Other assets	0.058***	0.018	0.056**	0.022
Intercept	0.059	0.052	-0.049	0.065
Prob > chi2	0.0489		0.0000	
Pseudo R <sup>2</sup>	0.0016		0.0047	

*\*, \*\*, \*\*\* means significant at 10%, 5% and 1% level respectively. The coefficients and standard errors are robust*

**Table 15: Poisson regression; Effect of shocks on consumption of other foods**

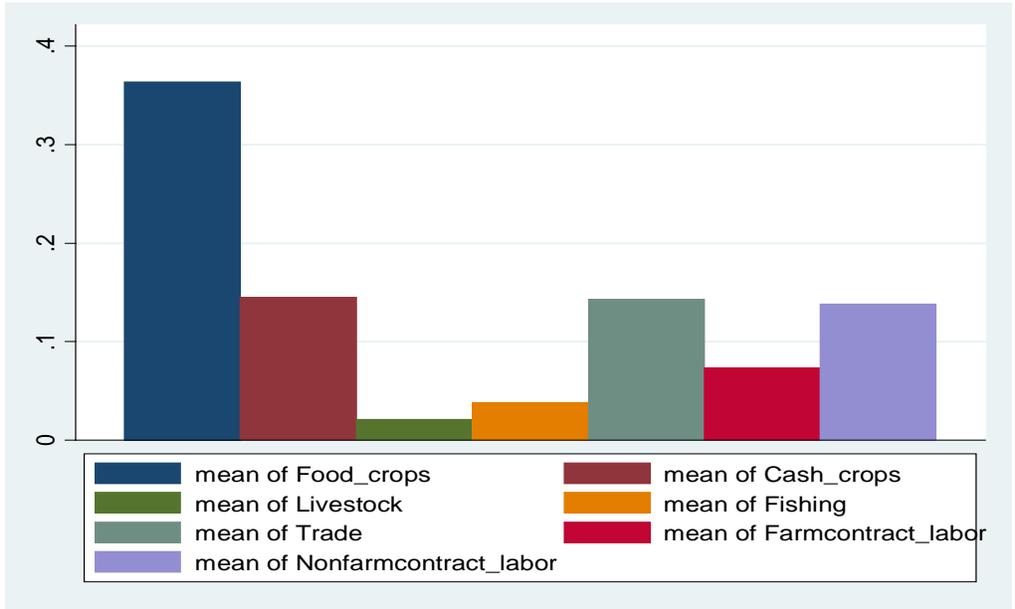
Explanatory variables	<u>Independent variables</u>			
	<u>Adults</u>		<u>Children</u>	
	Coefficient	Standard error	Coefficient	Standard error
Factor 1 (crop losses)	-0.012	0.018	0.009	0.018
Factor 2 (unemployment)	0.038***	0.014	0.042***	0.015
Factor 3 (death)	0.025	0.017	0.031*	0.017
Factor 4 (illness)	-0.021	0.017	-0.041**	0.017
<b>Control variables</b>				
Household size	-0.001	0.009	0.029***	0.008
Age of household head	0.001	0.001	-0.002	0.001
Sex (male)	-0.056	0.039	-0.053	0.041
Literacy	0.017	0.080	0.097	0.077
Education years (head)	-0.002	0.009	-0.010	0.009
Land	0.001	0.001	0.001**	0.001
Livestock	-0.099	0.071	-0.068	0.048
Other assets	0.082***	0.028	0.102***	0.029
Intercept	-0.185**	0.075	-0.184**	0.079
Prob > chi2	0.0111		0.0000	
Pseudo R <sup>2</sup>	0.0030		0.0083	

\*, \*\*, \*\*\* means significant at 10%, 5% and 1% level respectively. The coefficients and standard errors are robust

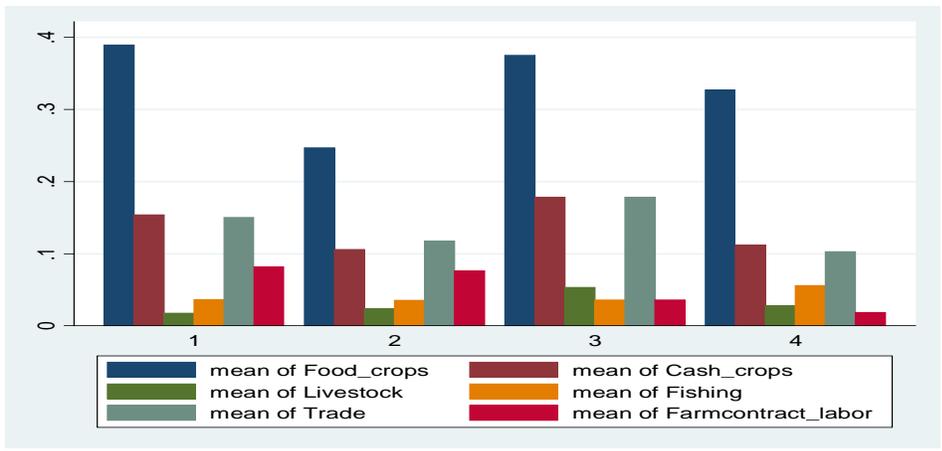
#### 4.7. What are the Livelihood activities?

For a better understanding of the households degree of resilience to shocks, knowledge of the nature of their livelihoods becomes imperative. The livelihood portfolio gives an idea of the extent to which households may be considered resilient or vulnerable to shocks. This depends on the type of livelihood activities and the level of diversification in them. In general terms, the households engage in a range of activities that include; food production (36%), cash crop production (15%), trade (14%), non-farm contract labour (13%), farm contract labour (7%), fishing (4%) and livestock production (2%). It can be seen that food crops, cash crop production and trade are relatively dominant among all the activities. The least practiced livelihood activities are fishing and livestock production (see figure 2). The same trend of distribution of activities is observed across all the clusters of household created based on the coping strategies used (figure 3).

In general terms, the households engage in at least some form of activities with some level of diversification. This indicates existing exploitation of the available livelihoods base in the different households. The fact that there is diversification in livelihood activities enables some households to cope with the shocks depending on their level of occurrence.



**Figure 2: Bar graph showing livelihood activities as reported by households**



**Figure 3: Bar graph showing livelihood activities among household clusters as reported by households**

#### **4.8. Discussion**

This study has generated a number of insightful findings that will contribute to a whole lot of existing literature on food security and rural households in relation to shocks. Despite the outcomes, a few issues require careful attention as far as these findings are concerned. The study involved communities from two counties that both lie within the central-southern part of Liberia and along the Atlantic coast besides being much closer to the city Monrovia. Comparison of these households and their livelihoods and those outside will to some extent not be logical given the differences and comparative advantages associated with physical environment among other factors. The livelihoods and opportunities available to households found in counties around big cities and along the coastline cannot be compared to those in the interior and far outward. This findings may not therefore necessarily apply to some households outside the study area or region.

Although the coping strategies are clearly defined, these findings may to some extent be limiting. There was an absence of distinguished dominance in the variables used thereby making it difficult to assess the significance of some of the strategies. Despite all, most notable is the significant role assets play in all the coping strategies. Literature from related studies suggest that engaging in practices that deplete physical and natural resources can bear consequences that may be detrimental for future household welfare. Also notable is the number of households reporting to have no coping strategy despite experiencing shocks. A more in-depth investigation would be vital for a conclusive understanding of the possible reasons for some households to have no strategy of coping.

The outcomes on household welfare may also require careful and discrete consideration. Household expenditures for example comprised of bi-weekly costs for different food and other related items. There was however no consideration of own food consumption in relation to the expenditures. Likewise with the consumption of rice compared to other foods in relation to shocks. Although the assumption for the estimated model was that the shocks are exogenous, some caution has to be adhered to especially in the context of illness. Illness may occur due to the fact that the members of the household are not feeding well, so its exogeneity becomes questionable. However, for this analysis the assumption still holds.

This study was based on baseline survey data that was collected within one year. Given all the considerations made, a panel study would provide more clear findings given household behavior and other aspects such as seasonality. It will enable deduction of consistent findings on the impact of the shocks on household welfare and other related studies.

## CHAPTER FIVE

### 5.0. Conclusion and Implications

This study explores the coping strategies of food insecure households using baseline survey data of 1,237 households from Margibi and Montserrado counties in Liberia. The study identifies common shocks, coping strategies, determinants of shocks and their effects on food consumption in the households using factor and cluster analysis as well as regression techniques.

The results show illness, death and crop losses as the most common shocks among the households besides other shocks. In coping with the shocks, most of the households adopt an asset based strategy while others engage in the food based or mixed strategy in which they use several coping mechanisms. Given the shocks, the coping strategies the households engage in are associated with aspects such as household size, age and sex of the household head. Land, livestock and other household assets are clearly associated with the coping strategies. Whereas asset endowment clearly plays a vital role in influencing the coping strategies, a significant number of the households do not have a clear strategy despite experiencing shocks. A sizeable proportion of the households uses asset based strategy of coping with shocks. The fact that the assets are largely used as a means of coping with the shocks bares some implications. Selling of high value productive assets such as land and livestock can have long term negative consequences for the household. It strips the household off its highly productive livelihoods base, yet accumulation of these productive assets takes a considerable amount of time. By selling their assets, the households render themselves vulnerable in the coming future.

Crop losses and illness show some impact on household expenditures and food consumption. Specifically, crop losses increased expenditures on food while illness reduced consumption of rice in the households. Unemployment although not very significant among the reported shocks also shows a profound impact on food consumption. The fact that crop losses from pests and diseases is reported implies existence of a gap in crop protection. There is need for interventions through research and agricultural support institutions to improve on crop performance. Likewise with illness, up scaling of health services in the communities will be vital and further investigations need to be done to determine the causes and dynamics of disease prevalence among rural households.

These findings may not however be substantial enough for a vivid picture of the effect of the shocks on household wellbeing as concerns food security. For instance, a household may generally be considered food insecure. However, some individuals may not actually suffer from food insecurity effects depending on factors like consumption behaviour as far as members of the household are concerned. Therefore, further investigations into the relationship of food security and nutritional status of the household would be highly recommended for an explicit understanding of the effects of the shocks.

In lieu of the livelihood activities, the findings show some degree of diversification although not so profound. It also indicates crop production and trade to be leading livelihood activities in the communities. Apart from a few, the households may be considered moderately resilient for the shocks and their effects. Given Liberia as a country, these findings may not however be generalized to other counties in the country due to existing physical, political, social and economic differences among others.

In a nutshell, the findings of this study portray the households as not to be in a state of distress given the coping mechanisms used. Moreover, other factors other than levels of food insecurity may be playing a vital role in the coping strategies adopted. More so, this study does not provide insight on whether they households really manage to cope to ensure food security. A further investigation of the extent to which the shocks are mitigated would therefore be recommended. Such a study will provide an understanding of whether the households are resilient enough to cope with the various shocks and risks that befall them.

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