COVARIANT SHOCKS AND THEIR MARGINAL EFFECTS ON HOUSEHOLD COPING STRATEGIES IN UGANDA

BY

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THIS DISSERTATION IS SUBMITTED TO THE DIRECTORATE OF RESEARCH AND GRADUATE TRAINING IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF ARTS DEGREE IN ECONOMICS OF MAKERERE UNIVERSITY

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DECLARATION

I, Hilary Bberinya, hereby declare that the work contained in this dissertation entitled "Covariant shocks and their marginal effects on coping strategies in Uganda" is an original research work carried out by me. I declare, to the best of my knowledge, that no part of this thesis was presented or submitted anywhere for the award of any degree before.

Signed.....

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ABSTRACT

This study analyzed covariant shocks and their marginal effects on household coping strategies in Uganda. Household level data contained in the Uganda National Household Survey (2005/2006) by Uganda Bureau of Statistics was used. The dependent variable was coping strategies with options; used assets, used savings, reduced family expenditure, widened employment, sought help, borrowed and other strategies. The independent variables were; drought, floods/hailstorm, pest attack, bad seed quality, livestock epidemics and other shocks. Location, region, gender, age, household size, economic status and education were used as control variables. Analysis was carried out using SPSS 12 and STATA 12 that generated preliminary descriptive statistics, variable cross tabulations, chi-square and multinomial logistic results. Three models were estimated to find out the effect of covariant shocks and their marginal effects on coping strategies. Out of the total number of 7421 respondents, 4885 (65.8%) reported to have faced at least one shock. Out of six shocks, drought was the largest specific shock that affected most respondents followed by; floods, livestock epidemics and a combination of other shocks combined.

Based on the results of the cross tabulation and chi-square test, the conclusion is that there were significant differences in reporting shocks by; location, region, gender, household size and economic status but no significant difference in reporting shocks according to education status. For the first choice strategy, there were significant differences in the choice of strategies between gender, location, region, household size, economic status; but no significant difference between education status. The choice of coping strategies was significantly different for various shocks. For the second choice strategy, there were significant differences in the choice of strategies based on, region, household size, economic status and location; but no significant difference between male and female. For the third choice strategy, there were no significant differences in the choice of strategies. Households were more likely to use savings in face of drought, floods/hailstorms, pest attacks, bad seed quality and other shocks. Male headed households were more likely to widen employment compared to use of savings than females. Use of savings to cope in face of shocks has policy implications in relation to the need to raise household savings.

STATEMENT OF APPROVAL

This is to certify that Hilary Bberinya has carried out the research embodied in the present dissertation entitled "Covariant shocks and their marginal effects on coping strategies in Uganda" for the award of a Master of Arts degree in Economics. The dissertation has been submitted with our approval as Makerere University supervisors.

Signed ..... Date 28/11/2017

Gertrude Sebunya Muwanga (PhD)

Signed ..... Date 28/11/2017

Fred Matovu (PhD)

DEDICATION

This piece of work is dedicated to the family of Mr. and Mrs Joseph Matovu and Angerine Nakate (of Kyannanjula, Kyannamukaaka, Masaka), relatives and friends for the vast contribution, support, love and encouragement given to me ever since I embarked on my academic endeavor.

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LIST OF ACRONYMS

ABBREVIATION	MEANING
BLR	Binary Logit Model
DDMTCs	District Disaster Management Technical Committees
df	Degrees of freedom
DREF	Disaster Relief Emergency Fund
DRR	Disaster Risk Reduction
FBO	Farmer Based Organization
GAPR	Government Annual Performance Report
HCCM	Heteroscedasticity Consistent Covariance Matrix
HIV/Aids	Human Immune Virus
IDPs	Internally Displaced Persons
IIA	Independence of Irrelevant Alternatives
KALIP	Karamoja Livelihood Program
LRDP	Luwero-Rwenzori Development Plan
ML	Maximum Likelihood
MNL	Multinomial Logistic Model
NDP	National Development Plan
NGOs	Non-Governmental Organizations
NLM	Nested logit models
NUSAF II	Northern Uganda Social Action Fund Phase II
NUSAF	Northern Uganda Social Action Fund
OLM	Ordered Logit Models
OLS	Ordinary Least Squares
OPM	Office of the Prime Minister
PMA	Plan for Modernization of Agriculture
PRDP	Peace Recovery and Development Plan
SAGE	Social Assistance Grants for Empowerment
SCG	Senior Citizens Grant

SDIP	Social Development Investment Plan
UBOS	Uganda Bureau of Statistics
UN	United Nations
UNHS	Uganda National Household Survey
UNICEF	United Nations International Children's Emergency Fund
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
UPE	Universal Primary Education
USD	United States dollars
WFP	World Food Programme

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CHAPTER ONE

INTRODUCTION

Chapter one contains the: background, problem statement, objectives, research questions, scope and significance of the study. It also gives the definition of terms and an outline of the organisation of the study.

1.1 Background to the study

It is estimated that worldwide wealth since 1990 has doubled; however, risks arising from widespread disasters have also increased, consequently, putting a strain on resources. The impact is felt by wealthy and poor countries alike. For example; it has been reported by Lusardi, Schneider and Tufano (2011) that half of Americans (and many Europeans) may be unable to cope with a moderate expense shock of $2,000. For poor countries in Asia and Africa such as Uganda, such a shock would leave most households in abject poverty (Reena et al., 2012).

The causes of such risks are mainly from economic and climatic events. There is increased concern of the adverse effects of climate change resulting into vulnerability. Climate change is the major cause of a number of shocks such as: drought, floods, famine, food insecurity, landslides and mudslides, epidemics, crop and animal diseases and others. Such shocks have directly or indirectly caused; more deaths, increased expenditure, reduced household incomes, malnutrition, crop failure or low yields, diseases, infrastructural damage and school drop-outs (Jayaraman, 2006).

In Africa, where agriculture is the economic mainstay, persistent shocks entrench chronic poverty. A large number of households in Africa practice subsistence agriculture and hence are concentrated near the poverty line with high levels of vulnerability to slide into abject poverty in the event of an adverse shock such as drought (Devereux, Baulch, Macauslan, Phiri & Sabates – Wheeler, 2006).

Africa faces both covariant and idiosyncratic shocks. A lot of resources are required to cope with covariant shocks. For poor countries, coping has involved households; dis-saving from what they accumulated in better seasons, selling off assets such as houses, electronic gadgets, livestock, seek extra employment and reduction in consumption (Deressa, 2010). Most times, the above strategies do not easily yield what affected households require. For instance, selling off assets by many households during covariant shocks depresses prices. Selling livestock during a drought is difficult since there are no pastures to feed them which also pushes their prices lower than during rainy seasons. This makes coping through long periods of covariant shock events such as drought a struggle for vulnerable households (Trench et al, 2007). The extended family network where every African in the neighborhood, clan and tribe was expected to be a kinsman and therefore expected to contribute to the welfare of the 'brother' can't help much where every 'brother' is affected and is looking for survival (Dercon, 2002).

In Uganda, the situation has not been any much different from the rest of Africa. Uganda is primarily an agricultural country with about 70 percent of the population concentrated in the agricultural sector whose contribution to Gross Domestic Product – GDP - is about 30 percent per annum. The agricultural sector is characterised by a predominantly subsistence sector with a small commercial role. Uganda has a high population growth rate estimated at 3.2 percent and total fertility rate approximately at 6.2 births per woman (WHO, 2014). This dependence on agriculture by a big population has implications when it comes to covariant shocks caused by climate and environmental changes.

Uganda is prone to covariant shocks mainly due to climate change that has led to temperature changes and increased El Niño and La Nina extremes. According to the Disaster Preparedness and Management Policy, the covariant disasters in Uganda include; drought, famine / food insecurity, floods, landslides and mudslides, epidemics, humans epidemics, crop and animal diseases, pandemics, heavy storms, pest infestation, earthquakes, transport related accidents, fires, internal armed conflict and internal displacement of persons. Others include: mines and unexploded ordinances, land conflicts, terrorism, industrial and technological hazards, cattle rustling, retrogressive cultural practices and environmental degradation (Republic of Uganda, 2010).

Vulnerable groups most affected by the shocks include; subsistence farmers, the poor, persons with disabilities, widows, aged persons and children such as orphans. Disasters in Uganda cause major problems such as, displacement and death of people and animals and destruction of property. The disasters sometimes strike in combinations hence making life worse off for the affected communities. According to the UNHS (2010/11) survey results, nearly two thirds of all households experienced at least one type of shock.

Table 1.1 shows that effects from covariant shocks may be disastrous. It presents single event numbers recorded by an international organisation (EM-DAT: The OFDA/CRED International Disaster Database). These numbers do one main contribution i.e. to wake up the stakeholders on the reality of the impact of shocks. As early as 1901, an epidemic decimated 200,000 Ugandans, in 1935 another epidemic killed 2000 people, further deaths occurred in 1966, 1989, 1990, 1991, 1997, 1999, 2000 and 2010, with death tolls of; 104, 156, 197, 100, 100, 115, 224 and 388 respectively on account of different disasters. These figures do not show further effects that were associated with those events.

Table 1.1: Death-tolls from disasters (1901-1997)

Disaster	**Date**	**Number Killed**
Epidemic	1901	200,000
Epidemic	1935	2000
Earthquake (seismic activity)	3/20/1966	104
Epidemic	Dec-89	156
Epidemic	1/1/1990	197
Epidemic	Mar-91	100
Flood	11/14/1997	100
Drought	Aug-99	115
Epidemic	8/8/2000	224
Mass Movement Wet	2/25/2010	388

Source: "EM-DAT: The OFDA/CRED International Disaster Database
www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium"

According to the Disaster Preparedness and Management Policy (Republic of Uganda, 2010), in the last two decades, on average, 200,000 Ugandans were affected each year by disasters. On top of that; in 1987, 600,000 were affected by drought while epidemic disasters killed 156 in 1989. In 1990 diseases killed 100. In 1994 earthquakes affected 50,000. In 1997 floods affected 153,500, killed 1000, in the same year epidemics affected 100,000 and; landslides killed 48. In 1998 drought affected 126,000 and in 1999 it affected 700,000 and killed 5 others. In 2000 epidemics killed 224. In 2002 drought affected 655,000 people killing 79. In 2005 drought affected 600,000 and in 2006 epidemic diseases killed 67 people and landslides killed 5 people. In 2008, drought affected 750,000 while in 2010 landslides killed 250 with the affected numbering 8500. Within the same year (2010) floods affected over 350,000. For the period 1998-2008 internal displacement stood at 1,800,000 people (Republic of Uganda, 2010). These are disheartening figures which show what happens on the ground.

Covariant shocks are real and require massive resources and effort to prevent and manage them. Coping in response to shocks occurs at the household level, community as well as country level. According to UNHS (2005/2006), faced with shocks coping strategies included; use of savings, reduction in consumption, help by relatives and friends, working as self-employed, more wage employment, change of crop choices to avoid bad weather or pest attack, selling of assets, local government interventions, informal borrowings and migration.

Uganda's plans are reflected in a number of frameworks such as: Poverty Eradication Action Plan (PEAP) (since 1997), National Development Plan (NDP) (2010/11-2014/15), Social Development Investment Plan (SDIP), Universal Primary Education (UPE), Northern Uganda Social Action Fund (NUSAF) and Plan for Modernization of Agriculture (PMA) (Republic of Uganda, 2010). These have formed responsive strategies to disasters but have not eliminated the effects from shocks. Uganda devoted resources towards the management of shocks during the period 2007-2010 indicated in Table 1.2.

Table 1.2 shows Uganda's figures of finances provided by the Directorate of Relief, Disaster Preparedness and Refugees, Office of the Prime Minister – OPM - for the subsequent years

(2007-2010). Expenditure cannot be said to be rising due to the fact that disasters may be more intense in one year than another hence warranting more expenditure in that year than another.

Table 1.2: Strategies financed by the Directorate of Relief, Disaster Preparedness and Refugees

Year	**2007**	**2008**	**2009**	**2010**
Strategy	Ushs(000,000)	Ushs(000,000)	Ushs(000,000)	Ushs (000,000)
Relief	1,600	1,300	1,600	2,600
Coordination and training	800	80	70	1,300
Land purchase	0	0	1,300	3,600
Resettlement	3,600	0	80	5,000
Conduct risk assessments	800	820	700	1,650
Food purchase	1,300	1,600	1,600	3,800
Land for resettlement	40	0	1,800	2,800
Total	**8,140**	**3,800**	**7,150**	**20,750**

Source: Compiled from the Directorate of Relief, Disaster Preparedness and Refugees Office of the Prime Minister, Kampala Uganda, (2012) Expenditures

Moreover, in face of disasters, resources are often diverted from other projects to tackle disaster, hence hampering development. From the above table the key strategies financed by government consist of; relief, coordination and training, land purchase, resettlement, conduct risk assessments, food purchase and land for resettlement. Relief and food purchase are some of the most funded strategies by government.

1.2 Problem statement

Climate change continues to cause unpredictability with new risks for countries such as Uganda. The worst affected from the new risks and resulting adverse events are the rural farmers and rural dwellers, who constitute 77 percent of the total Ugandan population. Moreover, more than 75 percent of those residing in rural areas depend on agriculture (UBoS, 2006).

Most parts of Uganda have reported experiencing heightened droughts particularly in eastern and northern areas. In addition, widespread floods have been reported in central, eastern and western regions. Other covariant shocks cited have included; epidemics, crop and animal diseases, pandemics, heavy storms, pest infestation, earthquakes, transport related accidents, fires, internal armed conflict and internal displacement and others. In consequence farmers' livelihoods have been affected resulting into food shortages, deaths, displacement of people as well as destruction of crops, livestock and infrastructural damage in places such as Bududa, Kabale and Karamoja (Republic of Uganda, 2010). The Government of Uganda and a number of nongovernmental organizations do occasionally intervene by offering financial and material support. However, in spite of the financial and other support, Uganda faces serious challenges in dealing with disasters due to inadequate resources. Given the conditions, households are forced to use various available coping strategies. It is argued that the type of shock faced influences the coping strategy adopted and that this varies from one region to another, household to household and rural to urban among others.

In order to design appropriate strategies for these shocks, it is necessary to recognize the linkage between shocks and the coping strategies adopted by the households. This calls for an investigation linkage between shocks and coping strategies including their marginal effects.

1.3 Objectives of the study

The objectives of this study were;

i) To investigate the linkage between covariant shocks and coping strategies
ii) To estimate the marginal effects of covariant shocks on coping strategies.

1.4 Research questions

In order to carry out the analysis of the above objective, the study asked the following questions:

i) What is the linkage between covariant shocks and coping strategies?
ii) What are the marginal effects of covariant shocks on household coping strategies?

1.5 Scope of the study

Geographically, the study covered the whole country subdivided into four regions (Central, Eastern, Northern and Western) of Uganda. The study period was between 2000-2005. This study used the UNHS (2005/2006) data. The data was chosen because of its availability, comprehensiveness and being nationally representative. The study focused on the analysis of the marginal effects of covariant shocks on household coping strategies in Uganda. This is because covariant shocks, unlike idiosyncratic shocks, affect a large section of the population of Uganda particularly those engaged economically in agriculture.

1.6 Significance of the study

This study adds to the existing body of knowledge about covariant shocks and their effects on household coping strategies in Uganda. Given that there is limited empirical information on the effects of shocks, this study contributes to literature useful in its own right for students, researchers, planners and others. It is one of the few studies that deal with this topic in Uganda complementing the few others. As a country with a rising population and aspiring to develop and achieve a middle income status as par Vision 40, such knowledge is indispensable for both academic and pragmatic application.

Secondly, the findings from this study will contribute usefully to policy on shocks and the available strategies. Knowledge about shocks and their effects is indispensable while designing policies to promote efficient and effective coping mechanisms. There is a critical need to fuse policy on how to cope amidst covariant shocks into national development plans at all levels in order to deal with their effects. However, before vast resources are set aside, there is need for comprehensive and well analysed knowledge that clearly informs policy from a study such as this in order to have priorities.

1.7 Definition of terms

Shocks are events that can reduce group or individual wellbeing, such as illness, unemployment, or drought, and which may themselves cause or compound poverty (Marques, 2003).

Idiosyncratic shocks affect individuals or households. On the other hand **covariant or common** shocks affect groups of households, communities, regions or even entire countries.

Coping strategies are strategies designed to relieve the impact of the risk once it has occurred. According to Holzmann (2001), coping strategies pertain to a reaction triggered by an adverse event.

Flood is defined by the EU Flood Directive as a temporary covering by water of land not normally covered by water which may include floods from rivers, mountain torrents, Mediterranean transient water courses, and floods from the sea in coastal areas, and may exclude flood from sewage systems. Floods occur when drainage basins reach maximum capacity and are unable to absorb additional rain resulting from certain weather phenomena such as heavy rains, tropical cyclones and other events (Hirschboeck, 1991).

Drought is described as a natural hazard that differs from other hazards because it has a slow onset, progresses over months or even years, and affects a large spatial region and causes little cultural damage. Their account borders around the long progressive nature of drought which contrast other natural disasters (Wilhite et al. 2000).

1.8 Outline of the study

This study consists of five chapters. Chapter 1 covers of the introduction and background of the study with statement of the problem, objectives, and research questions, scope of the study, significance, and definition of terms as well as the outline of the study. Chapter 2 reviewed theory, policy as well as empirical studies on shocks and coping strategies. Chapter 3 detailed the methodology that was used for the study highlighting the theoretical basis and the multinomial logistic model used. Chapter 4 analysed the effect of shocks and their effects on household coping strategies as well as discussed the results from both the preliminary and econometric analysis. Chapter 5 was the final chapter; it consists of brief summary of the findings, conclusions and policy recommendations and recommended areas for further research.

CHAPTER TWO

LITERATURE REVIEW

This section comprises of a critical review of literature and highlights various approaches to covariant shocks, risks, susceptibility to shocks as well as adaptation responses to address them. It then presents detailed empirical evidence from different researchers.

2.1 The life-cycle theory of consumption

The life-cycle hypothesis (LCH) is an economic theory that explains spending and saving habits of people over the course of a lifetime (Modigliani & Brumberg, 1954). The concept was conceived and developed by Franco Modigliani and his student Richard Brumberg. The model explains that in order to attain stable consumption over time, economic agents practice consumption smoothing (Modigliani, 1986). The life cycle model explains consumption and saving decisions of households at each point of time reflecting a more or less conscious attempt at achieving the preferred distribution of consumption over the life cycle, subject to the constraint imposed by the resources accruing to the household over its lifetime. Hence consumption smoothing is a rational decision. The idea that agents prefer a stable path of consumption has been widely accepted. This idea came to replace the perception that people had a marginal propensity to consume and therefore current consumption was tied to current income.

The theory further explains that a household's level of consumption will depend not just on its current income but more importantly, on its long-term expected earnings. Individuals are assumed to plan a lifetime pattern of consumer expenditure based on expected earnings over their lifetime. Therefore, consumption is linked to permanent income of agents. This means that peoples' spending is based on the idea that they make intelligent choices about how much they want to spend at each age, limited only by the resources available over their lives. By building up and running down assets, working people can make provision for their retirement, and more generally, tailor their consumption patterns to their needs at different ages, independently of their incomes at each age (Deaton, 2005). Thus, when income is affected by transitory shocks, for example drought and floods, agents' consumption should not change, since they can use savings

or borrowing to adjust. This theory assumes that agents are able to finance consumption with earnings that are not yet generated, and thus assumes perfect capital markets. Empirical evidence shows that liquidity constraint is one of the main reasons why it is difficult to observe consumption smoothing in the data.

In poor countries, households are exposed to a multitude of risks and that their strategies for coping with negative shocks are diverse and depend on the type of shock. Households living in these risky environments have developed a range of mechanisms to shield consumption from this risk, including income smoothing, self-insurance, and social insurance arrangements (Porter et al, 2014). Normally, consumption smoothing among poor as well as richer households is reflected in situations such as increase expenditures to cover medical expenses by use of savings.

Households engage in consumption smoothing through use of various means. The local labour market constitutes an important vehicle for risk coping in the income smoothing process. Although a household may devote land to agricultural activities, not all of its members may work on the household farm. In most cases, one or several of its members also participate in off-farm activities, such as self-employment in microenterprises or employment in other agricultural or non-agricultural activities (Alpízar, 2007). Male and female household members may take on work on other off farm work when the household is hit by a negative shock to smooth its income. However, McCarthy and Sun (2009), found that men were more likely to take on off farm work than females, but educated females were more likely to spend more hours on off farm work than males. A typical coping strategy in the context of limited access to financial markets involve building up asset stocks in good times and drawing them down to shield consumption from income fluctuations in bad times (Carter & Lybbert, 2012).

2.2 Risk and susceptibility to shocks

The concept of vulnerability as used in this study has two dimensions: a person's ability to manage a given shock (the higher their ability, the lower their susceptibility) and the severity of the impact of the shock (the more severe the impact if the risk is not managed, the higher the susceptibility). This definition implies that those with less resource endowments to manage risk who in most circumstances happen to be the poor are most susceptible. For this category of the

population even small risks may turn to be life-threatening or would generate some permanent consequences as far as human capital is concerned. These constitute not only the already poor but also those above the poverty line who are potentially subject to severe shocks and have little ability to manage risk (Tesliuc & Lindert, 2004).

Susceptibility to shocks can also be seen from the concept of poverty as the *ex-post* measure of a household's wellbeing. The degree of households' susceptibility depends on; exposure to risks and shocks and an inability to manage these risks and shocks due to inadequate assets and social protection mechanisms such as social insurance and assistance (Tesliuc and Lindert, 2004). Hence, susceptibility to shocks moves households closer to poverty although not all poor people suffer the same way when faced with disasters.

According to Martin Prowse (2003), although susceptibility to shocks is closely associated with poverty it is also distinct from it. Susceptibility is a symptom of poverty where a given section of households experience economic instability in terms of low incomes, unemployment and to externalities. Susceptibility to shocks is reached when a household has a greater probability of falling into poverty. Poverty explains what the situation is today but susceptibility is about how the situation will be tomorrow or in the future (Lerisse et al, 2003).

Susceptible households face uncertainties due to various risks such as environmental risks, market risks, political risks, health risks and others. Inability to cope while faced with such risks drives the susceptible further into chronic poverty. Some of the identified risks that susceptible groups face include climatic risk, climate fluctuations and individual specific shocks such as floods (Loprest & Maag, 2003).

According to Deverex et al (2003), one of the major factors that increases susceptibility to shocks is lack of financial resources, this is because lack of adequate resources translates in inability to take up opportunities when they arise in form of self-employment or access to health or education hence determining the type of life that the susceptible household has to live. Economic susceptibility is high in most developing countries as Deverex shows that in Malawi a

larger number of Malawians are concentrated near the poverty line hence with a high risk of falling back into poverty when faced with an adverse shock (Devereux et al, 2006).

2.3 Climate change, shocks and their impact

Shocks can be covariant or idiosyncratic. Covariant or common shocks affect large number of people whereas idiosyncratic or individual shocks are mainly experienced by individual households. Unlike idiosyncratic shocks, covariant shocks must affect a sizable number of the community hence strategies to cope with covariant shocks ought to be able to mobilise enough resources to deal with large numbers of people (Gordon et al, 2001). Covariant (or aggregate) shocks are experienced by everyone in a particular group, community or geographical region while an idiosyncratic shock affects only a particular individual or household (Dang, Thi Thu Hoai, 2011).

As a result of climate change shocks, grim forecasts continue to appear in various reports and some of them have been realised. For instance it is projected by the UN Millennium Project (2005) that cereal yields in tropical regions will decline markedly due to climate change vis-à-vis comparable temperate regions. It further provides evidence that domestic per capita food production in sub-Saharan Africa declined by 10 percent between 1985 and 2005 due to climate related causes, hence current food production in the region is not meeting the needs of the rising African populace (UN Millennium Project, 2005).

Among shocks, drought in particular represents one of the most important natural factors contributing to the most adverse effects to households in many parts of the world. For instance, the impact of a drought on households' income and poverty is expected to be higher than a landslide (Rosemberg et al, 2010). Drought directly affects production, lives, health, livelihoods, assets and infrastructure that contribute to food insecurity and poverty. However, the indirect effects of drought on environmental degradation and reduced household welfare through its impact on crop and livestock prices could be larger than its direct effects (Zimmerman and Carter, 2003, Holden and Shiferaw, 2004).

In the past five decades, drought has become a major problem in Africa which caused; asset depletion, environmental degradation, impoverishment, unemployment and forced migrations. There has been productivity loss (in crops, rangelands and forests); increased fire hazards; reduced water levels; increased livestock and wildlife mortality rates; and damage to wildlife and fish habitats (loss of biodiversity). These effects may finally manifest themselves in the form of reduced income for farmers and agribusiness; increased food prices; unemployment; reduced tax revenues; increased conflict, out migration and displacement; malnutrition and famine; disease epidemics and greater insect infestations; and spread of plant diseases and increased wind erosion (Shiferaw et al, 2014).

Another highly serious shock is floods/hailstorms, cyclones and others of similar type. Floods ravage infrastructure and submerge agricultural land. This directly affects farmers due to losses of crops and indirectly affects everybody in the resulting high food prices due to food scarcity. In their wake, floods and cyclones affect households by displacing communities; submerging agricultural crops or livestock; washing away assets; and destroying food stores. Following floods and cyclones, exposure to illness is estimated to result in a 25 percent reduction in food expenditures (Groover, 2011). This clearly highlights the fact that reduction in expenditure is a strategy forced on the households in desperation for survival.

Similarly pest attack has direct negative consequences to farmers and indirect ones to the community, region and country. This is due to the fact that when pests strike, crops are decimated which results in less food output hence skyrocketing prices. This has detrimental effects upon the entire economy since developing economies rely mainly on agriculture particularly for employment and livelihoods. In a study by Groover (2011), it was found that damage from pests and disease may impact a smaller percentage of total production when more land is cultivated; reducing the significance of the shock and the likelihood it is reported. However, in places such as Uganda where the majority of subsistence farmers have small pieces of land, pest attack may have grave effects on households' livelihoods.

Livestock epidemics pose serious effects to farmers. These attack large herds of animals which die off leaving their owners stranded with nothing to sustain them. According to Asseldonk et al

(2003) livestock epidemics, such as classical swine fever (CSF) and foot and mouth disease (FMD), can result in substantial losses for governments, farmers and all the other participants in the livestock production chain. On the other hand, immediately at the occurrence of such a disaster; government authorities prescribe quarantine measures to be adopted barring the movement and trade in livestock, both of these negatively affect those who rely on livestock through reduction in their incomes and depletion of their animal wealth.

2.4 Social demographic factors of households and the impact of shocks

The impact of shocks on household's ability to cope has been shown to differ according to household demographic characteristic such as family size, sex, education, occupation, age, marital status, economic status, residence and region among others. Results from a study by Deressa et al (2010), using a multinomial logit model showed that different socio economic and environmental factors affected adaptation with shock events. Included was gender of household head being male, age of the head of household which approximates experience, farm income, farm size, livestock ownership, extension on crop and livestock production, farmer-to-farmer extension, local agro ecology, temperature and precipitation.

Jayaraman (2006), using a multinomial logit model found that household size, dependency ratio, number of working members, land ownership, location, social assistance and education characterise the chronically poor. Ownership of physical and human capital makes households less likely to be chronically poor. However, larger households with more dependents pushed families towards chronic poverty. The amount borrowed by the household head had effects on food expenditure, adult goods and education expenditure, nutritional intake of children in the household. While it was also found that women's use of credit had a positive impact on expenditure on children's goods, durable goods, education and housing, hence resources in the hands of women have implications for improvement in child outcomes, especially educational outcomes.

Similarly Nti (2012), using a binary logit model in a study in Ghana found that households with large family size are more likely to adopt and use more labor-intensive adaptive or coping measures because they have a large labour pool. Results from the BLR model indicate that

literacy level, membership with a Farmer Based Organisation – FBO, household income, and location of households had positive and significant impacts on adaptation to drought. Again, source of seeds for planting, membership with a Farmer Based Organisation (FBO), household income, and farm size had positive significant influence on adaptation to flood. The main effect of these climatic extreme events on households included destruction of crops, livestock and buildings, food and water shortage, poor yield or harvest and limited fields for livestock grazing.

Velasquez & Bahadur (2007) found that larger households were more likely to adopt by using savings and help from Non-Governmental Organisations in comparison to work more during crises while Dang, Thi Thu Hoai (2011) found that an increase in the number of working members in a large family brings in more income and reduce the chances of households being chronically poor in the event of shocks. This, however, contrasts with the findings of Dedah and Mishra (2009) whose works found no evidence that number of kids and family size are important factors that determine the wealth accumulation of individual household.

Rural households face multiple sources of shocks, which are exacerbated by climate change. But household members do not all experience these shocks in the same way (Meinzen-Dick et al, 2011). In their analysis which drew upon the household asset surveys carried out by the Gender Asset Gap project in 2010 in Ecuador, Ghana and the state of Karnataka in India, Deere et al, (2014) found that women tend to be more vulnerable to a permanent erosion of their asset base when shocks occur.

According to Oduro (2010), in Ghana there is wide disparity in reported shocks between rural and urban households. Rural households tended to report shocks due to loss of assets, i.e. death and theft of livestock. Loss of harvests through pest infestation, poor rains, disease and theft were the next most important adverse shocks reported by these households. Amongst urban households changes in prices of output, inputs, food and utilities were the most frequently reported shocks.

Comparing men to women, shocks tend to affect them differently. In a household setting, women and men do not always have access to the same pool of resources and may therefore employ

different coping strategies even when experiencing the same shock (Doss et al, 2014). For instance men have many options regarding alternative employment which women may not be able to do. In a study in India, apart from agricultural labour, non-agricultural labour such as pulling rickshaws or rickshaw vans is one of the most important primary rural income strategies, involving nearly forty percent of all adults (WFP, 2006). On the other hand Velasquez & Bahadur (2007) found that male-headed households were more likely to use savings and get help from NGOs.

Nyarko and Gyimah-Brempong (2011) found that for benchmark interest rates, the returns to primary and secondary education are positive for social protection. This suggests that for the long run, education may be a more important means of social protection than cash transfers. As the impressive social and economic performance of East Asian tigers seems to show, strong education and health systems are vital to economic growth and prosperity (Bloom, 2007).

According to Deressa et al (2009), the age variable could represent the farming experience of the household head and using a multinomial model they found a positive significant effect of age on climate change adaptation model. Like most other variables, empirical literature on the influence of age has been varied.

2.5 Prevalent shocks and their consequences

2.5.1 Drought

Drought is a climate caused shock that affects large numbers of people. Arya (2007) and Dube and Phiri (2013) explain that adverse effects from drought are more manifested on agriculture which happens to be the mainstay of most rural households. Drought leads to food scarcity due to failure of rain fed agriculture. Famine is a predictable consequence of drought. The presence of famine increases rates of low energy intake, malnutrition, and stunted growth, low immunity to disease, body weakness and death. Drought retards development as peoples preoccupation becomes survival and not progress. Often drought leads to asset and savings depletion by households thus emerging out of the situation poorer. It also leads to drop in farm incomes (Alston & Kent, 2004).

2.5.2 Floods/hailstorms

According to Zulqarnain (2013), floods directly destroy sources of household livelihoods. Floods usually cover wide areas that often include agricultural land. Crops are usually submerged and top soil is carried away. Therefore agricultural output is affected and may result into famine and food shortages for the population. Flooding also hampers harvesting of crops often destroying mature crops in the gardens. Floods destroy public health facilities such as water sources and sanitation facilities (Republic of Uganda, 2010). Floods also trigger outbreaks of water borne diseases and malaria, hence compounding community vulnerability to health hazards. It also destroys infrastructure particularly roads which renders transportation of output and people hard. This automatically affects food supply causing shortages.

On the other hand flooding may cause landslides which often have devastating consequences. In Uganda landslides have been responsible for many deaths and asset destruction particularly in areas surrounding mountains. Flooding has also been known to spread diseases such as cholera among the affected population. This is because in flood conditions, there is potential for increased faecal-oral transmission of disease, especially in areas where the population does not have access to clean water and sanitation (Ahern, 2005).

2.5.3 Pests

Obidike (2011) in a study explained that pest attacks have a direct impact on agricultural output. Pests usually feed on crops and in that way destroy them. Pest attacks usually occur in large areas or regions. Given the fact that many developing countries such as Uganda are agricultural based, pest attack is a serious shock that affects households. Pests usually result into reduced harvests thus reducing available food. This may lead to famine, reduced food intake, malnutrition and disease. Common pests in Uganda include weevils, locusts and caterpillar while diseases include coffee wilt, banana wilt and cassava mosaic (Republic of Uganda, 2010). Economically, pest attack may reduce household incomes through the destruction of cash crops such as coffee, cotton, tea and others. The crops that survive pests usually turn out to be of lower quality. Under the threat of pest attack, many households spray chemicals which affect the quality of output

moreover such chemicals have been linked to prevalence of cancer and other human health hazards.

2.5.4 Livestock epidemics

In general livestock keepers face many shocks that include drought, flooding, famine, livestock epidemics and others. According to Asseldonk et al (2003) livestock epidemics, such as classical swine fever (CSF) and foot and mouth disease (FMD), can result in substantial losses for governments, farmers and all the other participants in the livestock production chain involved. On the other hand, immediately at the occurrence of such a disaster; government authorities prescribe quarantine measures to be adopted barring the movement and trade in livestock, both of these negatively affect those who rely on livestock through reduction in their incomes and depletion of their animal wealth.

Livestock epidemics often attack domesticated animals such as cattle, goats, sheep, pigs and others. Livestock epidemics include; swine fever, foot and mouth, nagana, bird flu and others. In face of livestock epidemics, various measures are instituted in order to contain the status quo; however the measures undertaken may have adverse effects to households. Such measures often include; restrictions of livestock movements within gazetted areas which take more than 3 months to be lifted. Investing in livestock is one way of fighting poverty however, this poverty fighting strategy is hampered by livestock epidemics (Perry & Grace, 2009).

Given the fact that livestock is a form of wealth in which households invest their savings, in case of epidemics which kill off livestock, the household is left in a poorer state. There are more costs related with livestock epidemics such as animal death, illness leading to condemnation, poor weight gain, poor milk yield, poor feed conversion, poor reproductive capacity and poor work capacity for ploughing or transport. Others include; loss of farm productivity, treatment costs and others (Perry, 2002).

Livestock epidemics involve disease outbreaks and the subsequent counter actions of quarantine, strategies of using; own assets, household savings, widening employment and borrowing are rarely effective to tackle livestock epidemics. Livestock keepers own assets are in form of

livestock itself which is made useless in face of epidemics yet use of other assets is also minimized given that selling off such assets fetches less as buyers often are affected in a similar way. While use of savings is curtailed by the fact that many of the livestock keepers are illiterate and rarely have savings accounts that would allow them save for such eventual disasters. On the other hand widening of employment is an option tried but remains ineffective due to lack of skills away from livestock keeping and rigidity in trying other trades. While borrowing during such epidemics may be viable but unsustainable since the effect of livestock epidemics lasts for medium to long term periods, there are limited sources for one to borrow from or the amounts involved are as well limited.

2.5.5 Poor seed quality

Poor seed quality affects yields of crops and this affects farmers' income and their livelihoods. Moreover poor yields have repercussions to the general population since food scarcity leads to high food prices. Hence household livelihoods are affected as a result of low harvests whereas the higher prices of food reduce household welfare through increased cost of living. All these raise household susceptibility (Felista & Farah).

2.5.6 Other shocks

Idiosyncratic shocks such as fire accident, civil strife, robbery/theft, death of head of the household, death of other family members, injury from accidents and others have a lot of negative consequences. They cause pain and loss to household and perpetuate poverty to the affected households. For example, death of the household head has been found to negatively affect household welfare through reduction in disposable income (Pitayanon, Kongsin & Janjareon, 1997). Injury from accident reduces on available resources by channeling savings to treat the injured (Bales, 2013). Similarly civil strife has uprooted entire communities where progress is virtually curtailed.

2.6 Coping mechanisms to the impact of shocks

Holzmann et al. (2003) explained that social risk management should comprise of prevention strategies; these are strategies put forward before the risk or shock occurs. This reduces the probability that a risk occurs; strategies may involve sound macroeconomic management,

environmental management policies, investment in education, health and others. Social protection avoids risks in the labour market such as risk of unemployment, underemployment, or low wages. Secondly a social management system looks at the mitigation strategies. As with prevention, these are strategies intended to mitigate risks before they occur. Risk mitigation strategies on the other hand reduce the impact of future risks through pooling of resources on assets, diversification, for example, planting two types of crops that mature at different times and may include formal and informal insurance mechanisms. Thirdly are the coping strategies. These are strategies designed to relieve the impact of risks once they have occurred, such as dissaving, borrowing, public and private transfers.

Coping strategies involve systems designed to reduce or relieve the impact of risk. Usually these consist of dissaving, borrowing, migration, selling labour including child labour, change in household composition, reduction of food intake and private transfers (Velasquez & Bahadur, 2007). Various have adopted a number of coping strategies. For example in Bolivia, coping mechanisms for vulnerable groups include; working more or increase in working days in order to earn extra income through increased labour market participation, use of savings and paying with goods, selling of assets or animals and getting help from NGOs. Velasquez & Bahadur (2007) explained that households with more livestock (cattle, llamas, alpacas, sheep, and goats) were found to be less likely to sell their assets or dissave. The accumulation of livestock which may be in form assets for vulnerable households,' acts as a shield in times when various income related risks strike and for those with more livestock they were able to cope with minimal distortions to their livelihoods than those with small herds of livestock. This is worsened by lack of social protection systems and social risk management (Velasquez & Bahadur, 2007).

According to Modena (2007) the ability to deal with effects from shocks depends on the type of the shock (whether covariant or idiosyncratic) as well as some household characteristics. Households living in difficult environments have devised mechanisms that are informal in nature as well as formal ones. Assets create income and smoothen consumption, however the selling of assets to smoothen income today creates repercussions on asset ownership and consumption tomorrow below a given asset level, households reduce consumption by reducing asset sale in

order to maintain their asset stock (asset smoothing) whereas above a certain level assets are sold to ensure consumption (consumption smoothing).

According to Holzmann et al (2003) in a paper titled: *Social Risk Management,* in order to deal with risk the intention should be more away from use of unproductive ex-post coping mechanisms such as getting children out of school, delaying health care or selling off livestock in face of shocks such as drought, cyclones, floods and conflicts. Hence there is a need to replace such strategies by ex-ante planning mechanisms such as public works; weather based insurance, water management, grain storage, micro savings and others.

The above argument is justified since following a large covariate shock traditional coping mechanisms tend to easily breakdown. The tremendous changes brought about by globalisation present opportunities as well as challenges. Based on comparative advantage, globalisation presents advantages; however there is no guarantee that the fortunes and wealth acquired is going to have wider coverage and be shared widely by individuals, ethnic groups or countries, given the resulting income variability (Holzmann et al, 2003). Some groups may find themselves so marginalised hence vulnerable to shocks and this is mainly due to the fact that in developing countries the modern sector which is the main beneficiary from globalisation is small but the majority is involved in the large traditional subsistence sector which is less monetised.

Amare and Waibel (2013), using a logit fixed effects model found that households who are structurally poor hold their wealth in the form of buffer assets and they rather engage in reducing consumption, while structurally the non-poor sell assets and smooth consumption. More than 60 percent of structurally poor and structurally downward mobile households reported that shocks had a severe negative impact on their welfare. The results showed negative shocks can have permanent effects on vulnerable households. households applied a range of different coping strategies, such as, forest extraction, diversifying their agricultural portfolio, drawing assets, lending credit from informal sources, relying on public transfers and reducing consumption, of which reduction of consumption, credit and forest extraction are the most common.

Similarly (ibid), taking loans from informal lenders in response to shocks did not improve asset accumulation, suggesting that the credit volume may not be large enough to prevent households from selling their assets. Reducing the number of meals and drawing down assets was negatively correlated with asset growth, although the coefficient was statistically insignificant. The probability of drawing down their assets increased with income shocks for both structurally poor and non-poor households. These shocks force households to deplete their assets in order to smooth consumption and overcome the negative effects of the shocks. In 2005, the same households suffered another shock which made them more vulnerable since it increased their odds of remaining asset poor (Rosemberg et al, 2010).

According to Tesliuc and Lindert (2004), in years with only a moderate number and magnitude of shocks, most households are able to smooth their consumption, using a wide range of risk management instruments and arrangements. The poor do so mainly through self-help and informal means (more labour, or borrowing and receiving help from friends, neighbours or relatives), while the non-poor through self-help and market-based mechanisms (drawing down savings, borrowing from banks or cashing insurance premium).

Alamnew and Officer (2014) found that about 3 percent of the households get their food by borrowing and/or gifts from relatives and friends and another 2 percent from their own agricultural production. Assistance and other sources make very little contribution. Over one-third of rural households access their food through credit, compared to 20 percent for urban families. A significant proportion of severely food insecure households depend on borrowing, while a similar proportion of food secure households use their own agricultural production as a source of food. Households borrow from friends and relatives in cash or in kind, and purchases are made on credit. Some informal lending involves significantly higher interest rates compared to borrowing from the formal sector. The high interest costs of the private money lender are partly due to the costs of monitoring (Oduro, 2010).

An off farm participation decision and activity choice showed that both variability and reduced availability of rainfall as well as neutral risk preferences increase the likelihood of off-farm participation. From policy perspective, the results imply that expanding off farm opportunities

could act as safety nets in the face of weather uncertainty. (Mintewab et al, 2010). During acute weather variability, off farm activities could become attractive adaptation options to agricultural activities.

From the above arguments we find that assets can play a big role in helping households and individuals cope with susceptibility and avoid impoverishment. However, there may be limits to using assets as a coping strategy if the shock itself involves the loss of assets, such as through a fire or livestock loss due to theft or disease. Asset ownership has been known to be low particularly among the rural subsistence population due to chronic poverty. Moreover some shocks deplete assets hence reducing the capacity to protect consumption and income using asset-based strategies when shocks occur (Doss et al, 2014).

Sometimes households seek for help or support from government and NGOs in form of financial and other forms. This assistance includes cash loans, foods, seeds and fertilisers. Leke Olaleye (2010) in his study found out many farming households relied on help from external sources in order to cope with drought. Such help may include dispersing family members to live with relatives within and outside their household villages. Other help as claimed by the farmers were in form of food and groceries from friends and families, others considered the monthly child grant and old age pension as a form of help from the government in assisting them to cope with drought effects (Leke Olaleye, 2010).

2.7 Coping strategies and their consequences

2.7.1 Savings

Use of household savings is one of the main ways of coping in times of need mainly because they are easily accessible and available to the household (Tongruksawattana, 2010). Households that use their savings avoid costs related to borrowing from sources such as money lenders.

However use of savings has a counter effect on households' future consumption levels. Moreover savings meant for investment and accumulation of wealth when used during disasters does lead to increased household susceptibility and poverty. This is because use of household

savings reduces the available resources for investment; hence a household's future wealth is negatively affected.

However due to low savings in poor countries such as Uganda, available resources for a household may not be sufficient to cope with covariant shocks which tend to be more persistent.

2.7.2 Assets

Household assets are also used as coping mechanism during shocks. Asset accumulation is usually the result of investment of household savings. These assets include radio systems, television sets, houses, cars and others as well as livestock.

The consequences of using assets during shocks include; household wealth depletion which invariably increases poverty for some households. Moreover selling off household assets during covariant shocks may lead to lower prices since covariant shocks tend to affect everyone from a particular region. Households particularly in rural areas tend to have similar assets hence selling them at the same time affects their price.

2.7.3 Reduced family expenditure

In times of great need some households desperately reduce their expenditure by cutting down on food budget, remove children from school, send some family members to relatives, and others. Reduction of household expenditure in terms of purchasing less food may for the household lead to inferior foods hence causing malnutrition and hunger. Yet by reducing consumption, households undercut critical investments in human capital, inhibiting both current and future productivity (Janzen & Carter, 2013).Whereas when children are removed from school the household's future income generating capacity is affected.

In an effort to cope, households may choose to cut back on meals. Yet by reducing consumption, households undercut critical investments in human capital, inhibiting both current and future productivity (Janzen & Carter, 2013). The associated adverse results from under nutrition are widespread among adults but have far reaching consequences to children whose physical, biological and emotional growth are directly affected.

2.7.4 Seek help

Seeking for help involves obtaining such help from local and/or central government and from other sources. However, one major problem is that such help may be insufficient to the household since during covariant shocks there are many households in need hence the demand for such help is higher.

2.7.5 Borrowing

Borrowing is one of the key strategies that households embark on in face of shocks. However, those who opt to borrow usually tend to be in a desperate situation that is exploited by unscrupulous lenders. This may take the form of high interest rates charged, high value collateral and other stringent conditions. These may in turn lead to losses on the side of the borrower and hence reduction in savings which affects a households future welfare. There are instances when land titles have been taken by money lenders hence further impoverishing the poor borrower.

In a study taken in 15 African countries by Leive and Xu (2008), it was found that household coping through borrowing and selling assets ranged from 23 percent of households in Zambia to 68 percent in Burkina Faso. In general, the highest income groups were less likely to borrow or sell assets, but coping mechanisms did not differ strongly among lower income quintiles. Households with higher inpatient expenses were significantly more likely to borrow and deplete assets compared to those financing outpatient care or routine medical expenses.

2.7.6 Employment widening

Employment widening is a long term strategy that may be difficult to resort to given the nature of flooding. Floods tend to occur suddenly, the ability of households especially from rural areas to widen their employment options is curtailed given the nature of floods hence the inability of such a strategy to effectively be relied on in managing flood shocks. This contrasts sharply with what Dang, Thi Thu Hoai (2011) findings that employment is one channel for households to cope with shocks. On the other hand borrowing amidst flooding may help but is a difficult option because everybody is seeking the same help at the same time.

2.7.7 Other strategies

Other coping strategies such as migration, change of crop choices to avoid bad weather or pest attack and improve technology have consequences to affected households that adopt them. For example migration as a strategy may increase available resources to the household but on the other hand it may also uproot members of the household away from their families, or the entire family may be forced to leave its community and transfer to new places. Coping with relatively idiosyncratic shocks is met by reductions in savings, asset sales and especially a far greater reliance on borrowing as compared to other shocks (Debebe et al, 2013). Those who migrate (in case of rural urban migration) reduce on the available labour in rural areas (Lawal & Okeowo, 2014). Change of crop choices to avoid bad weather or pest attack and improvement in technology may affect positively households coping to shocks (Pradhan & Mukherjee, 2016).

2.8 Shocks and their impact in Uganda

There have been few comprehensive studies on Uganda dedicated towards understanding the impact of disasters, their effects as well as adaptation strategies. Some of the studies have included; Matovu and Buyinza (2010), Hisali et al (2011) and Aliga (2013). However, there are notable differences between this study and those three studies. Matovu and Buyinza (2010) studied the direct impacts of climate change on household welfare, while Aliga (2013) studied health shocks. This study builds on Hisali et al (2011), and the main difference is in scope, while this study has seven coping strategies, Hisali et al (2011) has five (borrowing, modifying the labor supply, decreasing consumption, selling of assets or usage of savings and changing technology or crops) with differences in the strategies used. The other difference is that this study contributed further than previous studies by including in its analysis the impact of shocks on the first, second and third choice coping strategies in Uganda.

Uganda is prone to disasters and they cause major problems such as, displacing and killing many people and animals, as well destroying valuable property. According to the disaster preparedness and management policy, covariant disasters in Uganda include; drought, famine / food insecurity, floods, landslides and mudslides, epidemics, humans epidemics, crop and animal diseases, pandemics, heavy storms, pest infestation, earthquakes, transport related accidents,

fires, internal armed conflict and internal displacement of persons, mines and unexploded ordinances, land conflicts, terrorism, industrial and technological hazards, cattle rustling, retrogressive cultural practices, environmental degradation (Republic of Uganda, 2010).

Some of the evidence about the impact of shocks by the Republic of Uganda (2010) shows that each year since 2000 on average 200,000, Ugandans were affected by disasters. In actual terms though the picture is more alarming, for instance; drought alone affected 600,000 in 1986. In 1989 epidemic disasters killed 156 people. In 1990, diseases killed 100. In 1994, earthquakes affected 50,000. In 1997, floods affected 153,500 and killed 1,000 while in the same year epidemics affected 100,000 and landslides killed 48.

In 1998, drought affected 126,000 and in 1999 it affected 700,000 and killed 5 people. In 2000, epidemics killed 224. In 2002, drought affected 655,000, killing 79. In 2005, drought affected 600,000 while in 2006, epidemic diseases killed 67 people and landslides killed 5 people. In 2008, drought affected 750,000. In 2010, landslides affected 8,500 and killed 250 and floods affected over 350,000.

In order for the government to manage disasters, it drafted the Disaster Preparedness and Management Policy 2010/2011. Every government ministry was supposed to have a disaster management desk officer whose responsibility is to lobby for the integration of disaster issues into sector plans ensuring budgetary allocation and implementation of sector-specific disaster management activities. According government reports, efforts have been carried out to integrate disaster risk reduction into development processes at all levels. The task to manage disasters is not limited to the department of disaster management but is spread through all government ministries and institutions right from the top of government down to village level (Republic of Uganda, 2010).

In addition, the government of Uganda has implemented a number of special programmes, such as the PRDP, Luwero-Rwenzori Development Plan (LRDP), Karamoja Livelihood Programme (KALIP) and the Northern Uganda Social Action Fund Phase II - (NUSAF II) in areas formerly haunted by conflict (Republic of Uganda, 2011). To effectively prepare and respond to disasters,

15 out of the targeted 10 risk, hazard and vulnerability assessments were conducted in 2011/2012. Forty disaster preparedness/contingency plans for Local Governments (LGs) were prepared to help cater for disaster outbreaks. The reason for performance was that all LGs are requirement to have disaster management plans (GAPR, 2012).

The government has also been responding to disasters for example in 2010/2011 a supplementary budget of UGX5 billion was released to provide relief to Bududa landslide victims and in this regard data from OPM shows that 586 households from Bududa were resettled in Kiryadongo, 15,480 bags of 100kgs of maize meal and 5,035 bags of 100kgs of beans and other relief food items were distributed in nine districts. Ministerial Verification/Assessment Missions on reported flooding and landslide occurrences were also carried out in six districts (GAPR, 2011). Moreover, the government has also been working with NGOs such as UNOCHA, UNICEF and Oxfam at both national and district levels in several initiatives to develop contingency plans against prioritised hazards.

However, in spite of financial support, there are serious challenges that make the country incapable of effectively dealing with disasters. For instance, there has been lack of resources necessary to equip the relevant institutions rendering many projects failing to materialise despite being envisioned within the policy. The lack of resources is a key handicap for the country. Under the SAGE programme for the elderly, the monthly UGX23,000 (approximately US$8), given to them is clearly far below the poverty line of an estimated expenditure of $1 a day according to the UNDP measure. Moreover the project has been operating only in 14 districts of the more than 112 in the country. (Expanding Social Protection Programme (ESP) website accessed on 06/25/2015).

An effective disaster management system envisioned within the policy has not materialised for the country. The acuteness of disasters can be realised when one looks at just one landslide when it struck, it is estimated by IPSTCN (2014) to have cost the government and other stakeholders more than US$20 million, equivalent to UGX 10 billion, that is money that would not have been used had there been an effective disaster management system in place. Yet by the end of the planned three months (March - May 2010) the government had failed to resettle the displaced

people forcing the continuation of the operation beyond the planned period (URCS, 2010). Even the established disaster risk management desks at each ministry are reported to have debatable functionality and effectiveness. This is because technical staff in a given sector ministry can be appointed as a disaster desk officer, sometimes without prior knowledge or skills in disaster management, and they are expected to perform the role in addition to existing responsibilities and sometimes. As a result often attention is paid to assigned duties rather than disaster related activities (DRT, 2010).

Adding to the above the use of off budget interventions poses a challenge of sustainability given that achievement is based on them, whereas the National DRR Platform is mainly dominated by the UN and INGOs with less representation from key line ministries. The lower structures for disaster management are not actively functioning in most districts, while the DDMTCs are operational in only a few districts. The structures remain non-functional in most districts due to technical capacity and resource gaps.

2.9 Social protection in Uganda

According to Tesliuc and Lindert (2004) citing The World Bank's Social Protection Sector Strategy (2000) explained social protection as the mix of public interventions that assists individuals, households, and communities to manage risk better and that provides support to the critically poor. In this strategy document, social protection is regarded as a springboard as well as a safety net for poor people, and social protection interventions are seen as investments rather than costs. The strategy focuses less on symptoms and more on the causes of poverty and takes into account the complementarities and synergies that exist between the risk management instruments provided by the informal, private, and state sector.

Given the fact the climatic risks are increasing with no hope to subside soon, there arises the case for social protection as part of social risk management. According Mendoza (2009) aggregate shocks are going to be an increasingly common feature of the global economic landscape and these shocks could result in poverty traps, generating effects that harm not just present, but also succeeding generations. Social budgeting and social protection will be critical in order to shield poor households and vulnerable children from the worst effects of these shocks.

Loprest and Maag (2003) explained that in poor rural households in developing countries pension earners are the only recipients of regular income. This does help improve on their status. Despite the substantial efforts put into risk coping strategies, such as self-insurance through savings and informal insurance schemes, vulnerability to poverty related to risk remains high in developing countries; they found that informal insurance schemes, vulnerability to poverty related to risk remains high in developing countries. They find that informal risk coping mechanisms provides only limited protection. Hence public policy is appropriate for covariant shocks **(**Quisumbing & Mcnwenand, 2008).

According to Devereux and Sabates-Wheeler (2004), social assistance, which refers to non-contributory transfers to the vulnerable groups based on need or poverty include; cash transfers, school feeding programs and public works. Basic social services such as services provided by the state to citizens as a right include services such as education, health and water social insurance. These instruments enable people to pool resources together so as to provide support amidst shocks, they are contributory pension schemes, informal group schemes such as funeral insurance and others, however, Uganda's ability to provide effective social protection is severely curtailed by budget constraints due to narrow tax base plus the small ratio of tax payers to non-tax payers.

2.10 Social safety nets

Various kinds of social safety nets include cash, in kind transfers, price subsidies, social services fees waivers such as removal of out of pocket on accessing public health services removal of tuition fees in Uganda, such Universal Primary Education - UPE - use, special feeding programmes, public works, microfinance, social insurance programs, like pensions and unemployment programs.

According to Ssengooba (2006), the abolition of user fees has had positive effects on health seeking behaviours in Uganda. Ill health keeps people poor, it is a determinant of poverty and access to healthcare is hence one way of mitigating the problem. So in 1990s the Government of Uganda exempted the poor from paying user fees from public health service providers and in

2001 it abolished them altogether. This helped reduce on the costs they face given the enormous burden of malaria and other diseases in low-income areas (Matovu et al, 2009). Extra strategies such as provision of free bed nets integrated with other free services such as immunisation can further reduce on overall costs. However, although these have been carried out some of them have been marred with corruption particularly in government health centers where many times drugs and other medical utilities go missing.

Social assistance in terms of cash transfers helps reduce people's vulnerability to poverty and enable them to manage or cope better with their risks. Social pensions for the elderly help reduce peoples vulnerability to poverty and enable them manage or cope better with their risks, similarly social pensions for the elderly help to contribute to the income security of their children and relatives in times of need.

On the other hand, Tesliuc and Lindert (2004) suggests that pro-poor disaster management and relief initiatives will be more effective in cushioning the welfare losses of the poor than social insurance schemes (such as pensions or, if instituted, unemployment benefit schemes). In terms of risk management strategies, policymakers should focus on more on measures to reduce or mitigate risks than on measures for coping.

In Uganda, the government partnered with development agencies to establish the Social Assistance Grants for Empowerment (SAGE) to provide pension. Developing partners are piloting SAGE in conjunction with government which has been rolled out as a cash transfer support of 23000 Ugandan shillings monthly known as the Senior Citizens Grant (SCG). Under SAGE, SCG in the financial year 2011/12 government committed UGX125 million towards SAGE but released only UGX32.5 million. This was complemented by UGX4.75 billion from development partners for SAGE programme. The elderly population estimated at around 1.3 million of which 7.1 percent have access to pension , 60 percent being males (UNHS 2009/10), meaning that 92.9 percent are not covered hence they require measures to enable them cope. Negative shocks present huge challenges to the country. Hence, coping with such shocks should be approached in a comprehensive way using available resources.

CHAPTER THREE

METHODOLOGY

This chapter presents the methodological setting that guided the model formulation for the analysis of covariant shocks and their marginal effects on coping strategies. It includes the econometric model choice, model justification, model derivation and specification, empirical specification of model variables, variables used, diagnostic tests, data source and the estimation procedure.

3.1 Econometric model choice

This study used a multinomial logistic model which belongs to a class of discrete choice models. The origins of discrete choice models are rooted in the early studies of psychophysics (the physical study of the relations between physical stimuli and sensory response) in 1860. These models were later applied in biology with the expression models by discrete responses. Today they frequently occur in fields such as; econometrics, economics as well as in other social sciences (Rodriguez, 2007).

A strong linkage between qualitative choice models and the theory of utility has been acknowledged by many researchers. Suppose that an individual has to choose among K mutually exclusive alternatives of a product or of a service. The neoclassical economists' approach to this problem is that every individual has a utility function, which allows him to rank the alternatives in a consistent and unambiguous manner. The individual then chooses the alternative that is ranked first. Therefore, from the economists' point of view, the choice problem is a problem of maximization of a utility function while the choice process is deterministic since each unit just selects the alternative that maximizes its utility. These models were introduced, initially, by Thurstone (1927) and later by McFadden and Reid (1975) which were named Random Utility Models (RUM) (Rodriguez, 2007 and McFadden, 2001).

In 1959, modern discrete choice modeling was first implied by the ground breaking work of Luce (1959) through his description of the random choice theory. He pointed out that the odds of choosing alternative j over alternative k should be independent of the choice set for all pairs j; k .

In 1960 Block and Marschak indicated that the Luce attributes were random utility maximizers. In the same line McFadden (1975) constructed a random utility function for the Luce model using a Gumbel distribution. This work allowed practical estimation of Luce values as a function of (observable) background parameters. Falmagne (1978) characterized the defined set of all random utility maximizers.

3.2 Model justification

Since the dependent variable assumes many options, a multinomial (mlogit) model was preferred to either a simple logit or OLS. Non continuous values were assumed by the dependent variable making the use of OLS inappropriate whereas the fact that both the dependent and independent variables assumed many alternatives made a simple logit unsuitable. The large sample size permitted adequately the use of maximum likelihood (ML) estimation method.

According to Greene (2003), multinomial models may be grouped into two categories i.e. ordered or unordered structure. In case the choice of the dependent variable does not follow any particular order then one is at liberty to use either the generalized or conditional logistic model. Owing to the nature of the data, in order to determine the impact of shocks on the choice of coping strategies this study used the unordered multinomial logistic model since the adaptation strategies in face of shocks followed no particular order.

Usually the main problem with using the MNL is that it suffers from independence of irrelevant alternatives assumption. In such a situation Nested logit models (NLM**)** is recommended by grouping similar alternatives in a single nest or ordered logit models (OLM).

3.3 Model derivation and specification

There are three commonly used approaches and they consist of; the random utility approach, the latent variable approach and the non-linear or pure probability approach which leads to the logit model (Nti, 2012). The theoretical foundation of these models is the random utility framework. Following Adesina and Chianu (2002) and Hisali *et al* (2011), let us assume that a household's adoption decision in face of shocks is based on an underlying utility function. Since the

household has a choice to either adopt or not, let the household's choice be represented by *j*, where *j*=1 if the household chooses to cope, and *j*=0, otherwise.

In making a decision on whether to cope or not to cope the household's objective is assumed to be maximization of expected utility, and therefore the household's preference can be modelled through a total utility function. Utility levels cannot easily be estimated or measured owing to complexity of human behavior, but the probability of making a specific choice among alternative options is quantifiable. Therefore, the decision to adopt or use a particular strategy or not should include a probabilistic dimension. The underlying utility function for household *i*, faced with two choices *j* (cope or not to cope) can be represented as equation (1);

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad \text{..... (1)}$$

Where, *j*=0, 1; *i*=1, 2 …, *n*.

This utility function is the standard random utility model where U_{ij} is the utility function of alternative choice j for household i. V_{ij} is the observable, systematic or deterministic part of utility. This can further be divided into part of utility associated with the household ($V(C_i)$), alternative ($V(X_j)$) and associated with both ($V(C_i X_j)$). This means that V_{ij} can be written as equation (2) below;

$$V_{ij} = V(C_i) + V(X_j) + V(C_i X_j) = \beta_j x_i \quad \text{..... (2)}$$

Where,

x_i is represents explanatory variables which are the shocks and household characteristics in this study. While ε_{ij} is the unobservable or stochastic part of utility which is assumed to be *iid* as a gumbel. β_j is a vector of unknown parameters (Davis, 2002). Given this, households' choice of coping mechanisms in face of shocks can be presented as:

$$C_{ij} = \beta_i x_{ij} + \varepsilon_{ij} \quad \text{.....(3)}$$

Where the i^{th} household has j coping mechanisms (i=1..., n ; j=1..., k)

C_{ij} is the chosen coping mechanism, with seven coping choices as listed below; used assets, used their savings, reduced family expenditure, widened employment, sought help, borrowed and others.

In equation 3, β_i is a vector of parameters reflecting changes in x_{ij} on C_{ij} x_{ij} are independent variables consisting of covariate shock types and household characteristics listed as; drought, floods/hailstorm, pest attack, bad seed quality, livestock epidemics and others. Household characteristics included the following; location, region, gender, age, household size, economic status and education.

ε_{ij} is the error term which takes on a Gumbel distribution which is independently and identically distributed across alternatives and observations. The choice of coping mechanism is assumed to depend on the shock type experienced by the household and thus its reaction depends on this. The probability of the i^{th} household choosing alternative J is expressed by equation (4) below;

$$P_{ij} = \frac{\exp\left(\beta_j x_i\right)}{\sum_{j=1}^{J}\exp\left(\beta_j x_i\right)} \quad \ldots\ldots(4)$$

Where j=1, 2…J

Equation (4) above ensures that $0 < P_{ij} < 1$ and $\sum_{j=1}^{J} P_{ij} = 1$

However, the multinomial logit of equation 4 above is indeterminate and hence unidentified, as it is a system of J equations in only J-1 independent unknowns (Velasquez & Bahadur, 2007). For the multinomial logit model, a sum of j probabilities is 1. Therefore, in order to ensure model identification, β_j is set to zero (β_j=0) for one of the categories and coefficients are then interpreted with respect to that category, called the base category.

In the setting of a standard MNL model, the probability of the j^{th} alternative in the equation may be re-specified as equation (5) below;

$$P_{ij} = \frac{\exp\left(\beta_j x_i\right)}{1+\sum_{j=1}^{J}\exp\left(\beta_j x_i\right)} \quad \text{..... (5)}$$

Where j=1 is the base category and $\beta_1 = 0$ is an identification condition. Given that the sum of probabilities over a range of events is equal to one ($\sum_{j=1}^{J} P_{ij} = 1$), the equation above was transformed into equation (6) as below

$$P_{ij} = \frac{1}{1+\sum_{j=1}^{J}\exp\left(\beta_j x_i\right)} \quad \text{.....(6)}$$

And taking natural logs (through maximum likelihood), the probability produces the odds ratio given as equation (7) below

$$\ln\left(\frac{P_{ij}}{PiJ}\right) = x_i\left(\beta_j - \beta_k\right) = \beta_j x_i \quad \text{.....(7)}$$

The dependent variable in the above equation is the log of one alternative to the reference alternative. Interpretation of coefficients in multinomial logit model should be restricted to the magnitude and direction (sign, size) only since they do not make much economic sense when interpreted directly. It was therefore required that the marginal effects of the explanatory variables on the choice of coping mechanisms be derived as in the case of Green (2000). Differentiating equation (6) with respect to the explanatory variables provides marginal effects of the explanatory variables, which are given as equation (8):

$$\frac{\partial P_j}{\partial X_k} = P_j\left(\beta_{j_k} - \sum_{j-1}^{j-1} P_j \beta_{j_k}\right) \quad \text{.....(8)}$$

The above equation which was estimated provided results in form of marginal probabilities or effects. The marginal effects, or marginal probabilities, are functions of the probability itself.

They were derived to explain the effects of the independent variables on the dependent variable in terms of probabilities. They measure the expected change in probability of a particular choice being made with respect to a unit change in an independent variable (Green 2000). Marginal effects should be understood as differences between probabilities of given variables and the reference category variable.

3.4 Empirical specification of model variables

In practical terms, the Multinomial logit technique has been used widely to analyze; shocks and coping strategies (Jayaraman, 2006), determinants of coping mechanisms (Velasquez & Bahadur, 2007), crop and livestock choices as methods to adapt to the negative impacts of climate change (Deressa et al, 2010), adaptation to climatic change (Hisali *et al,* 2011), response choices to shocks (Nti, 2012). The advantage of the MNL is that it permits the analysis of decisions across more than two categories, allowing the determination of choice probabilities for different categories (Madalla, 1983; Wooldridge, 2002) and it is also computationally simple (Tse, 1987).

The general model in equation (7) is specified below and the study of the impact of shocks on the choice of coping mechanisms in Uganda was adapted from Hisali et al (2011) in their study about adaptation to climate change in Uganda.

P_{ij} =f (drought, floods/hailstorm, pest attack, bad seed quality, livestock epidemics, others, location, region, gender, age, household size, economic status, education level)

Following the above, the specific empirical model estimated was specified as in equation (9) below

$$P(y = cop) = \frac{\exp\left(\beta_j x_i\right)}{\sum_{j=1}^{13} \exp\left(\beta_j x_i\right)} \quad \ldots\ldots(9)$$

Where;

$x_i = x_1, x_2 \ldots x_{13}$

x_1 = drought,

x_2 = floods/hailstorm,

x_3 = pest attack,

x_4 = bad seed quality,

x_5 = livestock epidemics

x_6 = others

x_7 = location,

x_8 = region,

x_9 = gender,

x_{10} = age,

x_{11} = household size,

x_{12} = economic status,

x_{13} = education

y=coping mechanism

Since there are several categories of coping strategies there was need to choose a category to serve as the comparison group (a base category) and in this case the choice is coping strategy C_1 i.e. Used savings (*Sav*) as shown in Equations 10 and 11;

$$P(y = cop) = \frac{\exp\left(\beta_j x_i\right)}{1 + \sum_{j=1}^{13} \exp\left(\beta_j x_i\right)} \quad \text{.....(10)}$$

$$P(y = cop) = \frac{1}{1 + \sum_{j=1}^{13} \exp\left(\beta_j x_i\right)} \quad \text{.....(11)}$$

P_{ij} is the probability that household i chooses alternative j. this j ranges from 1 to J

In order to come out with meaningful results; four models were estimated. The first model was the restricted model which estimated the impact of shocks on choice strategies without inclusion

of household characteristics. The second model estimated was the full model. It measured the impact of shocks on coping strategies with explanatory variables that consisted of six shocks as well as the household characteristics. The third and fourth models reflected household adjustments during coping. The last three models differed from each only in the sample estimated but were otherwise similar in all respects.

There are seven coping strategies or response probabilities for drought, floods/hailstorm, pest attack, bad seed quality and livestock epidemics and they included; use own assets, use savings, borrowing , reduce family expenditure/consumption, seek help, widening employment and others. Household characteristics included were location, region, gender, age, household size, economic status and education level. They were all described in Table 3.1;

Table 3.1: Description of variables

Variable	**Description**	**Measurement**
Dependent variables		
Coping strategies		
Use Own Assets	Refers to number of households faced with shocks that used assets through mortgage and sell of assets such as house, other buildings, furniture, furnishings, household appliances, electronic equipment generators, solar panel/electric inverters, bicycle etc.	The variable assumes code 1 if household used own assets, otherwise 0
Use Savings	Refers to households that used household savings when faced with shocks	The variable assumes code 2 if household used savings, otherwise 0

Table 3.1: Description of variables continued

Variable	**Description**	**Measurement**
Dependent variables		
Coping strategies		
Borrowing	Households in face of shocks resorted to resources borrowed through formal and informal borrowing from sources such as friends and lenders	The variable assumes code 3 if household borrowed, otherwise 0
Reduce Family Expenditure	These are households in response to shocks withdrew their children from school and sent them for wage employment and to live elsewhere	The variable assumes code 4 if household reduced family expenditure, otherwise 0
Seek Help	Households in face of shocks sought help provided by relatives and friends as well as help provided from local governments	The variable assumes code 5 if household sought help, otherwise 0
Widening Employment	These are households in response to shocks engaged in widening employment through more wage employment, work as self-employed and increased agricultural labor supply	The variable assumes code 6 if household widened employment, otherwise 0
Others	Number of households in face of shocks resorted to other strategies that included: migration, change crop choices to avoid bad weather or pest attack, improve technology and any other ways	The variable assumes code 7 if used other strategies, otherwise 0

Table 3.1: Description of variables continued

Variable	**Description**	**Measurement**
Independent variables		
1.Shocks		
Drought	Those who faced prolonged shortage of water caused by dry weather conditions	Assumes code 1 if shock was drought, otherwise 0
Floods/Hailstorm	Households that faced large amounts of water that cover a place and often cause damage	Assumes code 2 if shock was floods/hailstorm, otherwise 0
Pest Attack	Households that faced unwanted and destructive insects or any animals that attack food or livestock both during the growing and post-harvest seasons	Assumes code 3 if shock was paste attack, otherwise 0
Bad Seed Quality	Households that faced this shock had used seeds of poor or bad quality	Assumes code 4 if shock was bad seed quality, otherwise 0
Livestock Epidemics	Households that faced livestock epidemics caused by animal diseases such as; swine fever, foot and mouth, nagana, bird flu etc	Assumes code 5 if shock was livestock epidemics, otherwise 0
Others	Households that faced shocks through fire accident, civil strife, robbery/theft, death of head of the household, death of other family members injury from accidents and others	Assumes code 6 if shock was others, otherwise 0
2.Other variables		
Location	Residential status of the household head. This was a dummy variable.	It assumes a value of 1 for urban residence and 0 for rural residence of the household head

Table 3.1: Description of variables continued

Variable	**Description**	**Measurement**
Independent variables		
2.Other variables		
Region	Region in which the household head resides.	This variable (region) was coded ranging from one to four with 1 for Central region, 2 for Eastern region, 3 for Northern region and 4 for Western region
Gender	Sex or gender of the household head. This is the femininity or masculinity of the household head.	Sex is a dummy variable assuming a value of 1 if the household is headed by a male and 0 if the household is headed by a female
Age	Age of respondent	This was a continuous variable
Household size	Household or family size. Household/ Family size was a discrete variable. It specifies the number of permanent members in a household arranged in groups.	It was directly measured using categories: 1 two persons and below, 2 three to five persons, 3 six to nine persons and 4 ten and more
Economic status	This is basically a measure of the distance of the household from the poverty line.	1= If is categorized as Poor 2=Non-poor
Education	This about whether the household head is received formal education or did not.	It ranged from 1 to 2 with 1 =Did not receive formal education 2 = Received formal education

3.5 Data source

The study used secondary data obtained from the Uganda National Household Survey (UNHS) 2005/6 module on characteristics of vulnerable groups sub topic 11.1 household shocks and subtopic 11.1.3 on coping mechanisms as well as household characteristics. Shocks identified by UBOS were 12 and they included; drought, floods/hailstorm, pest attack, bad seed quality, livestock epidemic, fire accident, civil strife, robbery/theft, death of head of the household, death of other family members injury from accidents and others. The shocks were re-arranged into 6 types since the interest was in covariate shocks. The following shocks were selected and arranged for analysis as in the following order; drought, floods/hailstorm, pest attack, bad seed quality, livestock epidemics and others (fire accident, civil strife, robbery/theft, death of head of the household, death of other family members, injury from accidents and others). The study hence had six shocks which were the independent variables.

The data collected by UBOS had 17 coping mechanisms and they included; mortgage assets, sell assets, use savings, withdraw children from school and sent them for wage employment, send children to live elsewhere, migration, formal borrowing and informal borrowing, reduce consumption and help provided by relatives and friends. They also included help provided from local governments, more wage employment, change crop choices to avoid bad weather or pest attack, improve technology, work as self-employed, increased agricultural labor supply and others.

The 17 coping mechanisms identified by UBOS were regrouped into seven coping strategies; use own assets (mortgage assets and sell assets)s**,** use savings**,** borrowing (formal borrowing and informal borrowing)**,** reduce family expenditure (withdraw of children from school and sent them for wage employment, send children to live elsewhere and reduce consumption)**,** seek help (seek help through help provided by relatives and friends, help provided from local governments) widening employment (more wage employment, work as self-employed and increased agricultural labor supply) and others (migration, change crop choices to avoid bad weather or pest attack, improve technology and any other ways).

Households were required to indicate three choices out of the 17 i.e. the first or priority choice, second choice and then third choice strategy in the event of shocks. In order therefore, to have a good picture of the covariant shocks and their marginal effects on coping strategies, three models were estimated each with a different sample for the three choices.

3.6 Estimation procedure and econometric analysis

The analysis of covariant shocks and their marginal effects on coping strategies was carried out in two steps that is, preliminary descriptive analysis and econometric analysis. Preliminary analysis involved generation of descriptive statistics as well as carrying out diagnostic tests. The descriptive statistics provided a general look at the data before estimation was carried out to check for presence of outliers so as to allow data cleaning before estimation. It thus included generation of the mean, minimum and maximum values of the variables. Furthermore; frequencies, cross-tabulations and chi-square tests were generated in order to obtain the initial picture of the variables used, shocks' reporting, coping strategies' choice and a general feel of the relationship between shocks and coping strategies. Then various diagnostic tests for presence of multicollinearity, heteroscedasticity as well as Hausman test for IIA assumption were performed.

Diagnostic tests helped in ensuring that the data was fine and the model was correctly specified as per the objectives of the study. These tests thus generated a correlation matrix for the detection of multicollinearity. To cater for heteroscedasticity, the command 'robust' was used which provided robust values with homoscedastic variance of the errors. Testing for IIA assumption was done using the Hausman test results. Further analysis was done which first generated multinomial estimation of the impact of shocks on coping strategies, then marginal effects were generated which indicated the true effect between the explanatory variables and the dependent variable.

3.7 Interpretation of the results

The results were interpreted according to the following;

First, the Coefficients of the independent variables obtained before generating marginal effects were interpreted in terms of their signs or direction and size or magnitude. A positive coefficient

sign signified a positive effect on the dependent variable by the independent variable while the negative sign of the coefficient was interpreted as showing a negative effect on the dependent variable by the independent variable.

Secondly, the significance of the parameters after obtaining the marginal effects were established after carrying out hypothesis testing to establish whether the chances of realizing the variable of interest are increasing or decreasing. For instance, a positive coefficient was interpreted in terms of its movement from the base category to the variable of interest whereas a negative coefficient was interpreted in terms of the movement away from the variable of interest towards the base category. A significant positive coefficient, taking all factors constant; in face of a shock (such as drought), meant that there were more chances of households choosing that strategy than using the reference category (by that particular percentage). A negative significant coefficient was interpreted as: taking all other factors constant, in face of a shock (such as drought) there were less chances that a household copes using that strategy than the reference category (by that particular percentage).

Hypothesis testing

$H_0 : \alpha_i = 0$

$H_A : \alpha_i \neq 0$

Significance was established if the computed z- statistic (z_k) is greater than the critical (z_c) value or less at given degrees of freedom and levels of significance (1%, 5% and 10%) and level of confidence (99%, 95% and 90%) respectively.

1. Pseudo or Count R^2 which is the ratio of the number of correct observations to the number of all observations was used to measure goodness of fit of the line
2. The Wald chi2 statistic was used to determine the overall significance of the model

3.8 Diagnostic test analysis

3.8.1 Testing for multicollinearity

Before estimating the data using multinomial logistic model, it was important to examine carefully the independent variables for the existence of multicollinearity. It is a situation where independent variables are strongly correlated to each other which present a risk such that the coefficient randomly changes in response to a small change in the model or data. The existence of multicollinearity minimizes the accuracy of the parameter estimates hence rendering the results less useful. In order to detect its existence a correlation matrix was generated and the coefficients examined.

3.8.2 Heteroscedasticity correction

Using survey data in research often presents problems and one key difficulty is the presence of heteroscedasticity. Heteroscedasticity normally arises in time series data as well as in cross sectional data where the scale of the dependent variable and the explanatory power of the model tend to vary across observations (Green, 2002). Its presence usually affects hypothesis testing which may turn to be incorrect. This makes less useful the results with heteroscedastic data. Heteroscedasticity violates one of the key assumptions of the Classical linear regression. In order to solve this problem White's heteroscedasticity consistent covariance matrix (HCCM),was used. According to Green (2002) Huber-white sandwich estimators are used for the correction of heteroscedasticity.

3.8.3 Test for Consistence of Independence of Irrelevant Alternatives (IIA) assumption

A strictly important feature in modern discrete choice modeling and was first implied by Luce (1959), is the Independence of Irrelevant Alternatives (IIA) property (Karlsson & Laitila, 2014). Luce (1959) derived Equation 4 above starting from a simple requirement that the odds of choosing alternative j over alternative k should be independent of the choice set for all pairs j; k (Rodrıguez, 2007). In simple terms, this assumption requires that the inclusion or exclusion of categories does not affect the relative risks associated with the regressors in the remaining categories. Independence of Irrelevant Alternatives or IIA assumes that the relative odds between any two outcomes are independent of the number and nature of other outcomes being

simultaneously considered. In case a subset of the choice set is truly irrelevant, omitting it should not alter significantly the estimates.

Testing for IIA assumption was therefore a requirement in order to establish whether the model did comply with this assumption. This IIA test was devised by Jerry Allen Hausman (Stata, 2013). The Hausman statistic is distributed as χ^2 (chi-square) and is computed as:

$H = (\beta_c - \beta_e)\ 0\ (V_c - V_e)^{-1} (\beta_c - \beta_e)$……………………………………………………………(12)

Where;

β_c =the coefficient vector from the consistent estimator

β_e = the coefficient vector from the efficient estimator

V_c = the covariance matrix of the consistent estimator

V_e =the covariance matrix of the efficient estimator

Under the IIA assumption, we would expect no systematic change in the coefficients if we excluded one of the outcomes from the model. We re-estimated the parameters, excluding the drought outcome, and performed a Hausman test against the fully efficient full model. The Hausman test following Hausman and McFadden (1984) was performed to check whether the IIA assumption was violated or not.

The null hypothesis (H0: X=0) choices are independent.

The alternative (Ha: X≠0) choices are not independent.

The choice set partitioning test of comparing full multinomial logit model (MNLM) coefficients with the coefficients of the restricted model was used and the results are presented below.

The significance of the parameters after obtaining the marginal effects was established after carrying out hypothesis testing to establish whether the chances of realizing the variable of interest were increasing or decreasing. For instance interpreting a positive coefficient was done in terms of the movement in importance from the base category to the variable of interest

whereas a negative coefficient was interpreted in terms of the movement away from the variable of interest towards the base category. The results are displayed and interpreted in the results section.

3.8.4 The chi-square test

The chi-square test was used to examine the difference between observed counts and expected values. It could be used to examine nominal data, ordinal data and interval/ratio data arranged in groups: it takes the form of;

$$\chi^2 = \text{Sum of: } \frac{(\text{observed - expected})^2}{\text{expected}} \quad \ldots\ldots(13)$$

The Chi-square test assumes independent observations, mutually exclusive row and column variable categories that include all observations as well as large expected frequencies. The value of the Chi-square is a single number that adds up all the differences between actual data and the expected if there is no difference. If the actual data and expected data are identical, the Chi-square value is 0.

The null hypothesis is that *k* classifications are independent (i.e., no relationship between classifications). The alternative hypothesis is that the *k* classifications are dependent (i.e., that a relationship or dependency exists). A bigger difference gives a bigger Chi-square value. Greater differences between expected and actual data produce a larger Chi-square value. The larger the Chi-square value, the greater the probability that there really is a significant difference.

If the Chi-square value is greater than or equal to the critical value then there is a significant difference between the groups being studied. It means that, the difference between actual data and the expected data is probably too great to be attributed to chance. In that case the conclusion would be in support of the hypothesis of a difference. On the other hand if the Chi-square value is less than the critical value. There is no significant difference. The amount of difference between expected and actual data is likely to be due to chance. Thus, it is concluded that our sample does not support the hypothesis of a difference.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

This chapter presents the findings of the study. It covers the descriptive statistics, frequencies analysis, cross-tabulations; chi-square tests and the multinomial logistic regression results with marginal effects of shocks and household characteristics on the strategies adopted by the households.

4.1 Number of households that faced shocks

Tables 4.1 and 4.2 present information on the number of households that faced shocks. Out of the total sample of 7421 households/respondents, a proportion of 34.2 percent did not face any shocks while 65.8 percent faced at least one shock within 5 years between 2000 and 2005.

Table 4.1: Total number of households that faced shocks

Number of shocks	Respondents	Percent
0	2536	34.2
1	2488	33.5
2	1340	18.1
3	591	8.0
4	265	3.6
5	118	1.6
6	83	1.2
Total	**7421**	**100.0**

A proportion of 33.5 percent reported having faced only one shock; 18.1 percent reported having faced two shocks; 8.0 percent faced three shocks; 3.6 percent faced four shocks; 1.6 percent faced five shocks while 1.2 percent faced six shocks. The numerous shocks that are experienced by households impact on their ability to cope and affect their welfare negatively. Households used various coping mechanisms that included; asset depletion, use of savings, borrowing or reducing on consumption.

Table 4.2 presents number of shocks with multiple responses. Accordingly, sixty five point eight percent (65.8%) experienced at least one shock. Thirty two point three percent (32.3%) reported having faced at least two shocks.

Table 4.2: Number of shocks (multiple responses)

Number of shocks	Frequency[1]	Percent*
No shock	2,536	34.2
At least one shock	4,885	65.8
Two or more shocks	2,397	32.3

Note: ***The sum of percentages above exceeds 100% due to multiple responses. Total number of households was 7421.

4.2 Type of Shocks faced by households and their characteristics

The major shocks faced by households were; drought, floods, pests, bad seed quality, livestock epidemics and other shocks. All the other shocks were grouped together and categorized as 'others'. The other shocks included; fire accident, civil strife, robbery/theft, death of head of the household, death of other family members and injury from accidents among others. The following table shows the responses on occurrence of shocks.

Table 4.3: Reported Shock types

	Responses[1]		Did not respond	
Shock type	**Frequency**	**Percentage***	**Frequency**	**Percentage***
Drought	3122	63.9	1763	36.1
Floods	1055	21.6	3830	78.4
Pests	183	3.7	4702	96.3
Livestock epidemics	720	14.7	4165	85.3
Bad seed quality	213	4.4	4672	95.6
Others	3523	72.1	1362	27.9

Notes: ***The sum of percentages above exceeds 100% due to multiple responses. Total number of respondents who faced shocks was 4885

The combined shocks under the 'Other' category were the most reported by 72.1 percent. Among the major shocks, drought was the most prevalent specific shock with 63.9 percent of the respondents who faced it either as the only shock or as one of the shocks. This was followed by

floods affecting 21.7 percent of the respondents; livestock epidemics affecting 14.7 percent; bad seed quality affecting 4.4 percent; and pest attacks affecting 3.7 percent.

The finding that drought was the most prevalent specific shock is consistent with extant literature. According to FAO (2011), drought is the major shock affecting most parts of Uganda, particularly the dry belt that stretches from western Uganda through the central to the eastern and northern parts of the country.

4.2.1 Shocks faced by location of households

The results in Table 4.4 show that the 'other' shocks were the most reported by both rural (71.5%) and urban (75.0%) households. More rural households reported drought (68.8%) compared to urban ones (41.1%). The three most prevalent individual shocks that affected rural people were drought (68.8%), floods (23.6%) and livestock epidemics (14.1%).

Table 4.4: Location and reporting of Shocks

	Area			
	Rural[1]		**Urban[2]**	
Shocks	**Frequency**	**%***	**Frequency**	**%***
Drought	2767	68.8	355	41.1
Floods	950	23.6	105	12.2
Pests	158	3.9	25	2.9
Livestock epidemic	566	14.1	154	17.8
Bad seed quality	148	3.7	65	7.5
Others	2876	71.5	647	75.0

Notes: ***The sum of percentages above exceeds 100% due to multiple responses. Total number of respondents from rural areas (1) was 4,022 while that from urban areas (2) was 863. Pearson Chi-Square = 242.2719 degrees of freedom = (5) Probability value = 0.000 (2-sided)

These are shocks that pose big challenges to areas where agriculture is the main economic activity. Given that Uganda's economy is mainly based on agriculture which employs about 70 percent of the workforce and 90 percent of the exports (Bategeka et al, 2013), the impact from these shocks on the sector and the economy as whole is enormous. Similarly, the three most prevalent individual shocks that affected urban areas were drought (41.1%), livestock epidemics

(17.8%) and floods (12.2%). These figures show, however, there was considerable variation between shock reporting amongst rural and urban households.

The Pearson Chi-Square test result shows the value of 242.2719 with 5 degrees of freedom and probability value of 0.000 (two-sided). The null hypothesis of no significant difference in reporting shocks between rural and urban areas was rejected. It was hence concluded that there were significant differences in reporting shocks between rural and urban areas.

4.2.2 Shocks faced by region

A regional analysis of the shocks is summarized in Table 4.5. Shocks were more prevalent in the Northern Region, followed by Eastern, Central and Western Region. Livestock epidemics, drought and floods emerged as the single most reported shocks from all the regions.

Table 4.5: Region and reporting of shocks

	Region							
	Central[1]		**Eastern[2]**		**Northern[3]**		**Western[4]**	
Shocks	**Freq.**	**%***	**Freq.**	**%***	**Freq.**	**%***	**Freq.**	**%***
Drought	619	53.1	717	59.7	1004	71.7	782	70.0
Floods	140	12.0	299	24.9	256	18.3	360	32.2
Pests	13	1.1	66	5.5	87	6.2	17	1.5
Bad seed quality	11	0.9	69	5.7	603	43.0	37	3.3
Livestock epidemics	58	5.0	80	6.7	33	2.4	42	3.8
Others	1056	90.6	694	57.8	1018	72.7	528	47.3

Notes: ***The sum of percentages above exceeds 100% due to multiple responses. Total number of respondents per region were 1,166 (central (1) region), 1,201 (eastern (2) region) 1,401 (northern (3) region) and 1,117 (western (4) region) respectively. Pearson Chi-Square = 1463.747 degrees of freedom = (15) Probability value = 0.000 (2-sided)

The most reported disasters for central region were 'others' (90.6%), drought (53.1%) and floods (12.0%). The region experiences considerable flooding and drought mainly due to widespread deforestation that is often done for firewood, charcoal burning and cultivation. The removal of land cover enhances the flood movement along the slopes. As the soil is washed downhill, the harsh dry season follows with no cover to protect the land.

For the eastern region, the most prevalent shocks were drought (59.7%), 'others' (57.8%) and floods (24.9%). This region comprises the Teso, Mbale and Karamoja sub regions which are well known for persistent drought, floods and landslides (see Taylor, 2006).

For the northern region, the most reported shock was 'others' (72.7%), followed by drought (71.7%), bad seed quality (43.0%), and floods (18.3%). These shocks have some implications for the agricultural based region: they mean famine, hunger and widespread lack of food. The most reported shock in the western region was drought (70.0%), followed by 'others' (47.3%), floods (32.2%), and livestock epidemics (3.8%).

A Pearson Chi-Square test was conducted to establish whether there were any significant differences in reporting shocks across the four regions. The result showed a Pearson Chi-Square value of 1463.747 with 15 degrees of freedom and a probability value of 0.000 (2-sided). This result informed the rejection of the null hypothesis in favor of the alternative hypothesis.

However, the Central Region reported more 'other' shocks (90.6%) than other regions, followed by the Northern Region (72.7%), Eastern Region (57.8%) and Western Region (47.3%). Basing on drought, the Northern Region is the most affected, followed by the Western, Eastern, and Central Regions respectively. Floods were reported most in the Eastern Region, followed by the Western, Northern and Central Region respectively. Pests and bad seed quality were also most reported in the northern region than elsewhere.

4.2.3 Shocks faced by gender

The study examined the gender dimension of the shocks and found that majority of those that reported the shocks were males. For both men and women, the most prevalent shocks were 'others', followed by drought, floods and livestock epidemics respectively.

The key specific shocks faced by men were: drought (64.4%), floods (22.4%), bad seed quality (14.0%), livestock epidemics (4.7%) and pests (4.0%). Women faced the same major shocks although the proportions were smaller compared to men.

A Pearson Chi-Square test result of 17.478 with 5 degrees of freedom and probability value of 0.004 (2-sided) revealed significant differences in reporting shocks by gender.

Table 4.6: Gender and reporting of shocks

	Sex			
	Female[1]		**Male[2]**	
Shock	Freq.	%*	Freq.	%*
Drought	861	62.7	2261	64.4
Floods	267	19.4	788	22.4
Pests	43	3.1	140	4.0
Bad seed quality	228	16.6	492	14.0
Livestock epidemics	47	3.4	166	4.7
Others	909	66.2	2614	74.5

Notes: *The sum of percentages above may exceed 100% due to multiple responses. Total number of female respondents (1) was 1,374 and 3,511 for male respondents (2). Pearson Chi-Square = 17.478 df = (5) Prob. = 0.004 (2-sided)

4.2.4 Reported shocks and household size

The study used information on shocks and household size to investigate the link between them. Household size data was categorized into four groups based on the number of persons living in a household, i.e., 2 persons and below, 3 to 5 persons, 6 to 9 persons, and 10 and above persons.

The results show that the household size of 6-9 persons was the most affected by drought and floods. This group reported drought (67.6%), followed by floods (23.8%), livestock epidemics (15.6%), pests (4.7%) and bad seed quality (4.5%). For the same respondents, the 'others' shock was reported at 75.7 percent.

The second most affected household size was that of 10 or more persons, which reported 'other' shocks (83.9%), drought (63.9%), floods (22.9%), livestock epidemics (13.2%), pests (4.6%) and bad seed quality (4.1%). The third most affected household size was the 3-5 category, which reported 'other' shocks (67.9%), drought (64.1%), floods (20.7%), livestock epidemics (15.7%), bad seed quality (4.2%) and pests (2.9%).

Table 4.7: **Incidences of shocks and household size**

Shocks	Household size[1]							
	≤ 2 persons		**3 - 5 persons**		**6 - 9 persons**		**≥ 10 persons**	
	Freq.	%*	Freq.	%*	Freq.	%*	Freq.	%*
Drought	387	54.0	1224	64.1	1249	67.6	262	63.9
Floods	127	17.7	395	20.7	439	23.8	94	22.9
Pests	21	2.9	56	2.9	87	4.7	19	4.6
Livestock epidemics	77	10.7	300	15.7	289	15.6	54	13.2
Bad seed quality	32	4.5	81	4.2	83	4.5	17	4.1
Others	489	68.2	1297	67.9	1399	75.7	344	83.9

Notes: *****The sum of percentages exceeds 100% due to multiple responses.1.Total number of respondents with household sizes were; 2 persons and below (717), 3 to 5 persons (1,911), 6 to 9 persons (1,847) and for 10 and more (410). Pearson Chi-Square = 44.077 df = (15) Prob.=0.000 (2-sided)

The least affected household size was that of 2 or less persons, which reported 'other' shocks (68.2%), drought (54.0%), floods (17.7%), livestock epidemics (10.7%), pests (0.4%), and bad seed quality (4.5%). In all cases, the figures show that the proportions reporting 'other' shocks were higher than those indicated for any of the specific shocks.

The Pearson Chi-Square of 44.077 with 15 degrees of freedom and probability value of 0.000 (2-sided) led to the rejection of the null hypothesis of no significant difference in favor of the alternative hypothesis that there were significant differences is reporting shocks by the different household size groups. The results are consistent with the view that larger households are more affected by shocks (Wodon et al, 2014). This could be due to the fact that such households have many dependents (Le Blanc et al, 2015). This observation does not apply to households with more than 10 members.

4.2.5 Shocks faced by households according to economic status

Shock type was cross tabulated with economic status, i.e. whether households were identified as poor or non-poor. This status was determined through questions that provided a set of indicators for monitoring poverty and living standards in Uganda (see, UNHS, 2006).

Table 4.8: Reporting of shocks and economic status

Shock	Economic status			
	Non-poor		Poor	
	Freq.	Percent*	Freq.	Percent*
Drought	2092	61.3	1030	70.1
Floods	760	22.3	395	26.9
Pests	121	3.5	62	4.2
Livestock epidemics	311	9.1	409	27.8
Bad seed quality	166	4.9	47	3.2
Others	2254	66.0	939	63.9

Notes: *****The sum of percentages above exceeds 100% due to multiple responses. 1.Total number of respondents categorized as non-poor below was 3,415. 2.Total number of respondents categorized as poor was 1,470 Pearson Chi-Square = 293.161 df = (5) Prob. = 0.000 (2-sided)

For the non-poor, the most reported specific shock was drought (61.3%), followed by floods (22.3%), livestock epidemics (9.1%), bad seed quality (4.9%), and pests (3.5%). For the poor, it was drought (70.1%), followed by floods (26.9%), pests (4.2%) and bad seed quality (3.2%). The 'other' combined shocks did play an important part affecting both categories, but were more reported by the non-poor (66.0%) compared to the poor (63.9%). This finding that the poor faced more shocks than the non-poor is consistent with earlier research findings by Mundial, 2004.

A Pearson Chi-Square test carried out to determine whether there were any significant differences in reporting shocks among the poor and non-poor showed a Chi-Square value of 293.161 with 5 degrees of freedom and probability value of 0.000 (2-sided). The null hypothesis of no significant differences in reporting shocks was rejected in favor of the alternative hypothesis.

4.2.6 Shocks faced by education status

The study examined the frequency of shocks and education status of the household head. Education status was determined according to whether a respondent had attained formal educational i.e. primary, secondary or post-secondary/tertiary, which then were categorized as "received formal education" and those who had attended no formal education institution were "did not receive formal education".

Table 4.9: Education status and reporting of shocks

Shock	Education status			
	Has no formal education[1]		Has formal education[2]	
	Freq	%*	Freq	%*
Drought	680	46.1	2442	71.6
Floods	235	15.9	820	24.0
Pests	19	1.3	164	4.8
Livestock epidemics	170	11.5	548	16.1
Bad seed quality	17	1.2	196	5.7
Others	593	40.2	2920	85.6

Notes: ***The sum of percentages above exceeds 100% due to multiple responses. 1. Total number of respondents with no formal education 1,475. 2. Total number of respondents with formal education 3,410. Pearson Chi-Square = 7.6310 df= (5) Prob. = 0.178 (2-sided)

The most experienced shock for the respondents that had formal education was the 'other' shocks (85.6%), followed by drought (71.6%), floods (24.0%), livestock epidemics (16.1%), bad seed quality (5.7%) and pests (4.8%). In contrast, the most experienced shock for those with no formal education was drought (46.1%), followed by 'other' shocks (40.2%), floods (15.9%), livestock epidemics (11.5%), pests (1.3%) and bad seed quality (1.2%).

The Pearson Chi-Square test was used to test whether there were significant differences in reporting shocks according to education status of respondents. The Pearson chi-square test results of 7.6310 with 5 degrees of freedom and a probability value of 0.178 (2-sided) does not allow us to confidently reject the null hypothesis. We conclude that there was no significant difference in reporting shocks according to education status.

4.3 Coping mechanisms used by households in face of shocks

The coping strategies covered by this study included borrowing, using savings, reducing family expenditure, seeking help, using own assets, widening employment and other strategies. Respondents were asked to indicate their first, second and third coping strategies whenever faced with a shock. Table 4.10 presents the responses of coping mechanisms to shocks by households.

The total sample of households that faced shocks and used various coping strategies was 4885 households. The total sample includes those who at least used one coping strategy in face of disasters in the previous 5 years from i.e. 2000-2005.

Table 4.10: Coping mechanisms used against shocks

	Choice strategies					
	First choice strategy		Second choice strategy		Third choice strategy	
Coping mechanisms	**Freq.**	**%**	**Freq**	**%**	**Freq.**	**%**
Use own assets	108	2.2	91	3.0	41	3.8
Use savings	1,007	20.6	417	13.5	99	9.3
Borrowing	644	13.2	688	22.3	191	17.9
Reduce family expenditure	984	20.1	648	21.0	215	20.1
Seek help	745	15.3	584	18.9	233	21.8
Widening employment	166	3.4	220	7.1	98	9.2
Others	1,231	25.2	434	14.1	190	17.8
Total	**4885**	**100.0**	**3082**	**100.0**	**1067**	**100.0**

The data above is presented according to strategies or mechanisms in response to a shock, that is, first choice strategy (4885), second choice strategy (3082) and third choice strategy (1067). In some cases the first strategy alone could have been sufficient in coping with the shock. It could also be that households had no other options available than the first choice strategy.

The figures in Table 4.10 show that for the first choice strategy, the 'other' (combined) strategies were the most used strategies. However, the most used specific strategies for the three choice categories were use of savings (20.6%) for first choice strategy, borrowing (22.3%) for second choice strategy and seeking for help (21.8%) for third choice strategy. This makes sense since after using its savings, a household would borrow and if this was not sufficient it would then seek for help (from relatives, friends and local government). The second most chosen specific strategy for the three choice categories was reduction in expenditure with proportions of 20.1 percent for the first and third choice categories and 21.0 percent for the second choice category.

4.3.1 Coping strategies and gender

The study explored the relationship between coping strategies and gender operationalized by sex of the respondent, using cross tabulation of the two. Table 4.11 presents the results.

Table 4.11: Coping strategies and gender

Coping strategies	Sex					
	Female[1,2,3]			Male[1,2,3]		
	1	2	3	1	2	3
	%	%	%	%	%	%
Use own assets	1.9	2.9	3.6	2.3	3.0	3.9
Use savings	15.9	12.9	8.8	22.5	13.8	9.5
Borrowing	3.6	9.1	7.3	3.3	6.3	10.0
Reduce family expenditure	14.3	22.7	21.2	12.8	22.2	16.4
Seek help	25.1	20.2	19.7	18.2	21.3	20.4
Widening employment	14.6	18.5	18.8	15.5	19.1	23.2
Others	24.7	13.7	20.6	25.4	14.2	16.6

Notes: 1. Total number of female respondents who used first choice strategy (1) was 1,374 second choice strategy (2) was 899 and third choice strategy (3) was 330. 2. Total number of male respondents who used first choice strategy (1) was 3,511 second choice strategy (2) was 2,183 and third choice strategy (3) was 737. First Choice Pearson Chi-Square = 47.73902 df = (6) Prob. = 0.000 (2-sided). Second Choice Pearson Chi-Square = 8.1225 df = (6) Prob. = 0.229 (2-sided). Third Choice Pearson Chi-Square = 9.1897 df = (6) Prob. = 0.163 (2-sided)

Most females sought for help (25.1% for first choice strategy, 20.2% for second choice strategy and 19.7% for third choice strategy), followed by 'other' strategies (24.7% for first choice strategy, 13.7% for second choice strategy, 20.6% for third choice strategy), reduction in family expenditure (14.3%) for first choice strategy 22.7% for second choice strategy and 21.2% for third choice strategy), widening employment (14.6% for first choice strategy, 18.5% for second choice strategy and 18.8% for third choice strategy).

The coping strategy used most by males in the face of shocks was 'other' strategies (with proportions of 25.4% for first choice strategy), followed by reduction in family expenditure (22.2%) for second choice strategy and widening of employment (23.2%) for third choice strategy). This was closely followed by use of savings (22.5% for first choice strategy), seeking help for second choice strategy (with 21.3%) and third choice strategy (with 20.4%). The third most used strategy by males was to seek for help (by 18.2%) for first choice strategy followed by widening of employment (by 19.1%) for second choice strategy and by other strategies (by 16.6%). Few of them used their own assets (2.3% for first choice strategy, 3.0% for second choice strategy and 3.9% for third choice strategy).

More males than females used savings to cope while more females than males (for first choice strategy) sought for help. These results highlighted the gender differences in adaptation to shocks. Most males and females reduced family expenditure as a second choice strategy rather than first choice strategy. This may be due to desperation and distress as a result of the persistence of the shock (Berloffa & Modena, 2009).

The Pearson Chi-Square test was carried out and the result shows that with Pearson Chi-Square test value of 47.73902 with 6 degrees of freedom and probability value of 0.000 (two-sided) for the first choice strategy, the null hypothesis of no significant difference in the choice of coping strategies between men and women was rejected. It was therefore concluded that there were significant differences in the choice of strategies basing on gender. However, we fail to reject the null hypothesis of no significant difference in the choice of coping strategies between men and women for the second and third choices (Pearson Chi-Square value of 8.1225 with 6 degrees of freedom and probability value of 0.229 (2-sided) and Pearson Chi-Square value of 9.1897 with 6 degrees of freedom and probability value of 0.163 (2-sided) respectively).

4.3.2 Coping mechanisms and location

The study analyzed the relationship between coping strategies and location of respondents with the following results in Table 4.12. For the first choice strategy, the most used responses to shocks in rural areas were the ‘other’ strategies (25.8%), followed by seeking help (19.3%), use of savings (18.9%) widening employment (16.0%), reducing family expenditure (14.0%), borrowing (3.6%) and using own assets (2.3%).

For the second choice strategy, most rural respondents reduced family expenditure (22.4%), followed by seeking help (20.3%), widening employment (19.5%), using savings (13.9%), ‘other’ strategies (13.9%) and borrowing (7.0%). For the third choice strategy, most rural respondents widened employment (21.6%), followed by seeking help (19.3%), ‘others’ (18.4%), reducing family expenditure (18.0%), borrowing (9.3%) and using savings (9.2%).

Table 4.12: Coping strategies and location

Coping mechanisms	Location					
	Rural[1,2,3]			Urban[1,2,3]		
	1	2	3	1	2	3
	%	%	%	%	%	%*
Use own assets	2.3	3.0	4.2	1.7	2.4	2.3
Use savings	18.9	13.9	9.2	28.4	11.3	9.6
Borrowing	3.6	7.0	9.3	2.7	8.2	8.5
Reduce family expenditure	14.0	22.4	18.0	9.4	21.9	17.5
Seek help	19.3	20.3	19.3	24.0	25.2	24.3
Widening employment	16.0	19.5	21.6	11.6	15.9	23.2
Others	25.8	13.9	18.4	22.2	15.2	14.7

Notes: Total number of rural respondents who used first choice strategy (1) was 4,022; second choice strategy (2) was 2,629 and third choice strategy (3) was 890. The total number of urban respondents who used first choice strategy (1) was 863 second choice strategy (2) was 453 and third choice strategy (3) was 177. First Choice Pearson Chi-Square = 65.45233 df = (6) Prob. = 0.000 (2-sided).Second Choice Pearson Chi-Square =10.8049 df = (6) = 0.095 (2-sided).Third Choice Pearson Chi-Square = 4.6795 df = (6) Prob. = 0.586 (2-sided)

For urban households faced with shocks, the most used first choice strategy consisted of use of savings (28.4%), followed by seeking help (24.0%), 'others' (22.2%), widening employment (11.6%), reducing family expenditure (9.4%), borrowing (2.7%) and using own assets (1.7%). The second choice strategy included seeking help (25.2%), reducing family expenditure (21.9%), widening employment (15.9%), 'others' (15.2%), using savings (11.3%), borrowing (8.2%) and using assets (2.4%). The third choice strategy consisted of seeking help (24.3%), widening employment (23.2%), reducing family expenditure (17.5%), 'others' (14.7%), using savings (9.6%), borrowing (8.5%) and using own assets (2.3%).

The differences in the choice of strategies between rural and urban areas were significantly different as indicated by the Pearson Chi-Square value of 65.45233 with 6 and probability value of 0.000 (2-sided) for first choice strategy and Pearson Chi-Square value of 10.8049 with 6 degrees of freedom and probability value of 0.095 (2-sided) for second choice strategy. There were no significant differences in the choice of strategy for the third choice with Pearson Chi-Square value of 4.6795 with 6 degrees of freedom and 0.586 (2-sided). Households in rural and urban areas differed in their choices for the first strategy; rural households used 'other' strategies while urban households used their savings. Rural households are characterized by lower incomes

than urban households, which may explain their low use of savings during shocks (Amendah, Buigut & Mohamed, 2014).

4.3.3. Coping strategies and region

Results of a cross tabulation between coping strategies used in face of shocks and region were presented in Table 4.13. As per region, the most used responses to shocks in the Central Region for the first choice priority strategy were seeking help (23.8%), followed by use of savings (22.9%), 'other' strategies (21.1%), reduction of family expenditure (13.9%), widening employment (10.6%), borrowing (2.4%) and using own assets (1.5%).

Table 4.13: Coping strategies and Region

	Region							
	Central[1,2]		**Eastern[1,2]**		**Northern[1,2]**		**Western[1,2]**	
	1	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Coping strategies	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Use own assets	1.5	2.5	3.2	2.7	1.6	3.8	2.6	0.0
Use savings	22.9	19.6	23.1	11.5	7.1	10.2	32.6	0.0
Borrowing	2.4	5.8	2.9	4.9	1.1	11.2	7.8	0.0
Reduce family expenditure	17.8	20.4	8.0	20.8	13.3	26.1	13.9	0.0
Seek help	23.8	20.5	24.2	20.2	14.1	22.5	19.6	0.0
Widening employment	10.6	16.3	17.8	24.3	22.0	14.8	8.9	0.0
Others	21.1	14.8	20.7	15.6	40.8	11.5	14.7	0.0

Notes: 1.Total number of respondents who used first choice strategy were; central (1,166) eastern (1,201) northern (1,401) and western (1,117). 2.Total number of respondents who used second choice strategy were; central (925) eastern (1,198) northern (959). First Choice Pearson Chi-Square= 691.0479 df= (18) Prob. = 0.000 (2-sided).Second Choice Pearson Chi-Square) = 118.8310 df= (12) Prob.= 0.000 (2-sided)

For the second choice priority strategy, the most used was seeking help (20.5%), followed by reduction in family expenditure (20.4%), use of savings (19.6%), widening employment (16.3%), 'others' (14.8%), borrowing (5.8%) and using assets (2.5%).

In the Eastern Region, for the first choice priority strategy, households coped by seeking help (24.2%), followed by using their (23.1%), 'others' (20.7%), widening employment (17.8%), reducing family expenditure (8.0%), using assets (3.2%) and borrowing (2.9%). For the second priority strategy, households coped by widening employment (24.3%), reducing family

expenditure (20.8%), seeking help (20.2%), 'others' (15.6%), using savings (11.5%), borrowing (4.9%) and using assets (2.7%).

For the Northern Region, for their first priority strategy, households mostly used 'other' strategies (40.8%), followed by widening of employment (22.0%), seeking help (14.1%), reducing expenditure (13.3%), using savings (7.1%), using own assets (1.6%), and borrowing (1.1%). For their second priority strategy, they reduced family expenditure (26.1%), followed by seeking help (22.5%), widening employment (14.8%), 'other' strategies (11.5%), using savings (11.2%), using assets (10.2%) and borrowing (3.8%).

The Western Region predominantly used assets (32.6 %) as the most used strategy; followed by seek for help (19.6%), other strategies (14.7%), reduction in family expenditure (13.9%), followed by widening of employment (8.9%), use of savings (7.8%) and borrowing (2.6%). Central Region sought for help and reduced family expenditure, eastern region mainly sought for help and widened employment, northern region used other strategies and reduced family expenditure whereas western region used savings more than other regions.

The choice of coping strategies against shocks between regions was significantly different as shown by the first choice strategy Pearson Chi-Square value of 691.0479 with 18 degrees of freedom and probability value of 0.000 (2-sided). This was similar to the second choice Pearson Chi-Square value of 118.8310 with 12 degrees of freedom and probability value 0.000 (2-sided).

4.3.4 Coping strategies and economic status

The choice of coping mechanisms was analyzed by economic status and the results are presented in Table 4.14.The results from Table 4.14 show that for the first priority strategy, the non-poor households used savings (25.2%) as their main strategy, followed by 'other' strategies (22.8%), seeking help (20.8%), widening employment (13.2%), reducing family expenditure (12.3%), borrowing (3.6 %) and using own assets (2.1%).

Table 4.14: Coping strategies and economic status

	Economic status					
	Non-poor[1]			Poor[2]		
	1	2	3	1	2	3
Coping strategies	%	%	%	%	%	%
Use own assets	2.1	2.6	3.6	2.4	3.7	5.1
Use savings	25.2	14.8	9.4	10.1	11.1	8.5
Borrowing	3.6	6.4	9.3	2.9	8.6	8.5
Reduce family expenditure	12.3	21.0	17.5	15.2	25.0	19.9
Seek help	20.8	21.6	20.2	18.6	19.9	19.9
Widening employment	13.2	19.4	21.7	20.0	18.0	22.7
Others	22.8	14.3	18.3	30.7	13.7	15.3

Notes to the table: 1.Total number of nonpoor respondents were 3,415 for first choice strategy 2,051 for second choice and 891 for third choice strategy.2.Total number of poor respondents were 1,470 for first choice strategy 1,031 for second choice and 176 for third choice strategy. First Choice Pearson Chi-Square = 181.4795 df = (6) Prob.=0.000 (2-sided). Second Choice Pearson Chi-Square = 21.5472 df = (6) Prob.= 0.001 (2-sided). Third Choice Pearson Chi-Square = 2.3843 df = (6) Prob. = 0.881 (2-sided)

For the second priority strategy, they sought help (21.6%), followed by reducing family expenditure (21%), widening of employment (19.4%), using savings (14.8%), 'other' strategies (14.3%), borrowing (6.4%) and using assets (2.6%). For their third priority strategy, they coped by widening employment (21.7%), seeking help (20.2%), using 'other' strategies (18.3%), reducing family expenditure (17.5%), using savings (9.4%), borrowing (9.3%) and using assets (3.6%).

As for the poor households, the most used for first priority strategy were 'other' strategies (30.7%), followed by widening employment (20.0%), seeking help (18.6%), reducing family expenditure (15.2 %), using savings (10.1%), borrowing (2.9%) and using own assets (2.4%). For the second priority strategy, they reduced family expenditure (25%), followed by seeking help (19.9%), widening employment (18%), using other strategies (13.7%), using savings (11.1%) borrowing (8.6%) and using assets (3.7%). For the third priority strategy, they widened employment (22.7%), reduced family expenditure (19.9%), sought for help (19.9%), used other strategies (15.3%), used savings (8.5%), borrowed (8.5%) and used assets (5.1%).

The results show that the differences between the poor and non-poor are manifested in the differences in the coping strategies used. For example, the non-poor used more of their savings

than the poor possibly because they are able to save (Dupas & Robinsona, 2013). This study also found that the poor widen employment more than the non-poor in face of shocks.

The choice of coping strategies between the poor and non-poor was significantly different as measured by Pearson Chi-Square value of 181.4795 with 6 degrees of freedom and probability value of 0.000 (2-sided) for first choice strategy. This was similar to the Pearson Chi-Square value of 21.5472 with 6 degrees of freedom and probability value of 0.001 (2-sided) for second choice strategy. However, for the third strategy, there were no differences in the choice of coping strategies between the poor and non-poor (with Pearson Chi-Square value of 2.3843 with 6 degrees of freedom and probability value of 0.881 (2-sided).

4.3.5 Coping strategies to reported Shocks

Table 4.15 presents a cross tabulation between first choice priority strategy in face of shocks. A cross tabulation of shocks by coping strategies reveals how households responded to various shocks. The most used strategy against drought was the use of savings (24.8%), followed by reducing family or household expenditure (22.7%), borrowing (3.6%), widening employment (21.3 %), 'other' strategies (13.2%), seeking help (11.7%) and using own assets (2.6%). The leading responses to floods were 'other' strategies (25.2%), followed by the use of savings (20.4%), widening employment (19.1 %), reducing expenditure (13.2 %), seeking help (15.5%), borrowing (5.0%) and using own assets (1.6%).

In response to pest infestations most households used other strategies (48.0%), widened employment (22%), sought help (13.8%), used savings (9.8%),borrowed (2.4%), used own assets (2.4%) and reduced family expenditure (1.6%). In the face of livestock epidemics, they used other strategies (66.6%), sought help (15.1%), reduced family expenditure (4.9%), widened employment (9.1%), used savings (3.4%), borrowed (0.6%), and used own assets 0.3%).

In response to bad seed quality, they used savings (28.7%), other strategies (25.8%), sought help (25.4%), widened employment (8.1%), borrowed (5.7%), reduced family expenditure (4.8%) and used own assets (1.4%).

Table 4.15: First choice priority coping strategies used in face of Shocks

	Shocks					
	Drought	**Floods**	**Pests**	**Livestock epidemics**	**Bad seed quality**	**Others**
Coping strategies	%*	%	%	%	%	%
Using own assets	2.6	1.6	2.4	0.3	1.4	3.3
Using savings	24.8	20.4	9.8	3.4	28.7	23.6
Borrowing	3.6	5.0	2.4	0.6	5.7	3.2
Reducing family expenditure	22.7	13.2	1.6	4.9	4.8	6.0
Seeking help	11.7	15.5	13.8	15.1	25.4	38.5
Widening employment	21.3	19.1	22.0	9.1	8.1	7.5
Others	13.2	25.2	48.0	66.6	25.8	18.0

First Choice Pearson Chi-Square = 1444.917, df= (30) Prob. =0.000 (2-sided)

In response to other shocks, they mainly sought help (38.5 %), used savings (23.6%), used other strategies (18.0%), widened employment (7.5%), reduced family expenditure (6.0%), borrowed (3.2%) and used own assets (3.3%).

According to the data in Table 4.16, the most used second choice strategy against drought was reducing family expenditure (24.8%), followed by seeking for help (20.8%), widening employment (19.1%), using savings (13.8%), other strategies (11.8%), borrowing (7.2%) and using assets (2.8%). The leading responses to floods were seeking help (22.7%), followed by reducing expenditure (20.2%), other strategies (16.7%), widening employment (16.4%), using savings (13.8%), borrowing (6.7%) and using own assets (3.6%).

In response to pests majority of the households reduced family expenditure (24.5%), widened employment (24.5 %), used other strategies (19.1%), sought help (16.0%), used savings (7.4%), borrowed (4.3%) and used own assets (4.3%). In the face of livestock epidemics, they reduced family expenditure (23.2%), sought help (23.2%), widened employment (15.4%), borrowed (13.2%), used other strategies (12.9%), used savings (9.6%), and used own assets 2.6%).

In response to bad seed quality, they reduced family expenditure (22.8%), widened employment (21.5%), sought help (20.1%), used savings (13.4%), used other strategies (12.8%), borrowed (5.4%), and used own assets (4.0%).

Table 4.16: Second choice priority coping strategies used in face of shocks

Coping strategies	Shocks					
	Drought	**Floods**	**Pests**	**Livestock epidemics**	**Bad seed quality**	**Others**
	%	%	%	%	%	%
Using own assets	2.8	3.6	4.3	2.6	4.0	2.6
Using savings	13.8	13.8	7.4	9.6	13.4	14.9
Borrowing	7.2	6.7	4.3	13.2	5.4	6.1
Reducing family expenditure	24.5	20.2	24.5	23.2	22.8	20.0
Seeking help	20.8	22.7	16.0	23.2	20.1	20.5
Widening employment	19.1	16.4	24.5	15.4	21.5	20.1
Others	11.8	16.7	19.1	12.9	12.8	15.8

Second Choice Pearson Chi-Square = 70.7112 df= (30) Prob. = 0.000 (2-sided)

In response to other shocks, they sought help (20.5%), widened employment (20.1%), reduced family expenditure (20.0%), used other strategies (15.8%), used savings (14.9%), borrowed (6.1%) and used own assets (2.6%).

The data in Table 4.17 show that the most used third choice strategy against drought was widening of employment (22.3%), seeking help (18.3%), reducing family expenditure (18.3%), using other strategies (17.2%), using savings (10.0%), borrowing (9.6%) and using own assets (4.3%). The leading responses against floods were reducing expenditure (21.5%), seeking help (19.0%), using other strategies (16.5%), using savings (11.6%), widening employment (18.2%), borrowing (9.9%) and using own assets (3.3%).

In response to pest attack, most households widened employment (33.3%), sought help (33.3%), reduced family expenditure (22.2%), used other strategies (11.1%), but never used savings borrowing and own assets. In the face of livestock epidemics, they widened employment (50.0%), sought help (37.5%), used own assets (12.5%) but never reduced family expenditure or used savings, borrowing and other strategies. In response to bad seed quality, they sought help (25.9%), widened employment (18.5%), borrowed (18.5%), reduced family expenditure (14.8%) used other strategies (18.0%), used savings (7.4%) but never used own assets.

Table 4.17: Third choice priority coping strategies used in face of shocks

Coping strategies	Shocks					
	Drought	**Floods**	**Pests**	**Livestock epidemics**	**Bad seed quality**	**Others**
	%	%	%	%	%	%
Using own assets	4.3	3.3	0.0	12.5	0.0	3.9
Using savings	10.0	11.6	0.0	0.0	7.4	8.4
Borrowing	9.6	9.9	0.0	0.0	18.5	7.6
Reducing family expenditure	18.3	21.5	22.2	0.0	14.8	17.0
Seeking help	18.3	19.0	33.3	37.5	25.9	21.2
Widening employment	22.3	18.2	33.3	50.0	18.5	21.9
Others	17.2	16.5	11.1	0.0	14.8	19.7

Third Choice Pearson Chi-Square = 33.1109 df= (30) Prob. = 0.318 (2-sided)

In response to other shocks, they widened employment (21.9%), sought help (21.2%), used other strategies (19.7 %), reduced family expenditure (17.0%) , used savings (8.4%), borrowed (7.6%), widened employment (7.5%), reduced family expenditure (6.0%), and used own assets (3.9%).

For the first choice strategy, the choice of coping strategies was significantly different for various shocks as highlighted by the Pearson Chi-Square value of 1444.917, with 30 degrees of freedom and probability of 0.000. Similarly, for second choice strategy (Pearson Chi-Square value of 70.7112 with 30 degrees of freedom and probability value of 0.000 (2-sided), there were differences in the choice of coping strategies in face of shocks. For third choice strategy, with Pearson Chi-Square value of 33.1109, 30 degrees of freedom and probability value of 0.318 (2-sided), there were no significant differences in the choice of coping strategies in face of shocks. In summary, for their first choice priority households used their savings; for the second choice priority, they reduced their expenditure, while for the third choice priority they widened employment more often than use other coping strategies.

4.4 Diagnostic tests results

This section presents the results of the various diagnostic tests that were carried out before generating the multinomial logistic regression results. Included were tests for multicollinearity, Independence of Irrelevant Alternatives (IIA) assumption and heteroscedasticity.

4.4.1 Testing for multicollinearity

The matrix in Table 4.18 examines bilateral relationships between the independent variables (shocks and control variables). The test results are explained in the following paragraph.

Table 4.18: Correlation matrix to detect multicollinearity[1]

	drou	floo	pest	live	bsee	othe	regi	loca	hsiz	ecos	sex	age	educ	msta
drou	1.00													
floo	0.16	1.00												
pest	0.11	0.13	1.00											
live	-0.07	-0.04	0.07	1.00										
bsee	-0.07	0.02	0.07	-0.03	1.00									
othe	-0.19	-0.09	-0.03	-0.01	-0.03	1.00								
regi	0.14	0.14	0.02	0.16	-0.05	-0.01	1.00							
loca	-0.22	-0.11	-0.02	0.04	0.07	0.04	0.03	1.00						
hsiz	0.07	0.05	0.04	0.02	0.00	-0.01	0.01	-0.04	1.00					
ecos	0.08	-0.02	0.02	0.24	-0.04	0.01	0.07	-0.13	0.16	1.00				
sex	0.01	0.03	0.02	-0.03	0.03	0.03	0.02	-0.02	0.16	-0.02	1.00			
age	0.07	0.01	-0.02	-0.04	-0.02	-0.02	0.00	-0.07	0.09	0.02	-0.16	1.00		
educ	-0.01	-0.02	-0.03	0.02	-0.03	0.01	0.08	0.06	-0.07	0.02	0.22	0.24	1.00	
msta	-0.09	-0.05	-0.03	-0.06	-0.02	0.11	-0.08	0.04	-0.33	-0.05	-0.60	0.22	0.18	1.00

In order to ascertain multicollinearity between two independent variables, the coefficient showing the degree of association between those variables should be equal or greater than 0.5 (Gujarati, 2004). Through examining the above correlation coefficients, it is clear that absolute correlations (association coefficients), apart from the correlation between marital status and sex (-0.60), are less than 0.5. Because of the seriousness of the multicollineality problem, one variable 'marital status,' was dropped from the model and this rectified the problem.

[1] **Where**;
Drou=drought,floo=floods, pest=pest attack, live=livestock epidemics, bsee=bad seed quality othe=others, regi=region, loca=location, hsiz=household size, ecos=economic status, sex=Sex, age=age ,educ=education/literacy, msta=marital status

4.4.2 Testing for Independence of Irrelevant Alternatives (IIA) assumption

Table 4.19 (see appendices) presents the results of the IIA test.The chi-square value of 5.33 and the high chi-square probability value of 0.9967 indicate insignificant results for Independence of Irrelevant Alternatives (IIA); hence we fail to reject the null hypothesis that the choices are independent. The coefficients of the variables from the two models were similar, had the same signs (save for variable 'other shocks') and shared a joint statistical significance. The above results indicate that our model does not violate the IIA assumption. This important finding permits us to proceed and interpret the results in section 4.5.

4.5 Econometric results

Results from the diagnostics of the regression one are presented in the Table 4.19. The number of observations used for analysis was 4885. The degrees of freedom are 65. The Wald chi-square value is 1223.86 with a probability of 0.000 which implies that the independent variables taken together influence the dependent variable.

Table 4.19: Diagnostics of the regression one

Number of obs	4885
Wald chi2(65)	1223.86
Prob > chi2	0.0000
Log pseudo likelihood	-7777.4493
Pseudo R2	0.0896

The low p-value from the Likelihood Ratio test, <0.00000, implies that at least one of the regression coefficients in the model is not equal to zero. Log pseudo likelihood of -7451.5369 is the likelihood of the fitted model used in the likelihood ratio chi-square test of whether all the predictors' regression coefficients in the model are simultaneously equal to zero. The Pseudo R–Squared of 0.0896 explained that about 9 percent variation in coping mechanisms is explained by the model.

Table 4.20: Marginal effects from multinomial logistic model estimates for first (priority) choice strategy (model 1)

	Coping mechanisms (Use Savings base)					
	Use Own Assets	Reduced Family Expenditure	Seek Help	Widening Employment	Borrowing	Others
Shocks	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value
Drought	**-0.0254 (0.0107)****	-0.0001 (0.0201)	**-0.0409 (0.0200)****	**0.0993 (0.0188)*****	**0.0174 (0.0078)****	0.0136 (0.0189)
Floods	**-0.0146 (0.0038)*****	**-0.0632 (0.0093)*****	0.0201 (0.0186)	-0.0119 (0.0127)	**0.0139 (0.0076)***	**0.1257 (0.020)*****
Pests	-0.0057 (0.0080)	**-0.1222 (0.0085)*****	**-0.0643 (0.0323)****	**-0.01395 (0.0266)**	**-0.0161 (0.0097)***	**0.3617 (0.0405)*****
Livestock Epidemics	**-0.0254 (0.0029)*****	**-0.1086 (0.0082)*****	-0.0271 (0.0190)	**-0.0854 (0.0118)*****	**-0.0323 (0.0048)*****	**0.5076 (0.0211)*****
Bad seed quality	**-0.0142 (0.0041)*****	**-0.0971 (0.0121)*****	**0.1370 (0.0366)*****	**-0.0849 (0.0201)*****	0.02613 (0.0174)	0.0277 (0.0337)
Others	**-0.0133 (0.0054)****	**-0.1224 (0.0140)*****	**0.2266 (0.0274)*****	**-0.0691 (0.0201)*****	0.0114 (0.0114)	0.0387 (0.0242)

Standard errors are in brackets; ***Significant at 1%, ** Significant at 5%, *Significant at 10%

ME ($\beta_j - \bar{\beta}_k$)= Marginal effect, P-value=Probability value Base=reference category/base category

4.5.1 Coping against shocks

Households were equally more likely to respond using savings than assets in response to drought (-0.0254) and livestock epidemics (-0.0254). Similarly, households were more likely to use savings than assets to drought and livestock epidemics than in response to floods (-0.0146), bad seed quality (-0.0142) and other shocks (-0.0133). This means that households were less likely to use assets when responding to drought and livestock epidemics than when responding to floods, bad seed quality and others. Households were almost equally likely to use savings than reduce family expenditure when facing pests (-0.1222) and other shocks (-0.1224). The use of savings was more prominent amidst pest attacks (-0.1222) and other shocks (-0.1224) compared to floods (-0.0632), bad seed quality (-0.0971) and livestock epidemics (-0.1086).

There were higher chances for households to seek help than use savings when struck by other shocks (0.2266) and bad seed quality (0.1370) but there were lower chances for them to seek

help than use savings when struck by drought (-0.0409) and pests (-0.0643). Households were highly likely to widen employment than use savings when struck by drought (0.0993). However, they were less likely to widen employment than use savings in the face of livestock epidemics (-0.0854), bad seed quality (-0.0849) and other shocks (-0.0691) in that order. Households were highly likely to borrow than use savings when struck by drought (0.0174) and floods (0.0139), but were less likely to borrow than use savings in the face of pests (-0.0161) and livestock epidemics (-0.0323). Similarly, households were more likely to use other strategies than use savings when faced with floods (0.1257), pests (0.3617) and livestock epidemics (0.5076).

4.5.2 Effect of drought on households' coping strategies

When faced with drought, households are significantly less likely to use their assets by 2.5 percentage points than use their savings as a coping strategy. However, they are also significantly less likely to seek help by 4.0 percentage points than use their savings as a coping strategy. For both of these two strategies therefore, households were likely to use their savings as a counter measure in the face of drought. This could be as a result of less asset ownership by some households. In the event of drought, households first use and deplete their savings before selling or mortgaging off their assets as their first option.

Households had higher chances of using their savings than seeking help in order to cope with drought. Households are significantly more likely to widen employment by 10 percent than use their savings when faced with drought. Usually the available savings are too little to enable households cope through prolonged drought. This is probably due to low levels of saving at household level.

Households were significantly more likely to borrow (by 1.7%) than use their savings when struck by drought. However, borrowing in the face of covariant shocks creates pressure on available resources which may affect households due to high interest rates charged.

4.5.3 Marginal effects of floods/hailstorms on households' coping strategies

Faced with floods/hailstorms, households have significantly less chances to use their own assets (by 1.5% points) or reduce family expenditure (by 6.3%) than use their savings as a coping

strategy. This means that in the face of floods/hailstorms households are more likely to use savings than use assets or reduce family expenditure. They are also significantly more likely to use 'other' strategies (by 12.6%) than use their savings when struck by flooding. The results obtained show that in comparison to strategies such as the use of assets and reduction in family expenditure, households are likely to use their savings.

Households are more likely to use savings than reduce family expenditure. Keeping other factors constant, household reduction of expenditure in the face of floods affects their welfare level. This finding resonates with that of Christiaensen et al (2006), who found that in the face of rain shocks such as floods, rural households in Kilimanjaro and Ruvuma largely relied on self-insurance (i.e. a form of savings).

4.5.4 Effect of pest attack on households' coping strategies

Faced with pest attack, households were significantly less likely to reduce family expenditure (by 12.2% points) or seek help (by 6.4%) but were significantly more likely to use other coping strategies (by 36.0%) than use their savings as a coping strategy. This means that households were able to cope by using other available means such as use of savings.

4.5.5 Effect of livestock epidemics on households' coping strategies

Faced with livestock epidemics, households were significantly less likely to use own assets (by 2.5% points), reduce family expenditure (by 10.9% points), widen employment (by 8.5% points) or borrow (by 3.2% points) than use their savings as a coping strategy. However, they are significantly more likely to use other coping strategies (by 50.7% points) than use their savings. This finding is similar to that of Hisali et al (2011) and Guloba (2014) who used a pooled MNL model to measure the effect of climatic shocks on adaptation strategies. However, households are more likely to use other coping strategies such as migration than use savings against livestock epidemics.

4.5.6 Effect of bad seed quality on households' coping strategies

With bad seed quality, households were significantly less likely (by 1.4% points) to use own assets, by 9.7 percent to reduce family expenditure, by 8.4 percent to widen employment than

use their savings as a coping strategy. On the other hand, households were more likely to seek help (by 13.7% points) than use savings when struck by bad seed quality. This finding concurs with that of Nahamya (2012) who, using a logistic regression, found that those struck with bad seed quality sought help from relatives and friends.

4.6 Household response to shocks given control variables

This study investigated the effect of key household characteristics on the household response to shocks. These household characteristics were introduced in the general model and the results are presented in Table 4.21. The model yields marginal effects obtained after introducing household characteristics as control variables in order to ascertain the impact of shocks in a more realistic environment.

4.6.1 Interpreting diagnostics of the regression (model 2)

Table 4.21 presents the diagnostics of the regression for model 2. The number of observations used in this study for analysis was 4885. The degrees of freedom are 102. The Wald chi-square value of 1752.36 with a probability chi-square value of 0.00000 leads us to conclude that at least one of the regression coefficients in the model is not equal to zero.

Table 4.21: **Interpreting diagnostics of the regression two**

Number of observations	4885
Wald chi2 (102)	1752.36
Prob > chi2	0.0000
Log pseudo likelihood	-7451.5369
Pseudo R^2	0.1277

The Pseudo R–Squared of 0.1277 explains that about 12.8% variation in coping mechanisms is explained by the model. Since this study used a cross sectional data set, the Pseudo R–Squared is an average measure of fit of the regression line.

Comparing the two models shows that model two is a better model than model one since the Pseudo R–Squared of 12.8 percent variation is better than that of model one of 9 percent. The

Wald chi-square value 1752.36 of model two is also better than the Wald chi-square value 1223.86 of model one.

Table 4.22: Marginal effects from multinomial logistic model estimates regression of first (priority) choice strategy with control variables (model 2)

N=4885

	Coping mechanisms (Use Savings, base)					
	Use Own Assets	Reduced Family Expenditure	Seek Help	Widening Employment	Borrowing	Others
Independent variables	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value
Drought	**-0.0279 (0.0105)*** **	-0.0051 (0.0209)	**-0.0373 (0.0206)*** **	**0.0818 (0.0187)*** **	**0.0146 (0.0072) ** **	0.0070 (0.0198)
Floods	**-0.0161 (0.0036)*** **	**-0.0580 (0.010)*** **	0.0133 (0.0197)	-0.0012 (0.0131)	0.0031 (0.0063)	**0.1433 (0.0218)*** **
Pests	-0.0074 (0.0069)	**-0.1233 (0.0093)*** **	-0.0548 (0.0357)	**-0.0381 (0.0229)* **	-0.0087 (0.0118)	**0.3624 (0.0415) *** **
Livestock Epidemics	**-0.0263 (0.0031)*** **	**-0.1212 (0.0088)*** **	-0.0039 (0.0245)	**-0.1265 (0.0096)*** **	**-0.0234 (0.0062)*** **	**0.4866 (0.0262) *** **
Bad seed quality	**-0.0134 (0.0042)*** **	**-0.0960 (0.0133)*** **	**0.1496 (0.0381)*** **	**-0.0815 (0.0196)*** **	0.0280 (0.0175)	0.0276 (0.0352)
Others	-0.0124 (0.0052)	**-0.1239 (0.0144)*** **	**0.2400 (0. 0283)*** **	**-0.0755 (0.0190)*** **	0.0126 (0.0106)	0.0291 (0.0249)
Location Rural (base)						
Urban	-0.0063 (0.0043)	-0.0024 (0.0141)	-0.0035 (0.0167)	-0.0031 (0.0159)	-0.0058 (0.0064)	**-0.0635 (0.0187)*** **
Region Central (base)						
Eastern	**0.0216 (0.0093)** **	**-0.0802(0. 0108)*** **	0.0205 (0.0185)	**0.0776 (0. 0193)*** **	0.0049 (0.0086)	**-0.0730 (0.0189)*** **
Northern	**0.0174 (0.0091)* **	-0.0092 (0.0135)	**-0.0457 (0.0202)** **	**0.1559 (0.0222)*** **	-0.0124 (0.0081)	**-0.0119 (0.0222)**
Western	**0.0213 (0.0099)** **	**-0.03013 (0.0117)** **	0.0195 (0.0196)	**-0.0431 (0.0163)*** **	**0.0540 (0.0132)*** **	**-0.1190 (0.0193)*** **

Standard errors are in brackets; ***Significant at 1%, ** Significant at 5%, *Significant at 10% ME($\beta_j - \bar{\beta}_k$) = Marginal effect, P-value=Probability value Base=reference category/base category

Table 4.23: Marginal effects from multinomial logistic model estimates regression of first (priority) choice strategy with control variables (model 2) continued

Independent variables	Coping mechanisms (Use Savings, base)					
	Use own assets	Reduced family expenditure	Seek help	Widening employment	Borrowing	Others
	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME $\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value
Gender Female (base)						
Male	0.0017 (0.0043)	-0.0088 (0.0109)	**-0.0524 (0.0153)*****	0.0031 (0.0125)	-0.0041 (0.0059)	0.0150 (0.0163)
Age	0.00003 (0.0001)	**0.0009 (0.0003)*****	**0.0020 (0.0004)*****	**-0.0021 (0.0004)*****	-0.00004 (0.0002)	0.00030 (0.0005)
Household size 2 persons and below (base)						
3 to five persons	0.0034 (0.0063)	0.0016 (0.0151)	-0.0153 (0.0185)	-0.0120 (0.0168)	0.0073 (0.0086)	0.0020 (0.0225)
6 to 9 persons	0.0046 (0.0064)	0.0140 (0.0155)	**-0.0560 (0.0185)*****	**-0.0366 (0.0166)****	0.0045 (0.0086)	0.0327 (0.0231)
10 and more	0.0072 (0.0104)	-0.0060 (0.0207)	**-0.0446 (0.0242)***	**-0.0491 (0.0198)***	0.0059 (0.0130)	0.0490 (0.0355)
Economic status Non-poor (base)						
Poor	0.0055 (0.0045)	**0.0392 (0.0124)*****	**0.0269 (0.0160)***	**0.0441 (0.0134)****	0.0069 (0.0064)	**-0.0292 (0.0166)***
Education						
Education in years of schooling	-0.0035 0.0040)	-0.0080 (0.0104)	0.0124 (0.0149)	0.0022 (0.0127)	0.0036 (0.0056)	-0.0051 (0.0167)

Standard errors are in brackets; ***Significant at 1%, ** Significant at 5%, *Significant at 10% ME($\beta_j - \bar{\beta}_k$) = Marginal effect, P-value=Probability value Base=reference category/base category

In response to drought, households were significantly less likely to use assets (by 2.8%) or seek help (by 3.7%) than use savings to cope. However, they were significantly more likely to widen employment (by 8.2%) than use savings to cope. In response to floods, households were less likely to use assets (by 1.6%), or reduce family expenditure (by 5.8%) than use savings but were more likely to respond by use of other strategies (by 14.3%) than use savings. In response to pest attack, households were significantly less likely to reduce family expenditure (by 12.3%) or widening employment (by 3.8%) than use savings but were more likely to use other strategies (by 36.2%) than savings. In response to livestock epidemics, households were significantly less likely to use assets (by 2.6%), or reduce family expenditure (by 12.1%), or widen employment

(by 12.7%) or borrow (by 2.3%) than use savings, but were more likely to use other strategies (by 48.7.7%) than use savings. In response to bad seed quality, households were significantly less likely to use own assets (by 1.3%) or reduce family expenditure (by 9.6%) or widen employment (by 8.2%) than use savings. In response to other shocks, households were less likely to use own assets (by 1.2%) or reduce family expenditure (by 12.4%) or widen employment (by 7.6%) than use savings but were more likely to seek help (by 24.0%) than use savings.

4.6.2 Household response to shocks given social demographic characteristics

In general residents located in urban areas were 6.4 percent significantly less likely to use other strategies than use their savings compared to their rural counterparts. Given the low savings rate in Uganda, availability of savings is less in the rural areas where the share of consumption is high and incomes so low (De Magalhaes & Santaeulàlia-Llopis, 2015). The coefficients; use of assets, reducing family expenditure, seeking help, widening employment and borrowing were not statistically significant implying that the likelihood of adopting the coping strategies was equally the same for both the rural and urban areas.

Regionally, in response to shocks, in comparison with central region, eastern region was more likely to respond by use of assets (2.2%) or widen employment by 7.8 percent than use savings but was less likely to respond by reducing family expenditure (8.0%) or use other strategies by 7.3 percent than use savings. Likewise, Northern region in comparison with central region was 1.7% more likely to use own assets or 16.0 percent more likely to widen employment than use savings but the region was less likely to seek help by 4.6 percent than use savings when compared to central region. In comparison to central region, western region was 2.1 percent more likely to use own assets or 5.4 percent borrow than use savings, but was less likely to reduce family expenditure by 3.0 percent or widen employment by 4.3 percent or use other strategies 11.9 percent than use savings.

In response to shocks, male headed households were 5.2 percent points less likely to reduce family expenditure than use savings, but were 0.3 percent more likely to widen employment than use savings as compared to their female counterparts. This finding resonates with the one by

Velasquez and Bahadur (2007) that in the face of shocks male-headed households were more likely to use savings than female headed households.

In terms of age, the findings showed that the older the household head, the more likely it was for that head to cope by reducing family expenditure (by 0.09%) than by using savings but the less likely it was to cope by widening employment (by 0.21%) than by using savings. This is probably due to savings.

Based on household size, households with 6 to 9 persons were less likely to seek help (by 5.6%) or widen employment (by 3.7%) than use savings compared to those with 2 persons and below. Similarly, households with 10 or more persons were 4.9 percentage points less likely to widen employment than use savings compared to households with 2 persons and below. Compared to the non-poor, the poor were 4.1 percent significantly more likely to reduce family expenditure or widen employment by 3.2 percentage points than use savings. Insignificant coefficients were recorded for education in number of years of schooling in face of shocks which implies that in this case education did not affect the coping strategies adopted in the face of the different shocks.

Two more models were estimated in order to establish the effects of shocks on the second and third choice strategies. There was need to find out the effect of shocks on the second and third coping strategies chosen by households after the first choice coping strategy.

4.6.3 Marginal effects from multinomial logistic model regression of second choice strategy

The results from the multinomial estimation of the second coping strategy when confronted by shocks are presented in Table 4.23. In the face of pest attacks, holding other factors constant, households were significantly less likely to seek help than use savings by 7.1 percent.

Hence, in the face of pest attack households are more likely to use their savings than seek help. In the face of pest attacks, they were more likely to cope by widening employment by 6.7 percent points and by borrowing by 3.4 percent points than by using savings. They were also less likely to use their assets than use savings (by 2.2%) when faced by bad seed quality. In terms of rural-urban differential, urban dwellers were more likely than rural dwellers to seek help (by

4.1%) when faced with shocks but were less likely (by 4.3%) to widen employment than rural dwellers. Holding other factors constant, households in the Eastern Region were more likely to cope by widening employment than use savings compared to those in the Central Region by about 8.0 percent.

Table 4.24: Marginal effects from multinomial logistic model estimates regression of second choice strategy with control variables (model 3)

Independent variables	**Coping mechanisms (Use Savings, base)**					
	Use Own Assets	Reduced Family Expenditure	Seek Help	Widening Employment	Borrowing	Others
	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value
Drought	0.0028 (0.0084)	0.00472 (0.0244)	0.00605 (0.0232)	0.02064 (0.0236)	-0.00377 (0.0131)	-0.01521 (0.0234)
Floods	0.00581 (0.0080)	-0.00895 (0.0208)	0.00224 (0.0204)	0.00717 (0.0190)	-0.01184 (0.0113)	0.00967 (0.0176)
Pests	0.00951 (0.0163)	-0.02629 (0.495)	**-0.07197 (0.0328)***	**0.06752 (0.0405)***	-0.00852 (0.0199)	0.05648 (0.0374)
Livestock Epidemics	-0.00213 (0.0085)	-0.02697 (0.0386)	0.04258 (0.0275)	-0.00779 (0.0252)	**0.03422 (0.0164)****	-0.02573 (0.0231)
Bad seed quality	**-0.02198 (0.0081)*****	0.04308 (0.0409)	0.03101 (0.0392)	-0.03704 (0.0317)	0 .02693 (0.0282)	-0.04137 (0.0267)
Others	0.00070 (0.0106)	0.00244 (0.0279)	0.00747 (0.0270)	0.00659 (0.0281)	-0.00799 (0.0152)	-0.00524 (0.0259)
Location Rural (base)						
Urban	-0.00257 (0.0085)	-0.00215 (0.0231)	**0.04113 (0.0236) ***	**-0.04318 (0.0195) ****	-0.00297 (0.0126)	0.02245 (0.0206)
Region Central (base)						
Eastern	0.00090 (0.0078)	-0.00296 (0.0197)	**-0.00825 (0.0185)**	**0.07975 (0.0190)*****	-0.01195 (0.0126)	0.00620 (0.0157)
Northern	0.00712 (0.0099)	0.05885 (0.0238)**	**0.00602 (0.0225)**	**-0.00738 (0.0221)**	0.03322 (0.0120)**	-0.03141 (0.0186) *
Western	-	-	-	-	-	-
Gender Female (base)						
Male	0.00337 (0.0063)	0.00207 (0.0181)	0.01801 (0.0172)	-0.01176 (0.0171)	**-0.02199 (0. 0151)***	-0.00046 (0.0149)
Age	-0.00035 (0.0002)*	0.00031 (0.0005)	-0.00014 (0.0005)	0.00022 (0.0005)	0.00037 (0.0114)	-0.00011 (0.0004)

Standard errors are in brackets; ***Significant at 1%, ** Significant at 5%, *Significant at 10%
ME = Marginal effect, P-value=Probability value Base=reference category/base category, n=3063

Table 4.25: Marginal effects from multinomial logistic model estimates regression of second choice strategy with control variables (model 3) continued

Independent variables	Coping mechanisms (Use Savings, base)					
	Use Own Assets	Reduced Family Expenditure	Seek Help	Widening Employment	Borrowing	Others
	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) &P-value
Household size 2 persons and below (base)						
3 to five persons	0.00264 (0.0091)	0.011546 (0.0244)	0.01380 (0.0234)	**-0.05111 (0.020)****	-0.01671 (0.0003)	0.01795 (0.0207)
6 to 9 persons	-0.00550 (0.0090)	0.00994 (0.0245)	0.01113 (0.0236)	**-0.05676 (0.0135)*****	-0.01122 (0.0131)	0.02563 (0.02095)
10 and more	-0.01050 (0.0103)	0.02648 (0.0353)	-0.03619 (0.0310)	-0.00774 (0.0209)	0.01371 (0.511)	-0.00297 (0.0285)
Economic status Non-poor (base)						
Poor	0.00655 (0.0071)	0.02505 (.0184)	-0.02427 (0.0174)	0.00582 (0.0103)	0.00510 (0.619)	0.00448 (0.0156)
Education						
Education in years of schooling	**0.001502 (0.0009)***	-0.00162 (0.0024)	-0.00066 (0.0022)	**0.000.439 (0.0013)****	0.00064 (0.622)	0.00039 (0.0020)
Number of obs	3063					
Wald chi2 (102)	204.53					
Prob > chi2	0.0000					
Pseudo R^2	0.0183					

Standard errors are in brackets; ***Significant at 1%, ** Significant at 5%, *Significant at 10% ME = Marginal effect, P-value=Probability value Base=reference category/base category

Households from the Northern Region were more likely to cope by reducing family expenditure and borrowing than those in the Central Region by 4.9 percent. This means that households in the Northern Region were less likely to use savings in the face of shocks. However, they were less likely to cope by using other coping strategies than those in the Central Region.

Compared to female headed households, in the face of shocks, male headed households were less likely to borrow by 2.2 percent points than use savings. This means that in the face of shocks

men use their savings while women are likely to borrow than use their savings. The more the age of household heads the less likely they are to cope using assets (by 0.4%) than use savings; hence household heads of more age were more likely to use their savings than their assets.

Compared to households with a household size of 2 persons and below, households with a household size of 3 to 5 persons were less likely to widen employment by 5.1 percent than use savings. Households with a household size of 6 to 9 persons were less likely to cope than those of a household size of 2 or less by 5.6 percent. There are higher chances of coping against shocks through widening employment than use savings by those with more years of education than those with fewer years by 0.4 percent points. This could be due to more skills acquired from many years of education.

In the face of drought, floods and other shocks results for all coping strategies under consideration were insignificant. Pest shocks did not have a significant effect on the use of own assets, reduced family expenditure, borrowing and others compared to use of savings. Similarly, compared to use of savings, livestock epidemics had no significant effects on the use of own assets, reduced family expenditure, seeking help, widening employment, and others. Bad seed quality showed no significant effects on reduced family expenditure, seeking help, widening employment, borrowing, and others compared to use of savings. Location had no significant effect on the use of own assets, reduced family expenditure, borrowing and others compared to use of savings. For economic status, insignificant results for all coping strategies were obtained. The Eastern Region had no significant effect on the use of own assets, seeking help, reduced family expenditure, borrowing and others compared to use of savings.

Likewise, compared to use of savings, the Northern Region had no significant effect on the use of own assets, seeking help and widening employment. The male gender had no significant effect on the use of own assets, reduced family expenditure, seeking help, widening employment and others compared to use of savings. Similarly, compared to use of savings, age did not significantly affect reduced family expenditure, seeking help, widening employment, borrowing and others. Compared to use of savings, the household size of 3 to 5 and the 6 to 9 persons showed no significant effect on the use of own assets, reduced family expenditure, seeking help,

employment, borrowing and others. Education had not significantly affected reduced family expenditure, seeking help, employment, borrowing and others compared to use of savings.

4.6.4 Marginal effects from multinomial logistic model estimates regression of third choice strategy

Table 4.24 presents results of effect of shocks on the third choice strategy with control variables. The third choice strategy model results show that during drought, households are less likely to use assets than use savings by 8.5 percent, but they are more likely to reduce expenditure than use savings by 9.9 percent. They are less likely to use assets than use savings by 2.3 percentage points when facing floods, by 3.0 percentage points when facing pest attacks, by 2.9 percentage points when facing livestock epidemics and by 2.6 percent in the face of bad seed quality. During floods households are more likely to seek help than use their savings by 9.6 percent but are less likely to borrow by 4.0 percent or use other strategies by 8.8 percent than use savings.

Households were less likely to borrow when facing pests than use savings by 9.3 percent. Similarly, they were less likely to use other strategies to cope against livestock epidemics and bad seed quality by 18.2 percent and 10.6 percent, respectively than use savings. A strike by other shocks would less likely lead households to choose other coping strategies than choose savings by 11.6 percentage points.

In the face of shocks, compared to use of savings, male headed households were less likely to cope using other strategies than females headed by 4.4 percentage points. Drought did not significantly affect the choice between using savings and seeking help, widening employment, borrowing and others. Compared to use of savings, floods had no significant effect on reduced family expenditure and widening employment.

Table 4.26: Marginal effects from multinomial logistic regression model estimates of third choice strategy with control variables (model 4)

Independent variables	Coping mechanisms (Use Savings, base)					
	Use Own Assets	Reduced Family Expenditure	Seek Help	Widening Employment	Borrowing	Others
	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value
Drought	**-0.08496 (0.0492)***	**0.09912 (0.05751)***	-0.00082 (0.05312)	0.04787 (0.0559)	-0.00433 (0.0426)	-0.11152 (0.0603)*
Floods	**-0.02314 (0.010)****	0.01609 (0.04364)	**0.09638 (0.0515)***	0.05317 (0.0475)	**-0.040090 (0.0237)***	**-0.08844 (0.0304)*****
Pests	**-0.03014 (0.0058)*****	0.08919 (0.14518)	-0.11450 (0.09792)	0.22626 (0.1471)	**-0.09297 (0.0096)*****	-0.09122 (0.0758)
Livestock Epidemics	**-0.02886 (0.0056)*****	-0.03699 (0.1548)	0.29221 (0.1988)	0.000272 (0.1370)	0.04713 (0.1256)	**-0.18196 (0.0124)*****
Bad seed quality	**-0.02596 (0.0064)*****	0.04092 (0.0776)	-0.05678 (0.0575)	0.13572 (0.0827)	0.05445 (0.0558)	**-0.10552 (0.0374)*****
Others	**-0.07031 (0.0281) ****	0.08106 (0.0674)	0.02999 (0.0582)	0.02426 (0.0615)	-0.00238 (0.0453)	**-0.11584 (0.0521)****
Location Rural (base)						
Urban	-0.01495 (0.0106)	0.01695 (0.0399)	0.05295 (0.0412)	0.01130 (0.0400)	-0.02917 (0.0110)	-0.04692 (0.0298)
Region Central (base)						
Eastern	-	-	-	-	-	-
Northern	-	-	-	-	-	-
Western	-	-	-	-	-	-
Gender Female (base)						
Male	0.00221 (0.0083)	-0.04514 (0.0292)	0.01041 (0.0293)	0.04515 (0.0300)	0.01795 (0.0174)	**-0.04430 (0.0267)***
Age	-0.00014 (0.0003)	0.00085 (0.0008)	0.00016 (0.0009)	-0.000754 (0.0009)	-0.00100 (0.262)	0.00085 (0.0007)
Household size 2 persons and below (base)						
3 to five persons	-0.00646 (0.0105)	0.02324 (0.0367)	-0.00543 (0.0356)	0.00141 (0.0381)	0.01344 (0.0243)	-0.04489 (0.0294)
6 to 9 persons	-0.01209 (0.0112)	0.02934 (0.0381)	-0.00181 (0.0374)	0.02400 (0.0408)	0.02927 (0.0264)	-0.04218 (0.0296)
10 and more	0.00083 (0.0159)	0.00919 (0.0554)	-0.04483 (0.0526)	0.00457 (0.0598)	0.02375 (0.0417)	-0.00632 (0.0434)

Standard errors are in brackets; ***Significant at 1%, ** Significant at 5%, *Significant at 10%

ME($\beta_j - \bar{\beta}_k$) = Marginal effect, P-value=Probability value Base=reference category/base category, n=1059

Table 4.27: Marginal effects from multinomial logistic regression model estimates of third choice strategy with control variables (model 4) continued

Independent variables	Coping mechanisms (Use Savings, base)					
	Use Own Assets	Reduced Family Expenditure	Seek Help	Widening Employment	Borrowing	Others
	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value	ME($\beta_j - \bar{\beta}_k$) & P-value
Economic status Non-poor (base)						
Poor	0.01788 (0.015)	0.01023 (0.0344)	0.00079 (0.0373)	0.01638 (0.0388)	-0.00526 (0.0222)	-0.02785 (0.0302)
Education						
Education in years of schooling	0.00136 (0.0011)	0.00024 (0.0038)	-0.00374 (0.0039)	0.00014 (0.0041)	0.00035 (0.0023)	0.00503 (0.0031)
Number of obs	1059					
Wald chi2 (102)	3311.42					
Prob > chi2	0.0000					
Log pseudo likelihood	-1895.5483					
Pseudo R^2	0.0241					

Standard errors are in brackets; ***Significant at 1%, ** Significant at 5%, *Significant at 10%

ME($\beta_j - \bar{\beta}_k$) = Marginal effect, P-value=Probability value Base=reference category/base category, n=1059

Likewise, livestock epidemics had no significant effect on the choice between using savings and reduced family expenditure, seeking help, widening employment and borrowing. Insignificant effects were obtained for bad seed quality on reduced family expenditure, seeking help, widening employment and borrowing compared to use of savings, while other shocks did not significantly affect the choice between using savings and reduced family expenditure, seeking help, widening employment, and borrowing. The gender of the household head had no significant effect the choice between using savings and use of own assets, reduced family expenditure, seeking help, widening employment and borrowing. Location, age, region, household size, economic status, and education did not have any significant effects on the coping strategies compared to use of savings.

4.6.5 Summary of the three models

Table 4.25 presents the diagnostic test results of the regressions of the three models for comparison purposes. A comparison of the models basing on the pseudo R-squared (which measures the proportion of variance explained by the predictors, also called the goodness of fit of the line) shows that the first (priority) choice model (Pseudo R–Squared of 0.1277) explains about 12.8 percent variation in the choice of first coping strategies.

Table 4.28: Diagnostics of the three models

Diagnostics	**First (Priority) choice strategy**	**Second choice strategy**	**Third choice strategy**
Number of obs	4885	3063	1059
Wald chi2 (102)	1752.36	204.53	3311.42
Prob > chi2	0.0000	0.0000	0.0000
Log pseudo likelihood	-7451.5369	-5463.6305	-1895.5483
Pseudo R^2	0.1277	0.0183	0.0241

The pseudo R-squared of the second choice strategy explains only 1.8 percent variation in chosen coping strategies and that of the third choice strategy explains only 2.4 percent variation in choice of the coping strategies. This implies that there are other factors influencing the choice of the coping strategies which were beyond this study.

The best model given the pseudo R-squared is the first choice strategy model. This implies that the government should focus more on the first choice coping strategy.

Table 4.29: **Summary of the results from the three models**

Coping mechanisms (Use Savings base)	Use Own Assets			Reduced Family Expenditure			Seek Help		
Shocks	M1	M2	M3	M1	M2	M3	M1	M2	M3
Drought	-***	+	-*	-	+	+*	-***	+	-
Floods	-***	+	-**	-***	-	+	+	+	+*
Pests	-	+	-***	-***	-	+	-	-*	-
Livestock Epidemics	-***	-	-***	-***	-	-	-	+	+
Bad seed quality	-***	-***	-***	-***	+	+	+***	+	-
Others	-	+	-**	-***	+	+	+***	+	+
Urban	-	-	-	-	-	+	-	+*	+
Eastern	+**	+		-***	-		+	-	
Northern	+*	+		-	+***		-**	+	
Western	+**			-**			+		
Male	+	+	+	-	+	-	-***	+	+
Age	+	-*	-	+***	+	+	+***	-	+
3 to five persons	+	+	-	+	+	+	-	+	-
6 to 9 persons	+	-	-	+	+	+	-***	+	-
10 and more	+	-	+	-	+	+	-*	-	-
Poor	+	+	+	+***	+	+	+*	-	+
Education	-	-*	+	-	-	+	+	-	-

Notes to the table:
M1= First choice strategy full model
M2= Second choice strategy full model
M3= Third choice strategy full model
Positive (+) and negative (-) signs indicate sign of the respective coefficient
***Significant at 1%, ** Significant at 5%, *Significant at 10%

Table 4.30: **Summary of the results from the three models continued**

Coping mechanisms (Use Savings base)	Widening Employment			Borrowing			Others		
Shocks	M1	M2	M3	M1	M2	M3	M1	M2	M3
Drought	+***	+	+	+**	-	-	+	-	-*
Floods	-	+	+	+	-	-*	+***	+	-***
Pests	-*	+*	+	-	-	-**	+***	+	-
Livestock Epidemics	-***	-	+	-***	+***	+	+***	-	-***
Bad seed quality	-***	-	+	+	+	+	+	-	-***
Others	-***	+	+	+	-	-	+	-	-**
Urban	-	-**	+	-	-	-	-***	+	-
Eastern	+***	+**		+	-		-***	+	
Northern	+***	-		-	+**		-	-*	
Western	-***			+***			-***		
Male	+	-	+	-	-*	+	+	-	-*
Age	-***	+	-	-	+	-	+	-	+
3 to five persons	-	-**	+	+	-	+	+	+	-
6 to 9 persons	-**	-***	+	+	-	+	+	+	-
10 and more	-***	-	+	+	+	+	+	-	-
Poor	+**	+	+	+	+	-	-*	+	-
Education	+	+**	+	+	+	+	-	+	+

Notes to the table:
M1= First choice strategy full model
M2= Second choice strategy full model
M3= Third choice strategy full model
Positive (+) and negative (-) signs indicate sign of the respective coefficient
***Significant at 1%, ** Significant at 5%, *Significant at 10%

The summary results (Table 4.27) for the first choice strategy model show that, out of 102 coefficients, 47 were statistically significant, of which 38.3 percent (18/47) were positive and 61.7 percent (29/47) negative. For the second choice strategy model, 16 out of 96 coefficients were significant of which 7 (46.7%) were positive and 9 (56.3%) negative. Similarly, 15 out of

84 coefficients for the third choice strategy were significant, of which 2 were positive and 13 negative.

Table 4.31: **Summary of the significant coefficients from the three models**

Model	Significant Positive coefficients		Significant Negative coefficients		Subtotals	
	Coefficients	Percent	Coefficients	Percent	Coefficients	Percent
Model 1 (n=102)	18	38.3	29	61.7	47	100
Model 2 (n=96)	7	46.7	9	56.3	16	100
Model 3 (n=84)	2	13.3	13	86.7	15	100
Subtotals	27	34.6	51	65.4	78	100

The results from the summary above show that when disasters like drought, floods/hailstorm, pest attack, livestock epidemics and bad seed quality strike, households resort to various coping strategies to manage the effects from such disasters. Such strategies are used in varying degrees depending on factors such as household characteristics. Of the various coping strategies, the use of savings is the most used strategy by households in Uganda. Households would be less likely to use any other strategy (such as the use of own assets, reduced family expenditure, seeking help, widening employment, borrowing and others) than savings. The impact of shocks makes many of the other strategies less desirable.

The implication from the summary is that there is a need to increase the means of savings by the government as well as other stakeholders. This could be done through support structures for village saving schemes and income generating schemes to enable households to earn and save more.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of findings

This study analyzed covariant shocks and their effects on coping strategies. Overall, out of 7421 respondents, 4885 (65.8%) faced at least one shock. The majority of the respondents (72.1 %) were affected by a combination of shocks. Drought, which affected 63.9%, was the largest specific shock, followed by floods (21.6%), livestock epidemics (14.7%), bad seed quality (4.4%) and pest attacks (3.7%).

In the face of shocks, the affected households used several strategies. A total of 4885 households used the first choice strategy, of which 63.1 percent also used a second choice strategy and 21.8 percent a third choice strategy on top of their first and second choices. For the first choice strategy, a combination of strategies categorized as 'others' was the most used type. For the specific coping strategies savings (20.6%) was the most used, followed by borrowing (22.3%) for the second choice strategy and seeking help (21.8%) for the third choice strategy. The second most used specific strategy was reduction in expenditure (20.1%) for the first, second and third choices.

The results revealed that there were significant differences in reporting shocks by households between region, gender, household size, economic status and education status at 1 percent level of significance. The choice of coping strategies against shocks was significantly different between gender, location, region, household size and economic status at 1 percent level of significance for the first choice strategy, while education status was not significant at 10 percent level of significance. For the second choice strategy, region, household size, economic status and location were significant at 1 percent level of significance; while gender was insignificant at 10 percent level of significance. For the third choice strategy gender, location, region, household size and economic status were insignificant at 10 percent level of significance.

The results of the multinomial logistic regression showed that the choice between using savings and assets by households was significant in the face of drought and other shocks (at 5% level of significance), and floods, livestock epidemics and bad seed quality (at 1% level of significance), but was insignificant for pests at 10 percent level of significance. Similarly, the choice between using savings and reduction in family expenditure was significant in the face of pests, floods, livestock epidemics, bad seed quality and other shocks (at 1% level of significance) but was insignificant in the face of drought at 10% level of significance. The choice between using savings and seeking help was significant in the face of drought and pests (at 5% level of significance), bad seed quality and other shocks (at the 1% level of significance) but was insignificant for floods and livestock epidemics at 10 percent level of significance.

Similarly, the choice between using savings and widening employment was significant in the face of drought, livestock epidemics, bad seed quality and other shocks (at 1% level of significance) but was insignificant for floods at 10% level of significance. The choice between using savings and borrowing was significant in the face of drought (at 5% level of significance), floods and pests (at 10% level of significance) and livestock epidemics (at 1% at level of significance) but was insignificant for bad seed quality and other shocks at 10 percent level of significance. The choice between using savings and other strategies were significant in the face of floods, pests and livestock epidemics (at 1% level of significance) but were insignificant for drought, bad seed quality and other shocks (at 10% level of significance).

The households' use of assets compared to use of savings was found to be statistically significant for region (at 5% for eastern and northern and 10% for western) but was insignificant for location, gender, age, household size, economic status and education status. Similarly, compared to use of savings, reduction in family expenditure was significant for region (at 1% for eastern and 5 % for western but insignificant for northern), age and economic status (at 1%) but it was insignificant for gender, household size and education status. Seeking help compared to use of savings, was significant for region (northern at 5% but insignificant for eastern and western), gender and age (at 1%), household size (6 to 9 persons at 1 percent, 10 and more at 10%, but 3 to 5 persons insignificant) and economic status (at 10%). Location and education status had insignificant effect on coping strategies compared to use of savings. The choice between using

savings and widening employment compared to use of savings was significant for region and age (at 1%), household size (6 to 9 persons at 5 percent and 10 and more at 10 percent but 3 to five persons insignificant), economic status (at 10%) but insignificant for location and education status. The choice between using savings and borrowing was significant for region (at 1% for western and insignificant for eastern and northern) and insignificant for location, gender, age, household size, economic status and education. The choice between using savings and other strategies resulted in significant results for location (at 1%), region (eastern and western at 1percent but insignificant for northern) and economic status (at 10%). It was insignificant for gender, household size and education.

5.2 Conclusions from the study

5.2.1 Conclusions from descriptive statistics

The most dominant specific shocks that affected rural people were drought, floods and livestock epidemics in that order, while for the urban areas, they were drought, livestock epidemics and floods in that order. Therefore, similar shocks affected rural and urban dwellers, although with varying occurrence.

Basing on drought, the northern region was the most affected, followed respectively by the western, eastern and central regions. Floods were reported more in the eastern region, followed respectively by the western, northern and central regions. Northern region was also the most affected by pests and bad seed quality. Therefore it was the most affected region by shocks. The most affected household size was the 6 - 9 persons, followed by the 3 - 5 persons.

Compared to the non-poor households who were mostly affected by other shocks, the poor households were more affected by drought, floods, pests and livestock epidemics. Bad seed quality shock was also reported more by the poor than by the non-poor households. Respondents with formal education mainly experienced other shocks while those with no formal education faced mainly drought shocks.

A combination of ‘other’ strategies was the most used strategy but savings was the most used specific strategy for the first choice strategy, borrowing for the second choice strategy and

seeking help for the third choice strategy. More males than females used savings to cope (for first choice strategy) while more females than males sought help.

The most used response to shocks in the rural areas was 'other' strategies, followed by reduction in family expenditure and seeking for help respectively. Urban households used more of their savings. The most used responses per region were seeking help and reducing family expenditure for the central region; seeking help and widening employment for the eastern region; 'other' strategies and reducing family expenditure for the northern region; and using savings for the western region.

There were significant differences in reporting shocks by location, region, gender, household size, and economic status. However, there was no significant difference in reporting shocks according to education status. For the first choice strategy, there were significant differences in the type of strategies basing on gender, location, region, household size, and economic status. However, there was no significant difference in reporting shocks according to education status.

The choice of coping strategies was significantly different for various shocks for the first choice strategy. For the second choice strategy, there were significant differences in the choice of strategies basing on region, household size, economic status and location. For the third choice strategy, there were no significant differences in the choice of strategies basing on gender, location, region, household size and economic status.

5.2.2 Conclusions from multinomial logistic regression results

The conclusion from multinomial logistic regression results is that in the face of drought, floods/hailstorms, pest attack, livestock epidemics and bad seed quality households are significantly more likely to use savings than assets or seek help or reduce family expenditure or widen employment.

In the face of pest attack and livestock epidemics affected households are more likely to use other coping strategies other than savings. In general residents located in urban areas were

significantly less likely to use other strategies than use their savings compared to their rural counterparts.

Compared to the central region, the eastern, northern and western regions were more likely to use assets than savings in the face of shocks. Male-headed households were less likely to reduce family expenditure than use savings, but were more likely to widen employment than use savings.

The more the age of the household-head, the more likely it was for one to cope by reduction of family expenditure than by use of savings. Based on household size, compared to the 2 persons and below, the 6 to 9 persons' households were less likely to seek for help or widen employment than use savings. Compared to the non-poor, the poor were more likely to reduce family expenditure or widen employment than use savings.

5.3. Recommendations from the study

The study recommends that emphasis should be put on programs that mitigate and manage drought, floods and livestock epidemics. This should be done by the government and NGOs by mobilizing and channeling resources in terms of time, funds and research to introduce drought resistant crops, boost incomes and extension services to control livestock epidemics in areas that are prone to these shocks, particularly rural areas. However, urban areas should also be taken into consideration by introducing programs unique to their conditions since they are also affected.

The government and development partners should provide resources to prevent and mitigate shocks in the northern region, which is the most affected region. This should be done by establishing and funding new programs as well as supporting established programs that prevent and control drought, floods, livestock epidemics and other shocks. Support should also be made available to other affected regions since they were also affected by the different shocks.

Support should focus more on large households. This is because large households have many children who need extra care. Support can be in the form of seeds, loans, food, funds, education,

sensitization and others. This may also call for family planning programmes which may help control the family sizes and thus their vulnerability to shocks.

Interventions that boost incomes should be provided to the non-poor so as to increase their welfare through employment provision and business enhancing policies like low taxes. The poor should be provided with social security whereas the non-poor should be assisted to save. This recommendation is based on the fact that saving requires sacrificing some amount of resources meant for current consumption, which the poor whose incomes are highly constrained may not afford.

Policy actions by government should focus on the use of modern methods of farming such as immunization of livestock, deeping, artificial insemination, spraying, extension services, and others. This will help address livestock epidemics that affect many livestock farmers. Programmes to strengthen other strategies such as change of crop choices or improvement in technology should be supported through funding of extension services by government. However, such programmes should always be implemented in consultation with the people they are designed to target in order to ensure their effectiveness. Government and other organizations can fund such programs and encourage people to participate in them.

Government should provide infrastructure and sensitization for rural areas in order to boost economic activities which may enable rural dwellers to cope with shocks. Learning of new methods of farming by rural people should be emphasized through the provision of extension services. For urban areas, government should emphasize saving and investment. Mechanisms designed to suit a region's circumstances should be established to raise employment and incomes. For the northern region, other strategies should be supported through the provision of better seed and innovative ways of farming. For the western region, boosting savings is an important intervention. These measures should be adopted by government as well as NGOs.

Policy interventions should prioritize support for the first and second choice strategies. This needs to be done carefully taking into account the various aspects of gender, region, economic status, household size, economic status and location. Household saving should be promoted by

government and development partners. Households should be empowered through education provision particularly to large families since they have many children. Training as well as improvement in the business environment in order to enhance employment opportunities should also be encouraged.

The government should boost support to local governments whose structures are used to offer help to the affected households. Social insurance structures should be established to help both the poor and non-poor to cope with disasters. Other strategies such as the use of improved seed and use of better ways of farming should be enhanced so that the poor can effectively cope.

In cases where drought, floods/hailstorms, pest attack, livestock epidemics and bad seed quality are prone, there is need to boost savings. This should be done through the establishment of formal and informal saving avenues. The government and civil society organizations should promote the formation of social security mechanisms; and provide education, health, sanitation, nutrition, income and others. This will enable the poor manage through prolonged shocks such as drought.

Borrowing channels such as the SACCOs should be funded by government and NGOs. Programs that encourage extra employment such as non-farm self-employment activities like carpentry and business should also be supported by government and non-government authorities. Households need to be sensitized in order to learn how to save by joining formal or informal savings groups within their communities.

Government should increase support research institutions through increased funding in order to control pest attacks. Institutions that are involved in funding development projects should also support businesses in rural and urban areas. Funding should also target transport and communication infrastructure and extension services so as to boost people's income to enable them save more. Government should also provide rural areas with electricity, water, extension services and marketing channels should be enhanced. These will encourage households to increase their involvement in production thus raising their income and hence savings.

For the four regions of the country, programmes that are aimed at increasing household savings should be provided and encouraged by government and NGOs. In addition for the northern, eastern and western regions, programmes that increase assets need to be supported through sensitization as well as provision of relevant infrastructure and projects.

Revamping savings in male headed households by government should be prioritized. This should be followed by the provision of employment. Government and non-government players should set up, fund and support programmes that raise household savings. While for females; programs that increase their income should be adopted. The government should employ both macro and micro strategies. These may include reduction in taxes on goods consumed by the poor as well as the provision of key social economic and physical infrastructures such as roads, railways, schools, hospitals, SACCOS and banks which together will allow households to earn and save more.

5.4 Limitations of the study

This study used secondary data collected by UBOS. Some other variables that would have been of interest for this study were not included in the UBOS data. These include traditional and cultural coping and survival options in the event of failure of conventional crop and livestock farming. Other variables such as brick making, charcoal burning, art, *bodaboda* cycling and others were not included.

5.5 Area for further study

The focus for this study was analysis of covariant shocks and their effects on coping strategies. There is a need for further research about the effect of individual (idiosyncratic) shocks to provide a balanced picture of shocks and their effects in Uganda. There is need to conduct studies that investigate the other factors which influence the choice of coping strategies other than those investigated in this study.

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APPENDICES

1. Descriptive statistics

Variable	obs	mean	std.Dev	Min	Max
Copmechan					
2	4885	0.206141	0.404575	0	1
3	4885	0.131832	0.338343	0	1
4	4885	0.201433	0.401112	0	1
6	4885	0.152508	0.359549	0	1
6	4885	0.033982	0.1812	0	1
7	4885	0.251996	0.434203	0	1
Drought	4885	0.640737	0.479834	0	1
Floods	4885	0.217196	0.412379	0	1
Pests	4885	0.038281	0.191892	0	1
Lepidemic	4885	0.149437	0.356555	0	1
Bsquality	4885	0.044012	0.205143	0	1
others	4885	0.249539	0.432791	0	1
1.urban	4885	0.176663	0.381423	0	1
region					
2	4885	0.245855	0.430637	0	1
3	4885	0.286796	0.452312	0	1
4	4885	0.228659	0.420012	0	1
1.Sex	4885	0.718731	0.449665	0	1
Age	4885	43.14985	15.6667	13	105
Hsizegroup					
2	4885	0.391198	0.488068	0	1
3	4885	0.378096	0.484962	0	1
4		0.08393	0.277312	0	1
1.poor06	4885	0.300921	0.458706	0	1
2.educlevel2	4885	0.301945	0.459148	0	1

2. Hausman test for Independence of Irrelevant Alternatives (IIA) results

	Coefficients			
	(b) Full model	**(B) Restricted**	**(b-B) Difference**	**sqrt(diag(V_b-V_B)) S.E.**
Variables				
Floods	-0.6287	-0.3147	-0.3140	0.1862
Pests	0.5712	0.7874	-0.2161	0.1515
Livestock epidemics	-1.4757	-0.8588	-0.6168	0.3079
Bad seed quality	-1.0792	-0.4853	-0.5939	0.3072
Others	-0.4073	0.5457	-0.9530	0.4052
Eastern	0.7534	0.7495	0.0039	0.0118
Northern	1.3345	1.2618	0.0727	0.0374
Western	0.4300	0.4067	0.0234	0.0052
Urban	-0.7671	-0.7193	-0.0477	0.0268
Three to 5 persons	0.1109	0.0753	0.0357	0.0177
Six to 9 persons	0.0532	0.0098	0.0434	0.0126
Ten and more persons	0.1538	0.1290	0.0248	0.0281
Poor	0.8148	0.8111	0.0037	0.0123
Male	-0.1592	-0.1458	-0.0134	0.0169
Age	0.0075	0.0074	0.0001	0.0004
Not literate	-0.1850	-0.1841	-0.0009	0.0041
Constant	-2.1907	-3.1472	0.9565	0.4027
b = consistent under H_o and H_a; obtained from mlogit B = inconsistent under H_a, efficient under H_o; obtained from mlogit				
Test: H_o: difference in coefficients not systematic				
$chi^2(17)$ = (b-B)'[(V_b-V_B)^(-1)](b-B) = 5.33				
Prob>chi^2 = 0.9967				
(V_b-V_B is not positive definite)				