

**Measuring Rural Household Vulnerability to Food Insecurity: the Case of UMzimkhulu
Local Municipality, KwaZulu-Natal, South Africa**

By

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DECLARATION

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As the candidate's supervisor, I agree to the submission of this dissertation.

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Prof E.W. Zegeye (Supervisor)

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ABSTRACT

The objective of this study is to examine the factors associated with vulnerability to food insecurity among rural households in Umzimkhulu Local Municipality, KwaZulu-Natal. This includes identification of the most vulnerable and food insecure households and assessment of their needs; studying socio-economic and demographic characteristics of the most vulnerable; and understanding the sources of idiosyncratic shocks which expose households to food insecurity. Food insecurity is measured by Vulnerability as Expected Poverty (VEP) using data collected from 150 households from ward 12 and 14 under Umzimkhulu Local Municipality. This model allows the estimation of vulnerability using cross-sectional data from a single point in time which as a result limits data requirements.

Variables that were found to have a statistically significant effect on household future food consumption were education level, household productivity ratio, age of household head representing experience and wealth accumulation in the course of the household life cycle, Coping Strategy Index (CSI), Total Livestock Unit (TLU), Food Consumption Scores (FCS), and the number of household members who fall sick in the year preceding the survey.

The findings of the study show education and labour as two fundamental factors that contribute towards improved household food security and economic strength. The low literacy levels in rural areas is still evident; thus the government interventions to enhance access to education by all is required as it hinders and minimises employment opportunities hindering socio-economic development therefore aggravates the poverty cycle. With regards to labour productivity of households has a positive effect towards the improved household food basket. The higher labour productivity in both on-farm and or off-farm activities strengthens the economic power for food purchases.

Age of the household head was found to have a negative effect on the vulnerability of rural households to food insecurity. This is because as people get older they accumulate socio-economic wealth. In this study socio-economic wealth is referred to experience or wisdom and asset acquirement. People who were over 65 years were reported that their contribution to household food basket depreciated with a negative implication on household productivity maximising exposure to vulnerability. There is a need for rural development policies to refocus on creating jobs for rural economic active group and further develop support systems for the older generation already in pension to optimise their livelihoods options.

Limited diversified livelihood strategies used by rural households compromised the household food security status exposing them to vulnerability. Consequently, the constrained diet of the household was found to pose a negative effect on income and education improvements. More diversified livelihoods opportunities maximise the chances of households the poverty trap. An intensive support in agricultural activities, job creation and equipping people with appropriate skills is highly recommended.

In this study livestock ownership was regarded as an investment, buffer and a coping strategy. Livestock plays a significant role in the well-being of rural households. This is a strategy used by most rural households to be resilient towards poverty and vulnerability as they used livestock to send their children to school and for food consumption. This suggests how critical agriculture is for effective development policies addressing food insecurity in rural areas.

Priority has to be given to rural development agenda in South Africa as it was found that about half of the sampled households were both currently food insecure and highly vulnerable to food insecurity. This suggests that while long-term interventions that promote investment on education, infrastructure and job creation are highly needed, provision of food

parcels and food stamps can be an appropriate relief to households that are severely suffering from food insecurity.

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God, for being my spiritual guide.

TABLE OF CONTENT

DECLARATION.....	i
ABSTRACT.....	ii
ACKNOWLEDGEMENTS	v
TABLE OF CONTENT.....	vi
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF APPENDICES	xi
LIST OF ABBREVIATIONS	xii
CHAPTER ONE. INTRODUCTION.....	1
1.1 Background.....	1
1.2 Motivation of the Study	3
1.3 Objectives of the Study	4
1.4 Methodological Overview	5
1.5 Organisation of the Study.....	5

CHAPTER TWO. LITERATURE REVIEW	6
2.1 Pillars of the Concept of Food Insecurity.....	6
2.1.1 Food Availability	6
2.1.2 Food Accessibility.....	8
2.2 How Do Risks or Shocks Affect the Food Insecurity Status?	9
2.3 Dimensions of Food Insecurity in South Africa	11
2.3.1 Background	11
2.3.2 Empirical Evidence on Poverty and Food Insecurity in South Africa.....	12
2.3.3 The Reasons for the Prevalence of Food Insecurity in Rural South Africa	13
2.3.4 The Contribution of Smallholder Farming to Rural Household Food Security	15
2.4 Evaluation of Policies Implemented to Counter Food Insecurity in South Africa	16
2.4.1 Social Grants	16
2.4.2 Land Redistribution.....	17
2.4.3 The National School Nutrition Programme	21
2.5 The Concept of Vulnerability to Food Insecurity	22
2.6 Summary	24

CHAPTER THREE. RESEARCH METHODOLOGY	25
3.1 Study Area	25
3.2 Sampling and Data Collection.....	28
3.3 Review of Methods Used to Measure Food Insecurity and Vulnerability	29
3.4 Coping Strategies Index.....	33
3.5 Food Consumption Scores	35
3.6 Household Productivity Ratio	37
3.7 Vulnerability as Low Expected Utility (VEU) and Vulnerability as uninsured Exposure to risk (VER).....	38
3.7 Vulnerability as Expected Poverty (VEP).....	39
CHAPTER FOUR. EMPIRICAL RESULTS AND DISCUSSIONS	44
4.1 Descriptive Statistics	44
4.2 Income Sources for Sample Rural Households in Umzimkhulu	51
4.3 Future Food Consumption Expenditure Analysis	53
4.4 Vulnerability and Food Insecurity Classifications.....	59
CHAPTER FIVE. CONCLUSIONS AND POLICY IMPLICATIONS	61
5.1 Recapping the Purpose of the Study.....	61
5.2 Summary of Key Findings.....	62
5.3 Conclusions and Policy Implications	63
5.4 Limitations of the Study and Suggestions for Future Research	65
REFERENCES.....	67
APPENDICES	72

LIST OF TABLES

Table		Page
Table 2.1:	Cluster Membership and Characteristics (N=150)	19
Table 3.1:	Household Vulnerability Index (HVI)	31
Table 3.2:	The Standard Food Groups and Current Standard Weights	36
Table 3.3:	Food Consumption Scores Thresholds	37
Table 4.1:	Descriptive Statistics on the Explanatory Variables and Expected Signs, UMzimkhulu Rural Households	45
Table 4.2:	Household Productivity Ratio	46
Table 4.3:	Food Consumption Scores for Umzimkhulu Rural Households	50
Table 4.4:	The Main Sources of Income for Rural Households in Umzimkhulu	51
Table 4.5:	Estimates of Future Log-Food Consumption Expenditure and Variance (N=150)	54
Table 4.6:	Classification of Umzimkhulu Households by Vulnerability and Food Security Status	59

LIST OF FIGURES

Figure	Page
Figure 2.1: Population and Global Food Production Indices (1966-1998)	7
Figure 3.1: Map of KwaZulu-Natal	26
Figure 3.2: Map of Sisonke District Municipality	27
Figure 4.1: Current Level of Income of Households Studied in Umzimkhulu, December 2013 (N=150)	52

LIST OF APPENDICES

Appendices	Page
Appendix 1: Household Survey Questionnaire	72
Appendix 2: The Results on the Socio-Economic Status of the Study Area	85
Appendix 3: OLS Regression Results of Food Consumption Expenditure Function	88
Appendix 4: Variance of the Error Term Explained by Household Characteristics	89
Appendix 5: OLS Regression Results for Variance of Future Household Food Consumption	90
Appendix 6: OLS Regression Results on Future Household Food Consumption	91
Appendix 7: Variance Inflation Factor for the Explanatory Variables	92
Appendix 8: Classification of Umzimkhulu Households by Vulnerability and Food Security Status	92

LIST OF ABBREVIATIONS

BRG	Bio-Resource Group
BRU	Bio-Resource Units
CBPWP	Community-Based Public Works Programme
CFSVA	Comprehensive Food Security and Vulnerability Assessment
CMIP	Consolidated Municipal Infrastructure Programme
CSI	Coping Strategy Index
FCS	Food Consumption Scores
FGLS	Feasible General Least Squares
HEA	Household Economy Approach
HVI	Household Vulnerability Index
IFSPC	Integrated Food Security Phase Classification
IHM	Individual Household Method
NSNP	National School Nutrition Programme
OLS	Ordinary Linear Regression
PRIF	Poverty Relief and Infrastructure Investment Fund
PSNP	Primary School Nutrition Programme
VAA	Vulnerability Assessment and Analysis
VEP	Vulnerability as Expected Poverty

VER	Vulnerability as uninsured Exposure to Risk
VEU	Vulnerability as low Expected Utility
VI	Vulnerability Indices
VIF	Variance Inflation Factor

CHAPTER ONE. INTRODUCTION

1.1 Background

Poverty is the state of one lacking resources to meet basic needs such as food, shelter, clothing, health care and education (Spillane, 2000). It is deprivation of wellbeing (Sen, 1981) as it includes low incomes resulting to inability to acquire the basic goods and services necessary for survival with dignity.

Poverty reduction is a major goal for many international organisations such as United Nations and World Bank. According to World Bank (2008), about 1.29 billion people in the world were estimated to be living in absolute poverty and this estimate was made based on a poverty line threshold of \$1.25 a day. About 47% of these people were from sub-Saharan Africa and this made the region with the highest rate of absolute poverty in 2008. Inflation, low incomes and high unemployment rate as a result of economic crisis were indicated as some of the reasons for increasing rates of hunger (FAO, 2009). This is because given a fixed level of income, an increase in price level will reduce the individual amount of expenditure which implies that increases in food prices, given that people are unemployed or have low incomes, reduces the affordability thus less accessibility to sufficient amount of food with adequate nutritional level.

On the other hand, food insecurity is a complex sustainable development issue, linked to health through malnutrition but also to sustainable economic development, environment and trade. There is a great deal of debate concerning food security as it is a complex issue in terms of its meaning, ideological orientations, conceptual issues, and causation (Triegaardt, 2005). As the above statistics suggest how severe poverty and food insecurity are globally, this has brought the need to address this issue especially by developing countries' governments where rural population (perceived to be poorer than their urban counterparts)

dominate. According to FAO (1996), the notion that food security exists “when all people at all time have physical and economic access to sufficient, safe and nutritious food to meet their dietary food requirements for an active and healthy life” was developed after 1996 World Food Summit.

This definition integrates food availability, accessibility and utilisation of nutritionally adequate food and its stability. Food availability refers to the presence of food from the household to national level (from own production or through market) whereas food accessibility refers to the ability to obtain an appropriate and nutritious diet and this is normally linked to entitlement to resources at the household level (Sen, 1981). Concerns about whether individuals and households make use of the food they have access to, are addressed by examining utilisation. This implies that, the ultimate aim is to ensure that, at all times (stability), people have access to enough food for an active and healthy life (Hamelin *et al.*, 2002). If any of these conditions do not hold then food insecurity exists.

Various definitions have been developed for vulnerability over the years by researchers from different disciplines (such as economics, psychology and anthropology) as they used the term in line with their discipline orientation. For instance, human geographers and ecologists theorise vulnerability mainly in the context of environmental change and exposure to environmental/natural hazards or shocks. This has necessitated to look closely to establish an explicit definition of vulnerability; the definition that is relevant to the research context. In the case of food insecurity, vulnerability refers to people’s propensity to fall or stay below food security threshold within a certain timeframe (Lovendal & Knowels, 2006).

Household’s vulnerability to food insecurity depends both on how the household is exposed to and their capability to withstand shocks that are associated with food insecurity (Dilley & Boudreau, 2001 cited by Hesselberg & Yaro, 2006). Households can then be food secure

using the farm and non-farm activities which together provide a variety of procurement strategies for cash and food (Hesselberg & Yaro, 2006). This implies that for a household to be less exposed, withstand shocks and be less vulnerable to food insecurity, there is a need to have control over multiple income sources (both farm and non-farm).

1.2 Motivation of the Study

In South Africa, even though the country is considered to be nationally food secure, the anecdotal and empirical evidence shows that malnutrition and food insecurity rates are rising in some parts of the country (Hendriks, 2013). The rural areas of South Africa are grappling with increasing unemployment, higher HIV and AIDS prevalence and poor basic service delivery as multiple challenges of attaining sustainable food security. With the post 2007/08 food price spike, the conditions do not show any signs of abating.

This problem can be addressed through policies informed by studies that empirically investigate the root causes and consequences of food insecurity. However, households that are regarded as food insecure may include some that are only transitory food insecure as well as others who will continue to be food insecure, even with a worsening trend in the future. Household observed food insecurity status is defined in most cases by whether or not household's level of consumption expenditure is above or below a pre-determined food insecurity threshold or poverty line. This is known as ex-post measure of household's well-being. For policy purposes, what really matters is the chance that a food secure household will fall below the food security threshold or if currently food insecure, will remain food insecure in the future or the food insecurity will worsen in the future.

Addressing vulnerability to food insecurity is essential because it is essential to mitigate the negative consequences of food insecurity and under-nutrition on economic and social development. Such an intervention has to aim to prevent or reduce future poverty or food

insecurity, not just address current poverty. Moreover, this study contributes to the emerging and scarce literature on vulnerability to food insecurity, particularly in South Africa. It can also be easily adapted and scaled-up to regional and national level analysis based on the availability of data.

This study will evaluate the socio-economic and demographic conditions that rural households of Umzimkhulu identified as making them currently food insecure and or likely to make them food insecure in the near future. This can then be elevated to strategies they use to withstand risks or shocks that can lead them to be food insecure and or vulnerable to food insecurity. It is worth noting that this requires the study of various forms of risk which can expose households to food insecurity before dealing with coping strategies. Empirical evidence on this linkage will pave the way for recommendations on the required policy interventions and institutional innovations to meet the potential food security challenges in South Africa.

1.3 Objectives of the Study

The general objective of this study is to undertake a critical assessment of factors associated with vulnerability to food insecurity among rural households in Umzimkhulu Local Municipality which is under Sisonke District Municipality, KwaZulu-Natal. The specific objectives include:

- Identification of the most households vulnerable to food insecurity and assessment of their needs,
- Profiling the socio-economic and demographic characteristics of the most vulnerable, and

- Identification of idiosyncratic¹ shocks which expose households to food insecurity.

1.4 Methodological Overview

Data on the vulnerability of rural households to food insecurity were collected from 150 Umzimkhulu rural households using random sampling procedure. The model that was employed for data analysis is Vulnerability as Expected Poverty (VEP) and estimates for parameters were obtained using the three-step Feasible General Least Squares (FGLS). VEP was expressed as a function of the expected mean and variance of household consumption. Vulnerability Indices (VI) with values ranging from zero to one for each household were also computed. Households with VI less than 0.5 were regarded as less vulnerable to food insecurity while households with VI greater or equal to 0.5 were regarded as more vulnerable to food insecurity. Detailed information on the research methodology and data analysis are given in chapters three and four, respectively.

1.5 Organisation of the Study

The study is organised as follows: A literature review of the South African food insecurity situation, effects of risks and shocks on household food consumption and evaluation on policies implemented to address food insecurity are given in Chapter Two. Empirical research was conducted and the data collection tools are presented. Secondary data was also done to review methods used to measure food insecurity in past studies and a model adopted in this study are in Chapter three. Chapter four presents the empirical study findings and discussion on the vulnerability. . Finally, Chapter Five draws conclusions, presents the policy implications and provides future research directions.

¹ Any form of shock that makes the household vulnerable.

CHAPTER TWO. LITERATURE REVIEW

This chapter presents a review of literature documented on household food insecurity and vulnerability. The review provides the researcher with an insight on how previous studies were conducted and guides on which models would be appropriate to model rural households vulnerability towards food insecurity.

2.1 Pillars of the Concept of Food Insecurity

Food insecurity is a situation that exists when people lack access to resources (human and non-human) to acquire food through production or purchasing, inappropriate distribution or inadequate utilisation at household level, thus negatively affect active healthy life and well-being of households (WHO, 1992). Food insecurity is commonly conceptualised as resting on four pillars, namely, availability, accessibility, utilisation and stability. These concepts are briefly explained below.

2.1.1 Food Availability

The past-half century has been marked as the period of growth in food production; this has allowed a drastic reduction in proportion of hungry people in the world despite the doubling of the total population (Godfray *et al.*, 2010). According to Rosegrant *et al.* (2001), approximately one billion people were added to the world population each decade for the past three decades. However, this was accompanied by increases in cereal and meat production and their respective growth rates exceeding the population growth rate (figure 1).

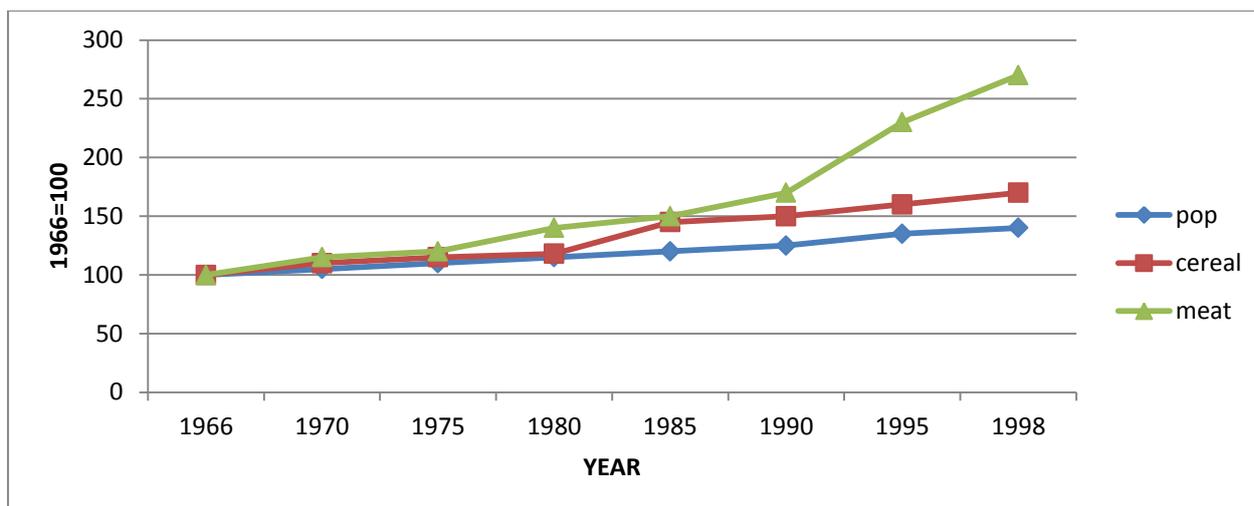


Figure 2.1: Population and Global Food Production Indices, 1966-1998

Source: FAOSTAT cited by Rosegrant *et al.*, (2001)

Cereals were mainly produced by Argentina, Australia, Europe and North America and it was distributed throughout the world by way of exports. Over the last two decades of this period (from the 80s to 90s), United States of America and Western Europe subsidised farmers who were producing cereals and consequently cereals production increased significantly. This also led to a considerable decrease in the world cereal prices, namely, maize, rice and wheat and consequently quantities of food supplied to the market had met the market demand (Rosegrant *et al.*, 2001). This benefitted consumers through low prices even though producers who were not subsidised incurred losses. Increasing income in some parts of the developing world was part of the reasons for a steady increase in meat production, particularly poultry.

2.1.2 Food Accessibility

Sen (1981) is generally credited with shifting the food security debate away from an exclusive on the availability food supplies, towards a focus on the ability of households' access to food. His work highlighted the effect of personal entitlements (resources used for production, exchanged and transfers) in ensuring access to food. The livelihood activities that people pursue are based on the quantity and quality of assets that they have access to. Assets can be various types (social, financial, physical, nature and human) and be privately or public held. Assets are important to risk management as tools for smoothing consumption. Different households have different levels of access to assets, influence their ability to prevent, mitigate or cope with shock.

Meeting the market demand is a necessary but not sufficient condition for addressing food insecurity because when people lack resources their needs are not translated to market demand (Mabaso *et al.*, 2014). Some statistics show that, globally, more than one in seven people do not have access to sufficient protein and energy from their diet and even more suffer from some form of micronutrient malnourishment (Godfray *et al.*, 2010). The ability of a household to produce sufficient food for one's household at home is one way that a household could ease accessibility to food thus achieving food security. It is thus expected that measures of home production, crop sales and measures of income or wealth to be predictive of food insecurity. Accessibility is primarily based on whether people at household level have enough resources to buy food available in the market and this is determined by prices at which food commodities cost (purchasing power).

2.1.3 Food Utilisation

According to The World Bank (2013), during the 2007/08 global food price crisis about 1.1 billion people were living on less than \$1 a day and 923 million were undernourished. This led to many countries being confronted with major social and political crisis including food riots and massive public protests which threatened governments as well as social stability in Africa, Asia, Middle East, Latin America and the Caribbean (United Nations, 2011). With the post 2007/08 food price spike, the conditions do not show any signs of abating. High and volatile food prices have become normal and poor families are coping by eating cheaper and less nutritious food which can have catastrophic life-long effects on the social, physical and mental well-being of millions of young people (World Bank, 2013).

Utilisation reflects concern about whether individuals and households make good use of the food to which they have access to. This includes consumption of nutritionally essential foods people can afford and safe foods which are properly prepared, under sanitary conditions so as to deliver their full nutritional value (Barrett, 2010). Utilisation is all about nutrition security. Stability then implies the consistency in food availability, accessibility and utilisation. Food insecurity analysis becomes more complex as one moves from mere availability to capturing the three dimensions. After giving concise definitions and presenting the pillars of food (in)security one can then elevate this by looking at the effects of being exposed to risks or shocks on food insecurity status, to which the following section turns.

2.2 How Do Risks or Shocks Affect the Food Insecurity Status?

The food security status of households is sensitive towards factors such as climatic fluctuations, conflicts (wars), job loss and epidemic diseases (Webb *et al.*, 2006). The risks compromise the stability of food security affecting the other three pillars of food security. Currently, climatic fluctuation risks have been reported to pose much threat to food security

as higher temperatures are projected to have a significant negative impact on agricultural productivity, farm incomes and this leads to food insecurity (Battisti & Naylor, 2009).

The 2007/08 food crisis has been a partial demonstration on how disruptive poor weather conditions can be in international markets. Amongst other reasons such as rising of oil prices and greater demand for biofuels, weather shocks (mainly drought) particularly in Australia put pressure on wheat price. Ukraine and other major cereal exporters restricted exports due to poor harvests caused by drought and as a strategy to protect their domestic prices (Headey & Fan, 2010). Severe drought was also experienced in the entire East Africa region between July 2011 and mid of 2012, which led to a severe food crisis across countries such as Somalia and Ethiopia and this threatened the livelihoods of about 9.5 million people (Rosegrant *et al.*,2001). A large number of refugees escaped Somalia to neighbouring countries (Kenya and Ethiopia). Crowding, unsanitary conditions together with severe malnutrition led to a number of deaths.

Wars and conflicts over resources, especially in Africa, are important factors influencing food insecurity and they are truly important components of human security (Ali & Lin, 2010). In the case of wars, people are at risk of losing access to the most basic necessities such as food and consequently millions of people live in the shadow of famine and poverty. This is explained by the fact that with political instability there are serious destructions in government systems, infrastructure, market and human resources required for food production and there will be devastating food insecurity through destruction of crops and the decimation of the farming population (Ali & Lin, 2010). Between 1980 and 2000, about 24 million people in 28 African countries were left with a shortfall of food as a consequence of violent conflict and there was an increase of about 13% in infant mortality rate during war time (Ali & Lin, 2010). Furthermore, some studies have shown that adult mortality exceeded

the infant mortality rate. Having discussed the possible roots of food insecurity in the world and Africa as a whole, the next section focuses on the situation of food insecurity in South Africa.

2.3 Dimensions of Food Insecurity in South Africa

2.3.1 Background

Sen (1981) in his treatise “Poverty and Entitlement” stated that availability of enough food in the aggregate is not sufficient for food security. This has been the case in South Africa that despite the fact that it is considered to be nationally food secure, malnutrition and food insecurity rates are conversely increasing in some parts of the country (Altman *et al.*, 2009). This is mainly due to suffering of rural households from increasing unemployment, HIV/AIDS making them less productive and lacking basic service delivery.

It is important to note that with food insecurity only stable deprivation of nutritionally adequate food is covered. This implies that it is possible for one to be rich but food nutrition insecure. The implicit implication of the earlier definition for poverty is that lack of resources (stock of endowments including physical, financial, natural, human and social capital) or low returns from these endowments may cause people to be poor and food insecure.

According to Baulch and Hoddinott (2007), households allocate their endowments across a number of activities based on the expected level of returns and nature will thereafter intervene in the form of shocks. These shocks are covariant if they affect all households in a specified area (e.g. drought and floods) and they are idiosyncratic (e.g. lengthy illness and death of economically active and adult household members) if they affect specific households. These shocks may then eradicate endowment’s stock and/or the returns from these endowments. The importance of these endowments is that their allocation and returns to them generate income which is used for consumption of goods and services. When these

shocks occur, income level decreases and this is likely to reduce consumption level thus household consumption level fluctuates over time (*ceteris paribus*).

The severity of these shocks determines the extent to which households seek consumption given these shocks and there is vast empirical literature that shows that poor households have limited smoothing ability due to liquidity constraints (Spillane, 2000). Hall (2005) emphasises that poverty observed in a single cross-section will be due to consistently low welfare levels and/or short-term shocks. It has also been noted that virtually all households in some localities appear to experience poverty at some time during their life (Spillane, 2000).

2.3.2 Empirical Evidence on Poverty and Food Insecurity in South Africa

Despite new statistics showing a considerable improvement in global nutritional status, it is contemporaneously decreasing in some developing countries, especially in Africa. According to a UNICEF report 2001, about 150 million children were estimated to be malnourished in developing countries of which 32 million people (about 21%) were living in Africa. These high levels of malnutrition in children and women in Africa pose a challenge for child survival and development.

A South African study was conducted by Rose & Charlton (2002) using Stats SA household survey data from a sample of 28,704 households. The results indicated that prevalence of food poverty in SA in 1995 was 43%. Food poverty rates were the highest among households headed by Africans (55.6%), followed by Coloureds with 34.9%, Indians (9%) and Whites (3.1%). There was also a positive correlation between food poverty and decrease in household head income, increase in household size, households in rural areas and households headed by females.

Another study was conducted by Oldewage-Theron *et al.* (2006) and it was based in Vaal Triangle in South Africa. The results indicated that about 68.8% of caregivers had an income

of less than R500 a month, 70.5% indicated a frequent shortage of money and 58.8% spent less than R100 per week on food. In terms of coping strategies, about 74.7% reduced the variety of food served, 80% limited portion sizes, 68.4% skipped meals and 75.8% were maternal buffering. The conclusion was that this community was poverty-stricken with food insecurity where caregivers changed food consumption as coping strategy, thus compromising nutrition.

McGarry & Shackleton (2009) also conducted a study on the role of natural resources in the lives of rural children experiencing heightened vulnerability to poverty and HIV/AIDS. It was found that wild food use by rural children was a regular activity that supplemented their domestic diets. The results further indicated that the quality of children's domestic diets was, on average, 60% lower than the FAO guidelines. This occurred in a population where 60% of the children surveyed were supplementing the diets with wild foods; and 30% with over half their diet supplemented this way. However, dietary diversity increased significantly by 13% when wild foods supplementation occurred. Another finding was that commercialisation of wild foods (observed among 47% of the children), wherein significantly more vulnerable children sold these foods. The conclusion was that wild foods represent the last freely attainable food sources available to rural poor households.

2.3.3 The Reasons for the Prevalence of Food Insecurity in Rural South Africa

To effectively implement policies at improving food insecurity, a thorough understanding of the location and causes of food insecurity is needed (Hamelin *et al.*, 2002). While food availability is still a problem for some countries, the root cause of food insecurity in developing countries today is believed to be the inability of people to gain access to food due to poverty (Spillane, 2000). The causes of food insecurity are long and multifaceted; they range from political instability, war and civil strike, macroeconomic imbalances to

environmental degradation, poverty, population growth, gender inequality and inadequate education (Hamelin *et al.*, 2002).

Smith *et al.* (2000) used data from 58 developing countries to examine the relative importance of national food availability and poverty in determining food insecurity in the late 1990s. The results indicated high poverty prevalence and this suggested severe food access problems; this was positively correlated with major food availability problem. Of the 26 developing countries that were dietary energy deficit, 17 were from Sub-Saharan Africa. Poor health environment was seen as a major contributing factor to child malnutrition as only 42% of the population had access to health services, safe water and sanitation. Ethiopia and Niger were among the countries in the region with the highest child malnutrition rates and Somalia with the worst food availability problem of all developing countries.

In a study by Oldewage-Theron *et al.* (2006), large percentage of the breadwinners were illiterate as 23.2% of them did not have any formal school education and 48.5% indicated primary education only. This indicated that poverty was present in the community because 89.9% of all households lived in non-permanent structure zinc shacks and had been there more than five years (88.8%). The household sizes were small and only 26.3% of the households had four or more rooms to fit the average household size of 4.9 people. Thus, problems like rodent infestation (53.2), dampness (30.8%), cold (9%) and rust (6.7%) were regularly experienced. The socio-economic status also reflected poverty as only 5.8% of the respondents and 19.9% of their spouses were employed. The majority of the households (58.3%) had an income of less than R1000 which indicated that they lived in dire poverty.

2.3.4 The Contribution of Smallholder Farming to Rural Household Food Security

From the discussion so far, it can be concluded that most of communities in Sub-Saharan Africa are poverty-stricken. Thus, the question is: how far can agriculture be a solution and specifically the role of smallholder agriculture? Given that the majority of people live in rural areas and most of them are engaged in agricultural production, investing in agriculture is the most effective way to alleviate poverty (Smith *et al.*, 2000). Some literature has revealed that with necessary support, smallholder farmers have the potential to produce marketable surplus. This is proven by smallholders in Kenya with farmers of less than two hectares but managed to increase their share of national agricultural production from 4% in 1965 to 49% in 1985 (Oldewage-Theron *et al.*, 2006). Zimbabwe's remarkable increase in maize production by smallholders in 1980s is another example.

Machete (2004) outlined government efforts to promote smallholder agricultural development in South Africa. He started with land reform which basically involves access to land for production purposes. This programme targets the poor and promotes both efficiency and equity (through increase in farm income). The second one was agricultural credit and this is regarded as one of the key elements in improving agricultural productivity. Insufficient progress made on access of smallholders to credit has resulted in the establishment of Agricultural Credit Schemes. The schemes are there to address accessibility of credits by smallholders while Land Bank provides loans to established commercial farmers. Nevertheless, infrastructure remains the main obstacle to smallholder agricultural growth in South Africa. This is seen from failure of government's initiatives such as Community-Based Public Works Programme (CBPWP), Consolidated Municipal Infrastructure Programme (CMIP), and Poverty Relief and Infrastructure Investment Fund (PRIIF) (Oldewage-Theron *et al.*, 2006).

Agriculture contributes to poverty alleviation at household to national level through reduction in food prices, employment creation and increases in real wages which result in improvement in farm income. With regard to addressing rural food security, it has been suggested that the agricultural sector is the primary channel for achieving it. It has been observed that rural households engaged in agricultural activities tend to be less poor and have better nutritional status than other households. According to Matshe (2009), it was indicated that most poor rural households rely on agricultural production for a significant share of their household income. It was recommended that strategies on improvement of rural households' livelihoods should prioritise on increasing agricultural productivity as this is critical for both increase in food security and poverty reduction. However, it should be noted that non-farm activities also play a crucial role in poverty alleviation as they are important for promoting growth in the agricultural sector. Section 2.3 and the sub-sections therein have presented the dimensions of food insecurity in South Africa and the next section summarizes the policies implemented to address food insecurity in South Africa.

2.4 Evaluation of Policies Implemented to Counter Food Insecurity in South Africa

2.4.1 Social Grants

In South Africa there are six administered social grants and they are in place as measures to improve living standards particularly of the poor people and redistribute income to create more equitable society (Samson *et al.*, 2004). This is also a fulfilment of the Sections 24 through 29 of the Bill of Rights in the South Africa's constitution which recognises the socio-economic rights of citizens, including the rights to social security (Samson *et al.*, 2004). Currently, about 15 million people in South Africa receive cash transfers from the state and spending on social assistance is projected to increase to R120 billions in the 2014/15 financial year (Altman *et al.*, 2009).

According to SASSA (2000), nearly one in five households experience hunger nationally. This mainly comes from Eastern Cape, Limpopo and Mpumalanga and these provinces are among the poorest provinces in South Africa. The major social grants (such as state old age pension, child support grant and disability grant) have a positive and significant effect on greater share of household expenditure on food and this is positively correlated to better nutritional outcomes. These social grants do not merely enable people to purchase food but people also use this money for health, education, social development, public transport and housing purposes. These factors are very crucial when addressing food insecurity. Social grant receipts are associated with lower expenditure on health care and this may be due to that social grants yield positive outcomes that reduce the need for medical care. They are also associated with improvements in education and stemming the spread of HIV/AIDS.

In a study by Samson *et al.* (2004), it was found that there is a consistency between empirical results and the hypothesis that households receiving social grants are having a higher success rate in finding employment and better able to improve their productivity thus earn higher wages. However, some studies such as Altman *et al.* (2014) have shown that South Africa's system of social grants negatively affect employment creation because they reduce the opportunity cost of not working.

2.4.2 Land Redistribution

Land reform programme has been considered as one important component of government's efforts in fostering a socio-economic environment that will enable individuals in former reserve economy to participate in a modern industrial economy. This is reflected in the White Paper on South African Land Policy as it reaffirms its commitment to transfer land to a significant number of eligible people (Department of Land Affairs, 1997). However, current trends suggest that the actual scope of land redistribution may be smaller than initial

projections. This then necessitates an in-depth analysis of constraints or challenges that hinder the progress of this program.

A study that was done by Shinns & Lynn (2004) was based on symptoms of poverty within a group of land reform beneficiaries in midlands of KwaZulu-Natal. This study groups the individuals into five clusters of the beneficiary households representing four distinct groups of poverty (Table 2.1). The first cluster represents beneficiary households that are relatively income and asset rich, the second cluster represents households that are income rich but asset poor with the third cluster representing households that are asset rich but income poor. And finally, the fourth cluster represents households that are income and asset poor; these beneficiary households are in chronic poverty.

Table 2.1: Cluster Membership and Characteristics, N=38

Cluster No	Cluster Size (households)	Household number	Income per A.E. R/month	Livestock per A.E. (Rands)	Household members sick per A.E.	Std of housing index
1	7	3,7,11,12,17, 18,23	328.77	3361.29	0.000	-0.487
2	11	1,5,10,14,15, 16,20, 26,31,33 & 37	116.89	4502.13	0.075	0.185
3	11	4,6,13,19,22, 24,27, 28,35,36 & 38	367.93	911.15	0.094	-0.516
4	4	2,8,30 & 32	110.67	1899.46	0.091	2.062
5	5	9,21,25,29 & 34	77.96	1404.26	0.563	-0.237
Overall mean			219.92	2570.90	0.133	0
F-value for different			6.48**	3.92**	6.24**	11.01**

Notes: ** denotes statistical significance at the 1% level of probability

Source: Adapted from Shinns & Lynn, (2004)

While income is an essential indicator of current poverty, household wealth which is measured in terms of saleable assets (such as livestock) which indicates ability for a household to withstand adverse shocks (key issues being declining life expectancy and old-age pensioners accounting for a large share of household income in the survey group). It was concluded that child support grants could be increased as pension earning becomes less effective in combating the symptoms of poverty in the area. Furthermore, land reform grants may address poverty more effectively when used to purchase equity in joint ventures with commercial farmers than when used to purchase land that many of household beneficiaries cannot use or transact.

The results of a study (Bradstock, 2006) reveal that households had low asset status and they heavily relied on social grants, particularly old age pensions and disability grants. For better-off families, it was participation to paid employment that saved them from poverty. Redistribution of land that is geographically distant from beneficiaries' residence location, accompanied by no service or technical assistance, especially at the beginning of agricultural activities, was identified as the potential trigger in the ineffectiveness of this programme in addressing poverty. It was then recommended that land should be made available to poor people in smaller plots and near their homes so that they can utilise it with minimal outside support (Bradstock, 2006).

According to Kepe & Tessaro (2013), food security programmes managed by government agencies experience difficulties at implementation stage due to land issues. Consequently; they concluded that for food security programs to succeed, they have to be integrated to land reform programs/policies.

2.4.3 The National School Nutrition Programme

Hunger and poor nutrition have a negative impact on the brain development of children and normally limit their chance of educational success. Children who lack certain nutrients in their diets are likely not to have the same potential for learning as healthy and well-nourished children. This is explained by the fact that learners who suffer from hunger or malnutrition have more difficulty in concentrating and performing complex tasks. Some studies on this issue have indicated that hunger affects children's access to school and their ability to attend and succeed. This ultimately affects their educational outcomes. This is a problem because if children face limited chances of attending school, they will end up without education and as a result their chances of breaking poverty trap are significantly reduced.

In recognition of education, sufficient food and basic nutrition as the basic constitutional rights that every South African is entitled to, the Primary School Nutrition Programme (PSNP) which in 2002 transformed to the National School Nutrition Programme (NSNP) was introduced in South African schools in 1994 by the democratic government. This school feeding scheme or as it is officially called NSNP is a small part of the Integrated Food Security Strategy for South Africa which means that this programme is just one of the range of projects that respond to nutritional needs and does not try to respond to all problems around poor nutrition, hunger and food insecurity. It aims to foster better quality education by enhancing children's active learning capacity, alleviate short-term hunger, provide an incentive for children to attend school and address certain micro-nutrient deficiencies.

The Public Service Commission (2008) undertook a study on the evaluation of the NSNP. Schools from Eastern Cape and Limpopo provinces were selected for the study because these two provinces are regarded as the poorest in the country and they are also predominantly rural. Some of the findings were that the majority of the beneficiaries or learners came from

rural background of which most of them stayed with their relatives as their parents have passed away or do not have capacity to look after them. This programme also plays a huge role in stimulating local economic development. This is because some of the food items especially vegetables are supplied by community farmers and other community members are employed as food handlers.

This school feeding programme is perceived to have impacted the learners positively (Public Service Commission, 2008). This is shown by increase in school attendance, concentration level with social and physical participation by learners in school-related activities. The level of absenteeism by learners has dropped among schools participating in the programme in both provinces. It was concluded that learners who benefitted from the programme seemed to have their health improved, their performance in class increased and so does their level of attendance and participation. These sections and the sub-sections therein have been about food security policies and programs in South Africa.

2.5 The Concept of Vulnerability to Food Insecurity

Various definitions for vulnerability have been developed over the years by researchers from different disciplines such as economics, psychology and anthropology as they used the term in their respective research paradigms. According to Lovendal & Knowels (2006), the primary difference exists between vulnerability as defenceless in relation to a harmful event (vulnerability to natural disasters) and vulnerability to a specific negative outcome, following a harmful event (e.g. vulnerability to food insecurity). In food security, vulnerability is defined relative to the negative outcome of food insecurity *i.e.* it refers to people's propensity to fall or stay below food security threshold within a certain timeframe.

This is grounded in the entitlement theory which is based on actual or potential resources available to households based on their own production, assets or reciprocal arrangement (Sen,

1981). It shall be noted that a livelihood status of a household at a particular point in time does not fall under vulnerability (Ellis, 2003). Furthermore, measuring vulnerability is distinct from measuring food insecurity as it is possible to distinguish those who are food secure but vulnerable and those who are non-vulnerable but food insecure.

Vulnerability is a forward looking concept which aims to reduce future than current food insecurity and a household is said to be vulnerable to future welfare loss if any risky event reduces household welfare below socially accepted norms. It seeks to explain the underlying forces that cause individuals and families to be unable to cope with uncertain adverse shocks that may happen to them (e.g. drought, losing a breadwinner). The severity of being vulnerable to food insecurity depends on the characteristics of the adverse event and how responsive that particular household is to risk which, in turn, depends on household's characteristics – notably their asset base (Dilley & Boudreau, 2001).

A considerable flow of households into and out of food insecurity has received an increasing recognition and this has necessitated the focus on household vulnerability as the basis of social protection strategy (Hoddinott & Quisumbing, 2003). Adopting a forward looking approach that not only identifies the group of households that are presently suffering from food insecurity but also the households that are vulnerable to shocks and other adverse events such as drought is recommended by Holzmann and Jorgensen (2000). This is an imperative way to perform more effectively the task of protecting households from adverse effects of shock.

2.6 Summary

Drawing from literature, it has been shown that poverty and food insecurity are severe in Sub-Saharan Africa and that there is a positive correlation between these two concepts. Liquidity constraint is still a major issue and this leads to less expenditure on basic needs such as food (less dietary intake), health, and education. Unsafe sexual practices have also been observed especially among women as a way to earn money and this accelerates the spreading of the pandemic HIV/AIDS. Women and children are seen as the ones who are more vulnerable to poverty and food insecurity than men. Due to the fact that poverty and food insecurity in developing countries are rural phenomena and the majority of livelihoods are linked with smallholder agricultural production, support for this sector is seen as an effective way to address rural poverty in Africa. There is also a need to simultaneously invest in rural non-farm economic activities as a way to effectively improve the livelihoods of poverty-stricken communities.

CHAPTER THREE. RESEARCH METHODOLOGY

This chapter describes the study area and the data collection process in the field. It motivates the selection of the empirical model for the study which is the Vulnerability as Expected Poverty (VEP) method.

3.1 Study Area

Umzimkhulu is a local municipality in KwaZulu-Natal. It is one of the five local municipalities (i.e. Ubuhlebezwe, Ingwe, KwaSani, Umzimkhulu and Kokstad) of the Sisonke District Municipality. This district neighbours Ugu district in the south, Msunduzi in the north, Lesotho in the east and Eastern Cape in the south. Umzimkhulu local municipality is the most populated of the Sisonke municipalities as it accounts for 39% of the population of the district. The municipal area consists of 20 wards of which 46% of the region is rural.

The estimated population of Umzimkhulu is 180,302 in an area that covers almost 2,435 km². Of this population, about 90.8% reside in rural areas and the remaining resides in urban areas. The population density is estimated to be 72 people/km². There are about 83 males in every 100 females and this translates to 45.3% males and 54.7% females. People at the ages of 15-64 years are the most dominant (53.7%) followed by the less than 15 years age groups as they account for 40.8% of the people of Umzimkhulu. Approximately, 46.6% of the population is unemployed of which 56.8% are youth.

Agriculture, forestry and tourism have been identified as the key economic growth drivers in Umzimkhulu municipality area. This is due to high rainfall, good climate and rich soil that give the area a high propensity for agricultural development. More than 50% of the households that participated in the survey were involved in crop production. They grow crops such as maize, beans, vegetables and potatoes. Households that grow maize, beans and potatoes rely mostly on rain due to water and electricity scarcity in area. Those who grow

vegetables use irrigation methods even though water scarcity constrains them as they only grow vegetables for subsistence purposes. There are also those who use both irrigation and rain-fed systems, but this practice is normally for multi-cropping where, for instance, an individual will grow vegetables and beans in the same plot. In those cases, beans will be rain-fed while irrigating vegetables. Maps of Umzimkhulu are given below, with figure 3.1 depicting the position of Umzimkhulu in KwaZulu-Natal and figure 3.2 showing location of Umzimkhulu in Sisonke district municipality.

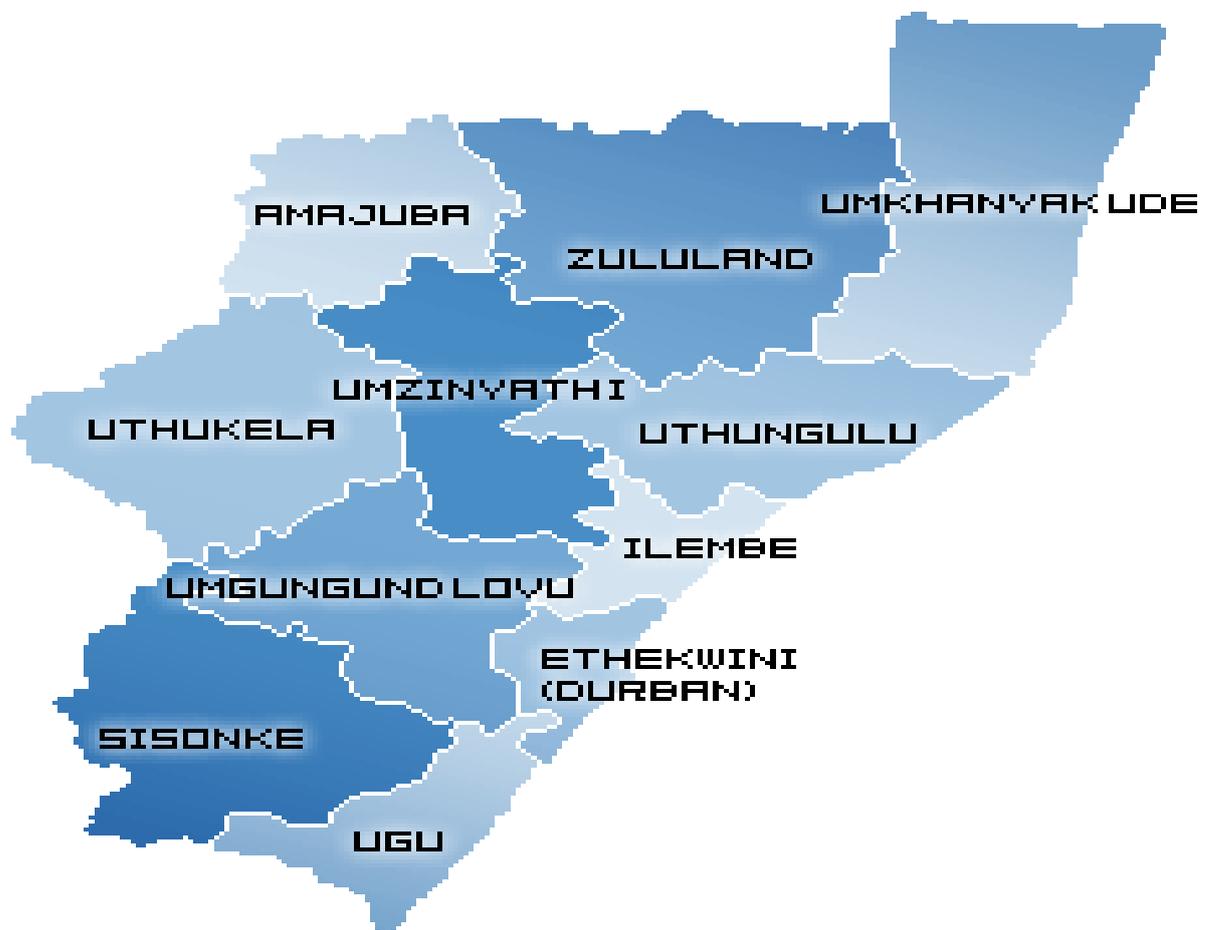


Figure 3.1: Map of KwaZulu-Natal

Source: (www.mapstudio.co.za/locationmap.php?loc=Umzimkhulu)



Figure 3.2: Map of Sisonke District Municipality

Source: (www.mapstudio.co.za/locationmap.php?loc=Umzimkhulu)

This section has laid out the background of the study area and the next section gives information about the sampling method and the methods employed to collect the primary data used.

3.2 Sampling and Data Collection

The analysis of vulnerability to food insecurity in this study is based on a household survey conducted in November of 2013. The Umzimkhulu local municipality has a total of 20 wards of which wards 12 and 14 were randomly selected to capture economic and social diversities within Umzimkhulu region. Ward 14 has a relatively high potential for agricultural production than ward 12. Both wards 12 and 14 are classified as areas under traditional authority on the current status for land ownership in Umzimkhulu local municipality. The household survey was conducted using the two stage random sampling procedure. In the first stage, six villages, namely, Khiliva, eMapulazini, Nxaphanxapheni, Rietvlei, eLovu and eMantuzeleni were randomly selected from a list of all villages in both ward 12 and 14. In the second stage, sample households were randomly selected from a complete list of the respective villages in conformity with the proportionate to size random sampling procedure. This study covered 150 households.

According to the Bio-Resource Units (BRUs) of the study area ward 14 has a high potential for agricultural production than ward 12. Ward 14 has soil ecotype Tb13 which falls under Bio-Resource Group (BRG) bush valley. Areas under BRG bush valley are found at an altitude range of approximately 313 to 906 metres above sea level. The area has a mean annual rainfall range of 688 to 723 mm and a mean annual temperature of 18.7°C with July minimum temperature of 7.1°C. Summers are hot while winters are mild with occasional severe frosts. Irrigation is needed for crop production (vegetables) on selected arable areas. The grazing capacity is 8 hectares per animal unit on good veld.

Ward 12 has soil ecotype Vc34 which is a dry midlands mistbelt BRU which lies on moderate to steep slopes. Mean rainfall is 775 mm per year and the soils are mainly well drained (60%) and glenrose which makes 25% of soil forms. Mean annual temperature is

17.4°C of minimum of 5.3°C is experienced in July. The arability is 20% of the BRU and the grazing capacity is 2.5 hectares per animal unit on good veld. The potential of the BRU is rated as restricted. The next section reviews the empirical methods of analysis used to measure both food insecurity and household vulnerability to food insecurity.

3.3 Review of Methods Used to Measure Food Insecurity and Vulnerability

There are a number of tools and approaches used in Vulnerability Assessment and Analysis (VAA). One of these tools is the Household Economy Approach (HEA) which provides a direct estimate of the food gap by establishing a household food balance which matches resources (all income and food sources converted into kilocalories or cash equivalents). This is against requirements such as food intake and other essential needs also converted into kilocalories or cash equivalents. This method groups households by their respective wealth. However, HEA takes time to obtain reliable information from each group interviewed which imposes constraints on sample size and raises questions about the representation of the findings (Sanefelds & Polsky, 2005).

Masuku & Sithole (2009) did a study on the impact of HIV/AIDS on food security and household vulnerability in Swaziland. Household vulnerability was measured by Household Vulnerability Index (HVI), generated using Fussy Set approach. The number of households was denoted by n and v , a subset of households that have some degree of vulnerability to HIV/AIDS (impacted by the pandemic). Vulnerability X can be broken down into m specific dimensions and each dimension can be given corresponding weights (W_i where $i=1, \dots, m$) to each dimensions. The weights can be predetermined or developed using an appropriate function. The vulnerability of any given household ($i=1, \dots, n$) to the dimension of impact ($j=1, \dots, m$) can be expressed as X_{ij} and bound to take values between zero and one where zero denotes no impact and one denote the maximum level of impact. The weighted vulnerability

is denoted by $X_{ij}W_i$ and they can be summed to give the particular household's total vulnerability (Vhh_i) to HIV/AIDS that is:

$$\sum_{j=1}^m X_{ij}W_j / \sum_{j=1}^m W_j = vhh_i$$

Furthermore, sum of the weights has been conveniently set to:

$$\sum_{j=1}^m W_j = 100$$

HVI was calculated by firstly selecting appropriate dimensions of impact with explanatory variables that explained them. Goal posts for each variable (minimum and maximum values) were set. Matrix of weight for dimensions was developed and the sum of weights was divided by 100 to ensure that weighting remained in a range between 0 and 1. This was followed by calculation of individual variable indices as a number between 0 and 100 by using:

$$\frac{\text{Actual value} - \text{min value}}{\text{max value} - \text{min value}} \times 100$$

HVI is then computed using the formula:

$$HVI = \text{average value of variable indices.}$$

The results revealed a contemporaneous increase in sales of crops and livestock with a decrease in expenditure on agricultural inputs and food. Decrease in food expenditure results to most households being vulnerable to food insecurity (Table 3.1).

Table 3.1: Household Vulnerability Index (*HVI*)

<i>HVI</i> Level	<i>HVI</i> Range	Situation of households (hh)	Freq	%
Vulnerability 1	0-33.3%	Coping level hh (but still vulnerable)	660	77.9
Vulnerability 2	33.4-66.7%	Acute level hh (high likely to recover)	186	22
Vulnerability 3	66.8-100%	Emergency level hh (less likely to recover)	1	0.1
Total			847	100

Source: Masuku & Sithole (2009)

The study recommended that the affected households needed assistance to maintain food production and security. This includes support of agricultural inputs such as fertilisers and seeds through markets and special arrangements to allow them access to affordable inputs. It was also recommended that therapeutic feeding and home-based care were needed for the chronically ill and vulnerable households.

A study by Bogale & Shimelis (2009) has shown that family size, annual household income, amount of credit received, access to irrigation, age of household head, farm size and livestock owned are the important variables affecting food insecurity. Another study was done by Kirkland *et al.* (2011) on food security in South Africa. Household food insecurity was measured using dietary diversity index, subjective measures of experience of hunger and access to food and coping strategies. Food insecure households identified by dietary diversity index (on the seven day time scale) exhibit a significant association with the reduction in the amount of food amongst adults, reduction in the amount of food for children and unpleasant food variables.

Quisumbing (2013) conducted a study on generating evidence on individuals' experience of food insecurity and vulnerability. It was based on that many indicators of food insecurity and vulnerability are reported at the household level, preventing policymakers from identifying

how differences among individuals within the households affect individual food security and vulnerability. The study illustrates how using individual rather than household level measures allow a better understanding of three dimensions of food security: agricultural productivity, impacts of development interventions on well-being and coping mechanisms in response to shocks.

Characteristics of households that are correlated with experiencing a food price shock were controlled by estimating a linear probability model with having experienced food price shock in the last two years as the dependent variable. According to Quisumbing (2013), female-headed households had more reports on experience of food price shock than men and they were also more likely to adopt coping strategies that can worsen nutritional status of household members, especially children. It was concluded that female-headed households should still be an important target for social protection mechanisms but also ascertain whether there are vulnerable groups within households regardless of gender of the household head.

Other studies used the Comprehensive Food Security and Vulnerability Assessment (CFSVA) to measure vulnerability to food insecurity. CFSVA provides information on how best to programme food assistance through the analysis of how many people are vulnerable to food insecurity, their location, why they are food insecure and how food and other assistance can make a difference in reducing hunger and supporting their livelihoods (Mock *et al.*, 2006). The Integrated Food Security Phase Classification (IFSPC) and the Individual Household Method (IHM) are other methods used to measure household vulnerability to food insecurity.

These approaches are mainly household sample surveys as is the case with HEA and the CFSVA and census as is the case with IHM and HVI. The methodology for data collection

also varies with most of the tools using household interviews whilst the HEA uses Rapid Rural Appraisal methods. Even though these approaches are informative for policy and methodologically sound, they lack in-depth empirical content. They only provide narratives and descriptions as they are largely based on descriptive statistics. This study counters this lack of empiricism by taking a step further in employing more rigorous analytical tools in addressing the research problem. The following three sections discuss and present the explanatory variables included in the model that had to be estimated and the process of their measurement.

3.4 Coping Strategies Index

Measuring food insecurity is a costly and complicated exercise. In highly food insecure countries, operational agencies need to regularly monitor and measure the impact of food aid and other policy interventions. The tools have to be quick and easy to administer, straightforward to analyse and rapid enough to provide real-time information. Coping Strategy Index (CSI) is such a tool. It was developed in Uganda, Ghana and Kenya but has been widely adopted and used for early warning and food insecurity monitoring and assessment in other African countries. In a nutshell, the coping strategies index measures people's response to shocks which is mostly the actions taken by people when they cannot access enough food for survival. This index is easy to observe because it is quicker, simpler to collect information on and correlates well with more complex measures of food security. As a result, CSI is an appropriate tool for emergency situation when other methods are simply not practical.

This index is derived from a series of questions about how households manage to cope with a shortfall in food for consumption. Thus, a simple numeric score is formed. In its simplest form, monitoring changes in the CSI score indicates whether household food security status is declining or improving. The CSI has a number of potential applications in food security

programming. It can be used to monitor the short-term impact of food aid on household food security, especially in case of emergency. It can also be used as a food security early warning indicator. However, most early warning indicators do not yield household level information. It can also be used as an indicator of longer-term changes in food security status and it can be used as a food security assessment tool, to target food aid to the most vulnerable households and estimate food aid requirement. CSI is, thus, a good reflection of current food insecurity status at the household level and is a good predictor of future vulnerability.

This index is based on the responses to a question on what a household does when it does not have enough food and does not have enough resources to access food. In general, people respond to conditions under which they do not have enough to eat and coping is what people do under those circumstances. CSI hypothetically is expected to be negatively correlated with household future food consumption expenditure per capita because the more people have to cope, the less food secure they are. Food insecure households may change their diet which means switching food consumption from preferred to cheaper and even to less preferred substitutes. Other households can attempt to increase their food supplies using short-term strategies such as purchasing food on credit, consuming wild foods, immature crops or even seed stocks. Households can also ration food that is available to household if it is insufficient by cutting portion size or the number of meals, favouring certain household members over other members or skipping the whole day without eating food.

It shall be noted that all these types of behaviour indicate problem of food insecurity status, but not necessarily problem of the same severity. For instance, a household where no one eats for the whole day is not the same as the household that purchases food on credit. This implies that there are two pillars of CSI, firstly the frequency of coping strategies and the severity of the problem *i.e* what degree of food insecurity is being experienced. Weighted scores with

information on the frequency and severity of coping strategies are then combined in a single score, the CSI and this is a continuous variable.

3.5 Food Consumption Scores

Food Consumption Score (FCS) is a score calculated using the frequency of consumption of different food groups consumed by individuals or households during seven days before the interview. It is meant to capture the diversity of food consumed by the household. This is a relatively new variable that captures one aspect of food security, its reliability and accuracy still under review. One of the key conclusions from the International Food Policy Research Institute (IFPRI, 2009) study was that food consumption scores are clearly superior to simpler measures of diet diversity.

When calculating FCS, a researcher starts by grouping all the food items into specific food groups as specified in Table 3.2. All the consumption frequencies of food items of the same groups are summed and the value of each food group above seven is recorded seven. The value obtained for each food item is multiplied by its weight and thus new weighted food group scores are created. Ultimately, weighted food group scores are summed to form FCS and this is a continuous variable.

Table 3.2: The Standard Food Groups and Current Standard Weights

	Food Items	Food Groups	Weights
1.	Maize, rice, sorghum, millet pasta, bread and other cereals	Main staples	2
	Cassava, potatoes, sweet potatoes and other tubers		
2.	Beans, peas, groundnuts and cashew nuts	Pulses	3
3.	Vegetables, relish and leaves	Vegetables	1
4.	Fruits	Fruits	1
5.	Beef, goat, poultry, pork, eggs and fish	Meat, non- meat poultry products, and fish	4
6.	Milk yoghurt and other diary	Milk	4
7.	Sugar and sugar products	Sugar	0.5
8.	Oils, fats and butter	Oil	0.5
9.	Spices and salts	Condiments	0

Source: IFPRI (2009)

Once the FCS is calculated, the threshold for the food consumption groups should be determined based on the frequency of the scores and knowledge based on the consumption behaviour in that country or region. Typical thresholds are in Table 3.3. Threshold of 21 was set at minimum food consumption composed by an expected daily consumption of staple (IFPRI, 2009). FCS below a threshold of 21 implies that the household is expected not eating least staple and vegetables on a daily basis and therefore considered to have poor food consumption. Households that score above 35 are estimated to have acceptable food consumption score.

Table 3.3: Food Consumption Score Thresholds.

Food Consumption Scores	Profiles
0-21	Poor
21.5-35	Borderline/threshold
>35	Acceptable

Source: IFPRI (2009)

A study by Kennedy *et al.* (2010) aimed to provide an overview of household Dietary Diversity Scores (DDS) and FCS used as two indicators for food security assessment and surveillance. The performance DDS and FCS scores was compared in food security assessments in three countries (Burkina Faso, Uganda and Democratic Republic of Congo).

3.6 Household Productivity Ratio

Household productivity ratio (*HP_Ratio*) is a ratio of productive household members to the total household size (*HHSIZE*) and it is expressed in equation 3.0 as follows:

$$HP_RATIO = \frac{\text{number of productive household members}}{HHSIZE} \quad (3.0)$$

This ratio is hypothesised to have a positive effect on the household future food consumption. The higher the proportion of household productive members in a total household size, the higher the probability that the household will attain a daily dietary threshold of 2100 kcal per adult equivalent. This variable can take values ranging between zero and one. A value of zero implies that none of the household members are economically productive or have the potential to contribute to household food basket. On the other side, a ratio of 0.5 implies that one productive household member can provide food for at least two household members (including him or herself) and a household faces less vulnerability to food security. The

remainder of this chapter discusses the empirical methods often used to measure vulnerability (Sections 3.7) and the one applied in this study (Section 3.8).

3.7 Vulnerability as Low Expected Utility (VEU) and Vulnerability as uninsured Exposure to risk (VER)

As it has been noted in Chapter two, there are a number of models and approaches developed for vulnerability assessment in Africa and elsewhere. This includes Vulnerability as Expected Poverty (VEP), Vulnerability as Low Expected Utility (VEU) and Vulnerability as uninsured Exposure to Risk (VER). According to Hoddinott & Quisumbing (2003), when using VEU, vulnerability is defined as the difference between the utility derived from some level of certainty-equivalent consumption (Z_{ce}), which is the same as the poverty line at and above which the household is not considered vulnerable. This can be written as in equation 3.1 below:

$$V_h = U_h(Z_{ce}) - EU_h(C_h) \quad (3.1)$$

where U_h is a weak concave, strictly increasing utility function. This approach was used by Ligon and Schechter (2003) in their study. Its advantages include that vulnerability estimates reflect largely factors underlying poverty (such as low asset levels, unfavourable setting or poor returns to assets and also shocks and inability to cope with shocks). However, this approach has two limitations of which the first one is that the results may be different depending on the utility functional form assumed. The second one is that units of measurement are likely to be units of utility (utils) and this abstract concept may be difficult to understand for many policy makers.

The VER approach seeks to capture the welfare loss a household suffers due to lack of effective risk management tools. This approach is similar to VEP and VEU in that it is

concerned with assessing welfare losses in a world where some risks are at best partially insured. The differences between VER and the other approaches are that it is backward looking: *ex-post* measure of welfare loss rather than an *ex-ante* welfare loss due to a negative shock. Secondly, unlike the other two, it does not attempt an aggregate measure of vulnerability.

Despite differences, all the above three methods measure vulnerability to poverty (the probability that a household will fall into or remain in poverty) with reference to the mean and variance of a household's income or expenditure. It is worth noting that even though these tools are available, it is still difficult to identify a vulnerable household because tracking wellbeing of a particular household over time or before and after a shock requires panel data that are seldom available (Gaiha & Imai, 2008).

3.7 Vulnerability as Expected Poverty (VEP)

Analysis of vulnerability to food insecurity requires a model that generates results obtained from poverty analysis, but that addresses the specific determinants of food insecurity and can be estimated using cross-sectional data. This method has been used by Chaudhuri *et al.* (2002) and Christiaensen & Subbarao (2005) and makes use of cross-sectional data or short panel data to measure vulnerability to poverty. Vulnerability analysis is forward-looking which implies that it is the result of recursive process as current socio-economic characteristics and exposure to risks determine household's future characteristics and their risk-management capacity (Capaldo *et al.*, 2010). In this approach, vulnerability of a household to food insecurity at time t (V_{ht}) is defined as the probability that the household's consumption (C) at time $(t+1)$ will fall below the benchmark (minimum daily consumption, Z). That is:

$$V_{ht} = P_r(C_{h,t+1} \leq Z) \quad (3.2)$$

Where $C_{h,t+1}$ is the household's per capita consumption level at time t+1 and Z is the minimum threshold measured by minimum daily consumption required to meet the calorie requirement of 2100 kcal per adult equivalent. This means that a household is regarded as vulnerable to food insecurity if its expected expenditure is less than the predetermined amount. Although this approach is criticised for not taking into account the depth of expected poverty, one of its advantages is that it can be implemented using a cross-section living standard survey data which is readily available in many developing countries (Chaudhuri *et al.*, 2002).

According to Gunther and Harttgen (2009), vulnerability measures are always a function of the expected mean and variance of household's consumption. The expected mean consumption is determined by household and community characteristics whereas the variance (also known as volatility) in household consumption is determined by the frequency and severity of idiosyncratic and covariate shocks as well as strength of household's coping strategies to insure smooth consumption despite these shocks. This approach starts by an empirical derivation of a variant of VEP from the food consumption expenditure function as:

$$\ln C_h = \beta X_h + \varepsilon_h \quad (3.3)$$

where $\ln C_h$ is the log of per capita household consumption, X_h is the household characteristics, β is vector of coefficients of household characteristics to be estimated and ε_h is the error term with a mean of zero and variance of $\sigma_{e,i}^2$. The main hypothesis in using VEP is that the error term (ε_h) explains the inter-temporal variance in consumption which means it captures idiosyncratic shocks that contribute to differences in food consumption

patterns of households that share the same characteristics. It must be noted that the error term is unlikely to capture covariate shocks which can affect all households at a given time and unexpected very large negative shocks such as drought or floods. As the household food consumption is assumed to be log-normally distributed, the error term is also assumed to be log-normally distributed.

Furthermore, the variance for the error term is assumed to be explained by household characteristics as in equation 3.4 below:

$$\sigma_{e,h}^2 = \theta X_h + \pi_h \quad (3.4)$$

where θ represents the vector of parameters to be estimated and π represent the error term for the second estimation. Assumption four of OLS states that given the value of X , the variance of the π_h is the same for all observations or the conditional variance of the error term is identical (Gujarati & Porter, 2009). It assumes homoscedasticity or equal variance of the error term. If this assumption does not hold, the estimated coefficients (β) are unbiased but inefficient. For consistent parameters, there is necessity for allowing heteroscedasticity which implies that the variances of the error term vary across households depending on X_h . As a result, the estimates of β and θ could be obtained using three-step Feasible General Least Squares (FGLS).

This starts by estimating equation 3.2 using the Ordinary Least Squares (OLS) method. Equation 3.3 is estimated by OLS using the squared residuals from the estimation of equation 3.2 as dependent variables. Predictions from this regression are used to re-estimate equation 3.3 by OLS after having weighted each residual by θX_h . The new estimates are asymptotically efficient and are used to weigh equation 3.1 and re-estimate it by weighted least squares to

obtain asymptotically efficient estimates of β . Then using the estimates $\hat{\beta}$ and $\hat{\theta}$, we can compute the expected log food consumption expenditure and the variance of log food consumption expenditure for each household as in equations 3.5 and 3.6:

$$E[\ln C_h / X_h] = \hat{\beta} X_h \quad (3.5)$$

$$E[\ln C_h / X_h] = \hat{\sigma} X_h \quad (3.6)$$

The assumption that food consumption expenditure is log-normally distributed and using the estimated parameters of the model, the probability that a household will be food insecure in the near future (say time t+1) is expressed as in equation (3.7) below:

$$\hat{V}_h = \hat{P}(\ln C_h < \ln Z / X_h) = \Phi \left[\frac{\ln Z - \ln \hat{C}_h}{\sqrt{\hat{\sigma}_h^2}} \right] \quad (3.7)$$

Where ϕ is the cumulative density of the standard normal distribution function, $\hat{\sigma}$ is the standard error of the regression and Z is the prescribed threshold food expenditure to meet the minimum dietary requirement. This is an *ex ante* vulnerability measure that can be estimated by cross-sectional data. \hat{V}_h is a set of estimates, one for each household, and denotes the probability that each household faces a chance of falling below the minimum threshold in the future. Its values range between zero and one.

When $\hat{V}_h = 0$, there is a certainty that household h will consume adequate amount of food in the future where at least the minimum amount of calories required will be obtained. When $\hat{V}_h = 1$, household h will consume fewer calories than the prescribed threshold which will not

be reached. When $0 < \hat{V}_h > 1$, no particular outcome is expected *ex ante* (Calpado *et al.*, 2010).

Since an index (\hat{V}_h) can be attached to all households, the question then arises which households should be considered vulnerable in between the two extremes. This distinction is more unclear as the movement is towards the centre of the spectrum and this brings the necessity for an arbitrary cut-off point. In most studies, cut-off points used are either the median or the 0.5 value. When the median is used, only those who exhibit the highest relative levels of vulnerability will be considered vulnerable even if most households show a very high probability of under-nutrition in absolute terms.

The cut-off point of 0.5 value emphasises the absolute likelihood of under-nutrition as vulnerable households are those who are more likely be under-nourished than not. When this cut-off is used, there is possibility that all or no households may be considered vulnerable to food insecurity of which this is not the case when the median is used. In this study, a value of 0.5 will be used as the cut-off point. This means that all households with vulnerability index less than 0.5 will be regarded as less vulnerable and all households with vulnerability index equal and greater than 0.5 will be regarded as vulnerable to food insecurity. Even though various options have been discussed in the literature as to how to determine the cut-off point to classify households as vulnerable and non-vulnerable, Capaldo *et al.* (2010) justify the use of 0.5 as appropriate for studies in under-nutrition and food insecurity.

The next section focuses on the results and the discussion. The analysis is driven by the results after running the VEP model on vulnerability to food insecurity in UMzimkhulu.

CHAPTER FOUR. EMPIRICAL RESULTS AND DISCUSSIONS

This chapter provides empirical results and discussions. It starts by the summary of descriptive statistics whereby means, standard deviations, minimum and maximum values and expected signs of coefficients were critically analysed in accordance with the economic theory.

4.1 Descriptive Statistics

Summary statistics of variables hypothesized to influence vulnerability of rural households to food insecurity with their expected signs are shown in Table 4.1. The analysis is based on a relationship between explanatory variables and the natural log of household consumption per capita.

The effect of household size on household future food consumption is unpredictable as it will depend on the additional member of the household. The addition of an economically unproductive member in the household is expected to have a negative effect on the household future food consumption because this will have no contribution on the household food basket. Meanwhile, an addition of an economically productive member is expected to have a positive effect on the household future food consumption because of extra household income. However, this depends on whether the study area provides good working atmosphere and production potential (Bogale & Shimelis, 2009). Sampled households have a mean of approximately five members with a minimum of one and maximum of 11 people per household (Table 4.1).

Table 4.1: Descriptive Statistics on the explanatory variables and expected signs, uMzimkhulu Rural Households

Explanatory Variables	Mean	Std error	Min	Max	Expected Signs
HP_RATIO (Ratio of economically productive members per household size)	0.52	.244	0	1	+
AGE (Household head age)	49.42	15.589	18	95	+
AGESQR (Household age squared)	2684	1704	324	9025	-
GENDER (Household head gender; dummy: Male=1, Female = 0)	.50	.502	0	1	±
EDUC (Years of schooling)	7.23	3.754	0	12	+
AGRIC (Involvement in farming; dummy: Yes=1, No = 0)	.65	.480	0	1	+
IRR (Access to irrigation; dummy: Yes=1, No = 0)	.21	.406	0	1	+
EXP (Years of experience in farming)	2.97	5.901	0	30	+
EXT_SERVICE (Extension services; dummy: Yes=1, No = 0)	.75	.436	0	1	+
TLU (Livestock holding in Total Livestock Units)	1.80	2.961	0	17	+
CSI (Coping Strategies Index)	9.69	9.922	0	51	-
FCS (Food Consumption Scores)	40.83	17.744	7	80	+
RELY (Number of people to rely on during shocks)	1.01	.839	0	4	+
NUM_SICK (Number of sick members in one year)	.18	.435	0	2	-

Source: Survey data (2013)

Household productivity ratio has a mean of 0.52 which means that, all other factors kept constant, on average, a productive household member supports 2 household members including him or herself. However, it should be noted that about 42.7% of the households in

the survey have a household productivity ratio less than 0.5 and it is the highest (Table 4.2). According to Stats SA (2014), the number and proportion of elderly persons has increased from 2.8 million to 4.8 million and from 7.1% to 8.0% respectively between the year 1996 and 2011. Projections also show that this population is likely to continue increasing and by 2030 there will be about seven million elderly people. As people get older health becomes critical and they highly rely on government for pension and shelter. This burden on future fiscal budget can be reduced through policies that provide incentives for people currently among the workforce to invest on retirement policies. Strengthening of the education system and the workforce in South Africa is one of the effective strategies in controlling the birth rate, especially teenage pregnancy. This ratio has a minimum value of 0 and a maximum of 1 and it is expected to have a positive effect on household food security status when other factors remain constant.

Table 4.2: Household Productivity Ratio

Ratios in Categories	Frequency	Percent
0 [HP_RATIO<0.5]	64	42.7
1 [HP_RATIO=0.5]	28	18.7
2 [HP_RATIO>0.5]	58	38.7
Total	150	100

Source: Survey data (2013)

Most households are headed by middle-aged individuals as the mean for households heads' age is 49 years old and men account about 50% of the households' heads (Table 4.1). Male-headed families are expected to be less vulnerable to food insecurity because of their better opportunity to have access to assets such as land (Bigsten *et al.*, 2002; Bogale *et al.*, 2005). It is worth to note that even though household future consumption improves as a household

head gets older; this is bound to whether he or she falls under the economic productive group (which is between 18 and 64 years old). Age squared is expected to have a negative effect on household future consumption because as people get older, the effect of age on household food basket is lessened.

Lack of education seems to be one of the main contributors of food insecurity in UMzimkhulu because, on average, sampled households are headed by people with a primary education. Exposure of household heads to education is vital especially in household's standard of living because it helps with the development of skills. Education equips them with the necessary knowledge of how to make a living; people are keen to get information and likely to effectively use it (Bogale & Shimelis, 2009). This may result in higher marginal productivity of labour that eventually enables members of households to engage in more remunerative jobs. The hypothesis then is that education positively correlates with household's future food consumption when other variables are held constant and this is converse to household's vulnerability to food insecurity.

Agriculture plays a significant role in Umzimkhulu because approximately 65% of the sampled households practice either crop or livestock production or both. Years of experience in farming has a significant effect on household's standard of living because farmers with more than 15 years of farming are declared to have harvested more than five bags of maize compared to the average bags that other farmers received that each weighed 50 kg. This was also despite prolonged rainfalls at the beginning of the planting season. Indigenous knowledge that farmers have such as the right timing for plantation which is normally linked with periods of high rainfall is positively correlated with experience in farming.

This implies that the higher is the number of years a household member(s) is involved in agriculture, the higher is the chance for bigger quantity of food to be harvested despite

adverse shocks. Thus, there will be less household vulnerability to food insecurity. Access to irrigation also plays a significant role in improving rural households' livelihoods and thus reduces their vulnerability to food insecurity through improving productivity. Only 21% of the smallholder farmers in the study area have access to irrigation and they plant vegetables which they sell in local markets and local communities.

Since this study is based on livelihoods of rural smallholder farmers with low levels of education, extension services will remain crucial for diversification of crops, use of improved seeds, use of fertilisers, etc. Access to extension services will boost both their production and harvest and as a result food availability for home consumption. Moreover, if marketable surplus exists, households will earn higher farm income and this income can be used to buy other goods than food. Farmers who witnessed visits and receive inputs through extension officers also received workshops and trainings. This implies that years of experience in farming, access to irrigation and agricultural extension services are hypothesized to have a positive effect on future food consumption per adult equivalent.

Household TLU has a mean of 1.8 and has a minimum value of zero and a maximum of 17 TLU. Ownership of assets such as livestock and cultivated land decrease the likelihood that a rural household will be food insecure. Besides for household consumption livestock can be used as collateral when accessing credit and selling livestock is also one of the strategies households use when facing idiosyncratic shocks (Bogale, 2012). Ownership of livestock can also be used as investment to education as other households have used income from livestock sales to pay for school fees. Total livestock owned is measured in Tropical Livestock Unit (1 TLU=250kg live weight of livestock) and it is expected to have a positive influence on future household food consumption (Bogale & Shimelis, 2009).

Coping Strategy Index has a negative effect on the household food security status. This implies that the higher the weighted score for CSI, the higher the probability that the household will be vulnerable to future food insecurity given that all factors are held constant. The implication of a high CSI is that the frequency of using coping strategies to shocks in a month by a household and the severity of coping strategies are high. CSI has a mean of 9.69 which is relatively lower than in other studies. However, the standard deviation is high and this suggests that the variance between household's CSI is high and this is also supported by a huge difference between the minimum and maximum CSI. It is worthwhile to also note that indication of household's food security status using CSI is clearer when scores are compared with scores of other households or the comparison is on household's CSIs computed in different time intervals.

The higher the FCS for a household, the higher the probability that the household will be less vulnerable to future food insecurity, all other factors held constant. This implies that FCS has a positive effect on food security status of a household. In Table 4.1, FCS has a mean of 40.83 which falls under acceptable category in FCS thresholds of Table 4.3. However, it shall be noted that the standard deviation for FCS is high and even though the maximum FCS is 80, there are households that can go as low as scores of 7.

Table 4.3: Food Consumption Scores for Umzimkhulu Rural Households

Food Consumption Scores	Percentage	Profiles
0-21	21.3	Poor
21.5-35	22	Borderline/threshold
>35	56.7	Acceptable

Source: Survey data (2013)

In the context of vulnerability to food security, social capital can be defined as the number of people, including traditional self-help associations and individuals living outside the location that the household resorts to in case of facing idiosyncratic shocks (Bogale, 2012). An increase in number of people (networks) a household can rely on when facing idiosyncratic shocks, the less are the chances that a household will be vulnerable to food insecurity, other factors held constant.

For idiosyncratic shocks, the number of people who fell sick during the course of the year in a household was used as a proxy. It is assumed that poor health affects productivity and living standards in a household in many ways. This may be through low labour productivity due to physical weakness and the high cost of medicines. Thus, larger number of sick persons in a household is hypothesized to be positively related to food insecurity. This section has discussed the variables considered to explain future food consumption. The upcoming section focuses on the income sources for the sampled rural households in the study area.

4.2 Income Sources for Sample Rural Households in Umzimkhulu

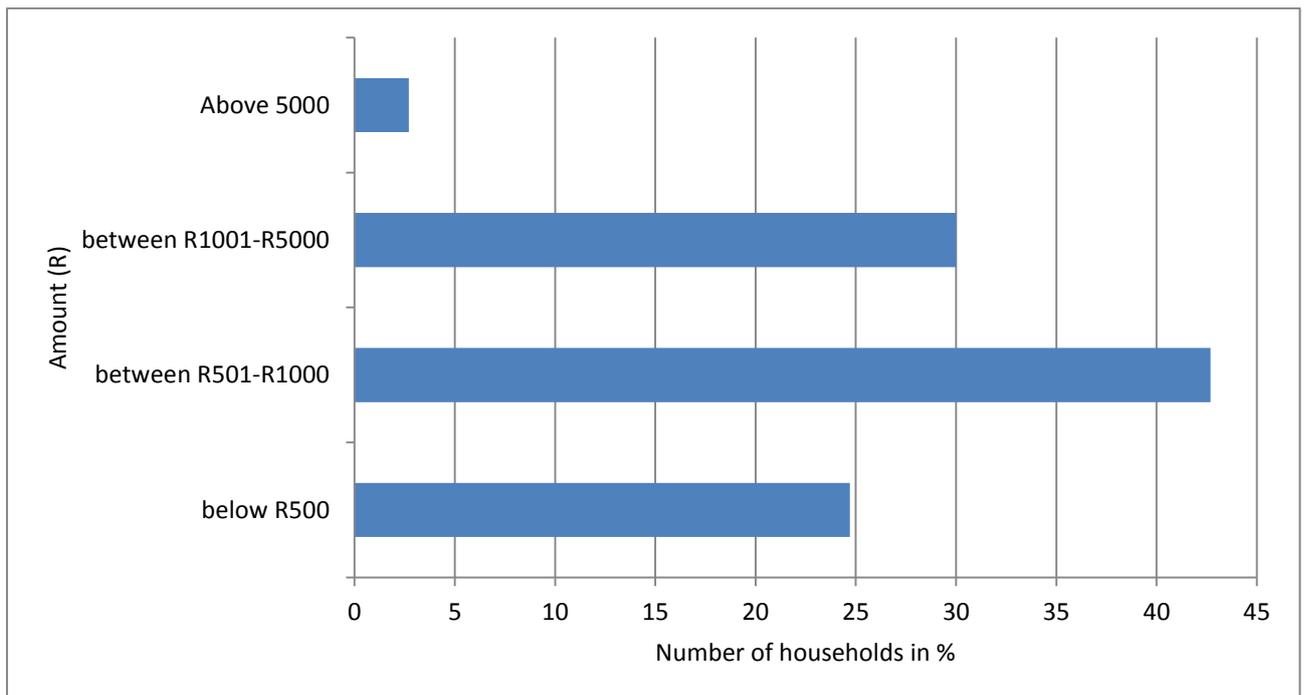
Income sources for Umzimkhulu rural households are presented in table 4.4 below. According to Matshe (2009), most poor rural households rely on agricultural production for a significant share of their household income. The same was found in Umzimkhulu as most of the households rely on farming and about 22.7% of the household heads stated that they rely on income they generate after selling either their harvested crops or livestock. For some of their crops (especially vegetables) they sell to vendors/hawkers who make 12.7% of the sample size. Sewing was also amongst the main sources of income and about 16% of the sampled households stated reliance on sewing for income. These households are headed by females and most of them are under a sewing community project and sell their clothes in the community and in Umzimkhulu town.

Table 4.4: Main Sources of Income for Rural Households in Umzimkhulu

Economic activity	Frequency	Percent	Cumulative percent
Farming	34	22.7	22.7
Formal employment	23	15.3	38
Hiring accommodation	12	8	46
Operating Taxi	13	8.7	54.7
Sewing	24	16	70.7
Hawking/street vending	19	12.7	83.3
Furniture and craft making/selling	12	8	91.3
Building and repair	13	8.7	100
Total	150	100	

Source: Survey data (2013)

According to Table 4.4 the people of Umzimkhulu have diversified livelihoods but it should be noted that even though they diversified livelihoods options, income generated from them had limited economic powers as the 45% of the households earned between R501-1000 with an average household size of 4.73 (Figure 4.1). The cash generated from various livelihoods activities was mainly spent on food consumption.



Source: Survey data (2013)

Figure 4.1: Current level of income of households studied in Umzimkhulu, December 2013, N=150

Most of the sampled households earn income that ranges between R501 and R1000 a month and they stated that more than half of their money is used on household food consumption, which is another indicator of prevalence of poverty. Households that earn income that is more than R1000 but less than R5000 are sitting at 30% of the sampled households. Households with an income of R5000 and above per month have the lowest percentage in the sample households (about 2.5%). These are the households that are less likely to be affected by food

insecurity as they are in a better position to have surplus income for non-food purposes. Some of their salary can be allocated to savings, medical aid, good education, etc. The next section presents the empirical results of the VEP model.

4.3 Future Food Consumption Expenditure Analysis

The equations to explain future natural log of food consumption expenditure (equation 3.4) and its variance (equation 3.5) were estimated after accounting for heteroscedasticity through the use of a generalized least squares and the results are presented in Table 4.5 below. The model has good overall fit and eight out of fourteen variables are statistically significant with correct signs.

The F statistic of the model is highly statistically significant ($P < 0.000$), indicating that the overall future household food consumption is related to the independent variables. The model has an R-Squared of 0.65 which means that the explanatory variables explain about 65% of variation in households future food consumption. Based on a simple multicollinearity test using Variance Inflation Factor (VIF), it was confirmed that there is no strong correlation among the independent variables because the explanatory variables have a mean VIF of 1.49. Statistically significant variables are household productivity ratio, age, age squared, years of education, coping strategies index, food consumption score, total livestock unit and number of persons who got sick.

Table 4.5: Coefficient Estimates to Explain Future Log Food Consumption Expenditure and Variance (N=150)

	Future food consumption	Robust standard deviation	Variance of food consumption	Robust standard deviation
	Coeff.	Robust std. error	Coeff.	Robust std. error
HP_RATIO	0.144***	0.43	-0.001	0.014
AGE	0.005**	0.002	0.001	0.001
AGESQR	-0.140***	0.015	0.003	0.005
HHSEX	-0.004	0.003	0.001	0.001
EDUC	0.103**	0.052	0.009	0.016
AGRIC	0.010	0.007	0.002	0.002
IRR	0.051	0.070	0.013	0.022
EXP	0.004	0.004	-0.001	0.001
EXT_SERVICE	-0.019	0.064	-0.002	0.019
TLU	0.028***	0.007	-0.001	0.002
CSI	-0.131*	0.084	0.035	0.024
FCS	0.005***	0.002	-0.001	0.001
RELY	0.005	0.036	0.010	0.008
NUM_SICK	-0.101*	0.059	-0.020	0.016
Constant	5.343***	0.172	0.021	0.052
F(14, 135)	16.64		3.21	
Prob > F	0.000		0.000	
R-Squared	0.647		0.158	
Root MSE	0.252		0.062	

Source: Survey data (2013)

The preceding results confirm that exposure of a household head to education represented by the total number of years spent in schooling has a positive effect on future food consumption expenditure and this is statistically significant at 5% level ($P < 0.05$). This is consistent with both economic theory and studies done in the past such as Gaiha & Imai (2008), Bogale & Shimelis (2009), Capaldo *et al.* (2010) and Bogale (2012). If the number of years a household head is exposed to education increases by one, the chance for a household to have secured future consumption expenditure increases by 10.3% (*ceteris paribus*).

This clearly indicates how important it is for breadwinners to be educated, a means for better livelihoods, as it is through skills they develop that they will have high chances of getting better jobs that will secure their household food security status. Educated household heads are also more likely to have more rewarding jobs which increase their opportunity cost of having children as they do not have enough time to raise them (Bogale, 2012). Thus, they tend to have small household sizes that secure their expected food consumption expenditure. As stated in literature, the implication from this is that households with household heads having many years of schooling are less vulnerable to food insecurity than household heads with less or no years of schooling.

The positive coefficient for household productivity ratio makes economic sense since its sign is consistent with economic theory and it is statistically significant at 1% level ($P < 0.00$). The higher is the proportion of economic productive members in a household, the higher the probability that the household will have secured future food consumption expenditure. The results indicate that an increase in household productivity ratio by one when other factors are held constant will result to an increase in household future consumption by 14.4%. This variable further proves the importance of education to household food security as the individuals that make the proportion of household economic group have spent more years on

education. Moreover, this suggests prioritisation of education on developmental policies aimed to address food security at the household level. Most of the empirical studies that have been reviewed on vulnerability both to poverty and food insecurity (such as Capaldo *et al.*, 2010; and Bogale, 2012) have not included household productivity ratio. It should be noted that the inclusion of this variable is one novel aspect of this study. It signifies the importance of a higher proportion of productive labour force in the household.

Age of the household head is another factor that has a positive effect on the expected food consumption expenditure of the household and it is statistically significant at 5% level ($P < 0.05$). If age of the household head increases by one, the chance for a household to have secured future food consumption expenditure increases by 0.5% (*ceteris paribus*) *i.e.* as the household head gets older, he or she gains or develops better strategies for coping with idiosyncratic shocks (such as livestock loss). As long as the household head is in the productive age bracket, with old age comes better endowment with more farming experience and indigenous knowledge which plays a huge role in techniques and methods they use in farming and this makes a significant contribution to inform their livelihood strategies. Household assets (wealth) normally take time to accumulate which means older household heads are likely to be wealthier than younger household heads. Thus, households headed by old people (within economic productive individuals) are less vulnerable to food insecurity than households headed by young people. This is especially the case for household heads who fall under the economically productive age group.

As far as the age of the household head is concerned, people whose age are 65 years and above are classified as economically unproductive and they do not make contribution in the household food basket. The results do show that productivity and contribution by the household head to the household food basket increases with age but this is conditional to

whether they still fall within productive age bracket. The coefficient of age squared term makes economic sense since its sign is negative and statistically significant at 5% level ($P < 0.05$). An increase in age squared term of a household head by one, results to a decrease in household future food consumption expenditure by 14%. Age reduces vulnerability to household food insecurity but beyond a certain age bracket, it will have a negative effect as household heads get much older less productive and/or more dependent. In other words, the impact of age would depend on the household head's age bracket.

A coefficient of livestock holding units for a household makes economic sense since its sign is consistent with the economic theory and it is statistically significant at 1% level. This variable captures the contribution of livestock ownership to household food security status. It is found from the results that an increase in livestock holding unit by one increases the possibility for a household to have secured future food consumption expenditure by 2.8%, other factors held constant. The results statistically show how important agriculture is for rural households and why agriculture should be used as a vehicle for rural development to address vulnerability to food insecurity in the rural areas.

Bogale & Shimelis (2009) found a positive and statistically significant relationship between livestock holding units and food security. They also stated that livestock, besides its contribution to subsistence need and nutritional requirement, is a vital input into crop production by providing manure. It also serves to accumulate wealth that can be disposed during times of need, especially when food stock in the household deteriorates.

Household FCS also have positive influence on the household expected food consumption per adult equivalent and they are statistically significant at 1% level ($P < 0.00$) *i.e.* if household food consumption scores increase by one, the probability that the household will have secured future food consumption expenditure increases by 0.5% (*ceteris paribus*). This

variable is a simple measure of food groups consumed in a household over a certain reference period (which is seven days) and it is a good measure of household dietary diversity and access to food. The higher is the household's access to food (this being quantified by food consumption scores) the higher the probability that the household is less vulnerable to household food insecurity. Despite the absence of standardised measurement tool to evaluate FCS across various settings, the variety of measures employed have indicated a positive relationship between FCS and nutrient adequacy (Kirkland *et al.*, 2011). It was also found by Hoddinott & Yohannes (2002) that as FCS increases so too does per capita consumption and energy availability which led to the conclusion that FCS is a promising indicator of household food security.

On the other side, household coping strategies index has a negative impact on the household expected food consumption and it is statistically significant at 10% level ($P < 0.10$). Given that all factors are held constant, if household's coping strategies index increases by one, the probability that the household will have secured future food consumption expenditure decreases by 13.1%. This simply implies that the more a household has strategies to cope with household food shortages, the higher the probability that the household is either currently food insecure or vulnerable to food insecurity or both. It should be noted that both FCS and CSI have not been included in previous studies on vulnerability to food insecurity.

Following previous literature (Bogale, 2012 & Gaiha & Imai, 2008), idiosyncratic shocks facing rural households at Umzimkhulu were captured with the number of people who fell sick in the year preceding the survey. The results are found to be consistent with economic theory as its coefficient is statistically significant at 10% level ($P < 0.10$). Accordingly, as when all other factors are held constant, one more person gets sick in a household means that there is 10.1% probability that a household will be vulnerable to food insecurity. It is evident

from the results that household health status is an important determinant of vulnerability to food insecurity. Expected household food consumption relates to lower number of ill household members which implies that, as the general household health status declines, future consumption is expected to decrease, making the household vulnerable to food insecurity in the near future. According to Novignon (2010), good health status is an important vulnerability-improving variable which has to be taken into consideration in designing policy interventions. The next section deals with the classification of the vulnerable and currently food insecure sampled households in the study area.

4.4 Vulnerability and Food Insecurity Classifications

Once food security and vulnerability thresholds have been established, based on current level of food consumption expenditure, these may be extended to several food insecurity and vulnerability categories as in Table 4.6 below.

Table 4.6: Classification of Umzimkhulu Households by Vulnerability and Food Security Status

		Vulnerability		Total
		Low	High	
Food Security Status	Secure	47	17	64
	Insecure	16	70	86
Total		63	87	150

Source: Survey data (2013)

Firstly, households may be classified as either low or high with regard to their vulnerability to food insecurity according to whether vulnerability score is ≤ 0.5 if low vulnerable and ≥ 0.5 if high vulnerable to food insecurity (Pritchett *et al.* (2000) cited by Bogale (2012)). Secondly, the sample households may be divided into food secure and food insecure, using an inflation-adjusted poverty line of R355 per capita per month in South African Rands (Stats SA, 2014).

Those who have average food consumption below the food poverty line are generally termed as food insecure and the rest food secure.

The results reveal that 47 households which account 31.3% of the sample have stable secure food consumption expenditure as these households are currently food secure and less vulnerable to food insecurity. On the contrary, about 70 households which account about 46.7% of the sample suffer from chronic food insecurity because food consumption expenditure per adult equivalent is below the poverty line and they are highly vulnerable to food insecurity. This means that these households have slim chance of escaping food insecurity in the near future. Sixteen households (about 11% of the sample) are in transient food insecurity, which means that even though these households are currently food insecure, they have less vulnerability to food insecurity. This means that they may be able to escape food insecurity in the near future.

Furthermore, 17 households, which make up 11% of the sample, are currently food secure but having high probability of falling in food insecurity trap in the near future. This implies that these households live under threat of becoming food insecure in the future. For policy purposes, policy makers need to take account of the vulnerable groups as they account 68.7% of the sample size. These vulnerable groups consist of households that are chronically food insecure, transient food insecure and those that are currently food secure but high likely to experience food insecurity in the near future.

The following chapter concludes the thesis and presents the conclusions, policy implications and directions for further research.

CHAPTER FIVE. CONCLUSIONS AND POLICY IMPLICATIONS

This chapter concludes the thesis. It provides policy recommendations drawn from the empirical results that can be implemented to strengthen existing programmes or establish new ones to address food insecurity in South Africa. Finally, directions for future research are presented drawing from the limitations of the present study.

5.1 Recapping the Purpose of the Study

Despite dramatic progress made by international humanitarian organisations such as UNICEF and WFP in attempting to enhance food security, an approximation of 790 million people in developing countries are still undernourished and do not have enough food to eat. There has also been confirmation by some food security studies that while global food security status is improving, it is concurrently deteriorating in some countries especially in Africa. This is supported by statistics of 150 million children that are malnourished in developing countries of which 32 million are in Africa. The high levels of malnutrition in children and women in Africa still pose a challenge for child survival and development.

South Africa is among the richest countries in Africa and nationally perceived to be food secure. However, there is some evidence of malnutrition and food insecurity prevailing, especially in rural areas as most of them are the victims of unemployment, HIV/AIDS and poor basic service delivery. Therefore, addressing food insecurity will remain among the key priority objectives of the development policy of the country for the foreseeable future. It should be noted that effective policy decisions to address the issue of food insecurity would require empirical research evidence that yields outputs with relevant policy recommendations. This problem can be addressed through policies informed by studies that empirically investigate the root causes and consequences of both current and future food insecurity

To this end, the objective of this study is identification of the most vulnerable and food insecure households and assessment of their needs. This includes studying the socio-economic and demographic characteristics of the most vulnerable and the identification of the idiosyncratic shocks which expose them to food insecurity. This study employed Vulnerability as Expected Poverty (VEP) approach to assess the vulnerability to food insecurity of 150 rural households in Umzimkhulu. This study systematically constructed appropriate probability distribution of food consumption expenditures of sampled households conditional on their characteristics and subject to idiosyncratic shocks which then used to estimate vulnerability index for each household.

5.2 Summary of Key Findings

This section summarises the explanatory variables that were found to have correct economic signs and had significant economic effect on the livelihoods of the people of Umzimkhulu. Household labour productivity ratio, education, age of household head, tropical livestock unit and food consumption scores had statistically significant positive effect on Umzimkhulu households' food security and they are consistent with the economic theory. These variables proved to significantly improve the livelihoods of the people in Umzimkhulu with the household labour productivity ratio being statistically significant at 1%. This signifies the importance of a household to have a balanced proportion of economic active members on the total household size. This can be achieved through interventions that strengthen and improve education system, household agricultural production and infrastructural investment in rural areas since it does not develop the area but it also has the potential of creating jobs for people especially youth in rural areas.

Coping strategies index, age squared of a household head and the number of sick household members in one year as an idiosyncratic shock were found to have a statistically significant

negative effect on the future food security of Umzimkhulu households. Age squared of the household head is statistically significant at 1% and this variable accounts for household heads that no longer contribute to household food basket hence increasing probability of vulnerability to food insecurity. In a sample of 150 households, 70 households (46.7%) were identified as both currently food insecure and vulnerable to food insecurity. This goes to show that demographic profiling especially in terms of age is very important when making an intervention in rural areas and tools to assist these households should be readily available.

5.3 Conclusions and Policy Implications

Household heads with high school and tertiary education had unique skills that earned them decent jobs with relatively better remunerative salaries and were able to purchase sufficient food for their families. This calls for continued prioritisation of investment in education as it has proved to be an effective development policy addressing food insecurity in rural areas. In this study, household productivity ratio has statistically shown that it positively correlates with future household food consumption expenditure. This ratio reflects the availability of productive labour force in a household. Households with higher productivity ratio normally have higher household agricultural production or alternatively higher income from off-farm income sources which also improves household food security status. This signifies the importance of development policies that support rural agricultural production and that aim rural job creation in South Africa.

As agriculture is intensively practised in this community, food security can be improved by offering relevant agricultural training especially to subsistence farmers to enable them to produce not only for themselves but also for the market. Training of farmers will enhance their productivity, enabling them to attain better incomes from their farming operations. Policies that promote training of farmers can also be implemented for livestock farmers as the

empirical results have shown that ownership of livestock improves rural households' livelihoods. However, rural development policies should also take into account the old age group as it has been proven in this study that as people pass the age of 65 years, their contribution to household food stock starts to be negative. This calls for improvements in social security of this age group which is through policies such as provision of old age pensions which is already in place and improvement of health facilities since health becomes critical for older people. For the current labour productive group, strategies to be implemented should focus on providing incentives for savings and investment in retirement policies, medical scheme and life covers to reduce the reliance of the retiring group on public expenditure.

The level of vulnerability and food insecurity encountered in the study areas is high, calling for implementation of rural developmental policies that can empower the local people to maintain their livelihoods. High level of food insecurity or limited dietary diversity reduces school attendance since students cannot be expected to cope with school duties without enough food. A considerable number of sampled households scored poorly on household FCS and this implies that some households in rural areas still face severe food insecurity.

This was also shown by the severity of coping strategies used by these rural households to cope with food shortages. These households form part of the currently food insecure households and without an immediate intervention these households are prone to future food insecurity. Besides long-term interventions (policies targeted at job creation), short term interventions (such as food stamps or parcels) are highly needed as they address current food insecurity.

When people live under limited dietary diversity or if they are forced to use severe coping strategies where nutrition is compromised, this may result in nutrient deficiency which will

make them prone to a variety of diseases. This makes life more difficult for households because it has a potential not only to decrease labour productivity of a household but also to increase their health care bills. The results have shown that there is a positive relationship between number of sick household members and the vulnerability of that household to food insecurity. In the short-run, the availability of health facilities (such as mobile clinic) in rural areas may be an appropriate intervention. But for a long-term intervention, this still calls for more investment in education and infrastructure in rural areas.

5.4 Limitations of the Study and Suggestions for Future Research

This study has some limitations. First it was the availability of information on vulnerability to food insecurity assessments, especially using VEP. For finance and time constraints, only 150 rural households from one local municipality were sampled for this study whereas a larger number of households sampled from a number of municipalities would have shown more complete spatial dimension of vulnerability to food security. Most vulnerability studies have been conducted using a panel data whereas in this study only a cross sectional data was possible and for some variables people had to recall information on their food expenditure as early as the beginning of year 2013 which was hard for most respondents.

This study may be expanded in various ways:

- As noted above, conducting a similar study using panel data can generate better information on temporal dimensions of food insecurity and vulnerability. Capturing the longitudinal dynamics would have far more utility to policy than a study based on a snap shot of cross-section data.
- The focus of the study has been in UMzimkhulu local municipality. One may then have an interest in comparison of rural and urban households' vulnerability to food

insecurity or scale-up this study and cover a number of districts or even undertake a national study.

- Future studies can focus on the spatial dimensions of vulnerability and food insecurity.
- Impact of climate change and climate variability on food insecurity and vulnerability is another research agenda that has not been catered for in this study.
- Impact of biofuel policies on vulnerability of rural households to food insecurity can be another research focus area for future studies.
- The South African government invests millions on social grants. The impact of social grants programs on rural food insecurity and vulnerability is another area of research for future studies.

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APPENDICES

Appendix 1: Household Survey Questionnaire

Questionnaire number:

Household Survey Questionnaires

KZN Department of Agriculture and UKZN, South Africa

Measuring Rural Households' Vulnerability to Food Insecurity in Sisonke District Municipality in KwaZulu-Natal Province, South Africa

Introduction

My name is _____. The KZN Department of Agriculture and the University of KwaZulu-Natal are conducting research in KwaZulu-Natal that is looking at how agricultural practices, consumption and off-farm sources of income affect the living conditions and food security of rural households in Sisonke District Municipality. Some households have been selected to participate in this survey regardless of whether they are involved in farming or not and your household happens to be one of them. There are no wrong and right answers to these questions. I would like to assure you that your answers will be handled with strict confidentiality. The interview will take about one hour. Are you willing to participate in the survey?

Yes	
No	

(Proceed with interview if the respondent says yes)

IDENTIFICATION

1. Interviewer ID Number		6. Household name	
2. Date of Interview		7. Time interview starts	
3. Local Municipality Code			
4. Main enumeration area Code			
5. Name of key respondent			

Province is **KwaZulu-Natal**, District Municipality is **Sisonke**

Main enumeration area:

Local Municipality

SECTION A: ROSTER

I will start by asking you about the composition of the household. Please give me a list of all individuals you consider members of this household.

ID	Name of Household	Relation to head Codes 1...Head 2...Spouse 3...Child 4...Brother/Sister 5...Parent 6...In-law 7...Other (specify)	Gender Codes 1...Male 2...Female	Age in Years	Ethic Group Codes 1...Amabhaca 2...Other (specify)	Marital Status Codes 1...Single 2..Married 3..Widowed 4..Divorced 5..other specify	Is this member presently? Codes 1...Yes→(go to Section B) 2..No →(go to the last column)	When and why did he/she leave?
01								
02								
03								
04								
05								
06								
07								
08								
09								
10								
11								
12								
13								
14								
15								

SECTION B: EDUCATION AND OCCUPATION

ID	Number of years schooling	Number of languages a member can read and write	Primary Occupation Codes 1...farming 2...formal employment 3...unemployed 4...pensioner 5...self employed 6...underage 7...other (specify)	Secondary Occupation Codes 1...farming 2...formal employment 3...unemployed 4...pensioner 5...self employed 6...underage 7...other (specify)
01				
02				
03				
04				
05				
06				
07				
08				
09				
10				
11				
12				
13				
14				
15				

SECTION B FOOD PRODUCTION

I will now ask questions about agricultural activities practised in this household.

1. Is there any kind of agric practice(s) that you do (**if No go to Section C**), if any what kind?
2. 1....Crop production (**go to Q2**), (2)....Livestock rearing (**go to Q14**)
3. What crops are you growing?
1....Maize, (2)....Beans, (3)....Sweet potatoes, (4)....Vegetables, (5)...Other (specify)
4. Why do you grow crops?
1....Main source of food, (2)....Extra source of food, (3)....Main source of income, (4)....Extra source of income, (5)....Leisure activity/hobby, (6) Other (specify)
5. Household member(s) who work on these crops.....
6. How many years have you been growing crops?.....
7. How did you get the right to use the land?
1...inherited, (2)...given by chief, (3)...purchased, (4)....rent, (5)...Other (specify)
8. How many hacters of land do you have?.....
9. Are you happy with the size of the land you are currently cultivating? (1)Yes, (2)No
10. Is the soil that you are using fertile? 1...Yes, 2...No
11. Have you received any form of training e.g attending workshops? (1)Yes, (2)No
12. How did you acquire seeds?
1....own, (2)....bought, (3)....received, (4)....Others (specify)
13. Do you use fertilisers, manures or pesticides? (1)Yes, (2)No
14. Source of water supply
1...Rain fed, (2)...Irrigation, (3)...both, (4)...Other (specify)
15. How many harvests do you make each year?.....

Livestock Rearing

16. What type of livestock are you having?
1..Cattle, (2)..Goat, (3)..Sheep, (4)..Poultry, (5)..Pigs, (6)...Other (specify)
17. How many do you each?
(1) Cattle.....(2) Goat.....(3) Sheep..... (4) Poultry..... (5) Pig.....
18. How much can you sell each 1..... 2..... 3.....
4..... 5.....
19. Are you currently happy with the size of your livestock? (1)Yes, (2)No
20. What animal products do you get from your livestock?
(1)...Meat (2)...Milk, (3)...Eggs, (4)...Other (specify)
21. Average number of livestock slaughtered each year for home use.....
22. Have you received any form of training e.g attending workshops? (1)Yes, (2)No

SECTION C FOOD CONSUMPTION

I will now ask questions about household consumption

1. What is the main staple food for this family?
1...Maize meal, 2...Rice, 3...Bread/flour, 4...Other (specify)
2. How many meals do this household normally have each day?
1→one meal; 2→two meals; 3→three meals; 4→other (specify)
3. How do you normally acquire this food?
1...Own Production, 2...Buying (**go to SECTION C**), 3...Other (specify)
4. If own production, what crop has been your most harvest recently?.....
& please state the month of harvest.....
5. Do you still have it in your storage? (1)Yes (**go to Q7**), (2) No (**go to Q8**)
6. If yes, how long do you think it will last you?
1..a day/more, 2...a week/more, 3..a month/more, 4..until the next harvest, 5...more than enough until next harvest, 6...Other (specify)
7. If no, in which month was the food finished?.....
8. Since your food was finished, what did the household do to survive?
1..Purchasing, 2...reduce the number of food consumed, 3...reduce the number of meals, 4...eat wild foods, 5...casual work, 6...gifts from friends, 7...transfers from govt and NGOs, 9...other (specify)
9. How many times did you have meat (any type) as part of your meal (as a household) last month?
1...none, 2...once, 3...twice, 4...more than twice
10. Have you been faced with a situation when you did not have enough food to feed the household since January 2013?....(1) Yes, (2) No→ **go to Section D**
11. If yes to Question 10, when did you experience this situation tick below

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

For SECTION D, E, F: P = number of purchase per period (e.g number of 10kg rice bought per month); M = number of periods (e.g week, months) since January 2013

SECTION D

FOOD PURCHASES

Where do you normally get this item? <i>Codes?</i> 1...supermarkets 2...spaza/street vendors 3..own production 4...Food aid 5..borrow from others 6..other sources		Since January 2013 to this day, did the household spend money on the following items? <i>Codes</i> 1..yes 2..no→ go to next item	How frequent were these items bought? <i>Codes</i> 1...daily 2..weekly 3..monthly 4...annually 5..other (specify)	Quantity normally bought of this item since January 2013 (in kilograms (kgs) and litres(l))	How much was normally spent per item	Number of purchases per period Since January 2013 Fill P & M as instructed above!	
<i>Item</i>	<i>Code</i>				<i>Rands</i>	P	M
1 Maize Meal							
2 Rice							
3 Flour							
4 Vegies & tomato							
5 Sugar, tea, coffee							
6 Salt, Knorrox,							
7 Cooking oil							
8 Rama, butter,							
9 potatoes							
10 sweet potatoes							
11Beans, peas,							
12 Canned beans							
13 Canned fish							
14 Meat& raw fish							
15Milk&milk products							
16.Fruits							
17 Stamp							

SECTION E NON FOOD EXPENDITURES

I now would like to ask you about non-food expenditures. Let the member who has made the purchase give the monetary value

Did the household spend money on the following items since January 2013? Code 1...yes 2...no → go to next item		If yes how frequent were these purchase per period? Code 1..daily 2.. weekly 3...monthly 4..quartely 5..other (specify)	Number of purchase per period? Fill P & M as instructed above!		How much money is normally spent per each purchase? <i>Rands</i>
item	code		P	M	
electricity					
batteries					
Fire wood					
Charcoal					
petrol					
paraffin					
Candles, matches					
security					
telephone					
transport					
Soap, lotions					
Make up & hair					
School fees					
Uniform					
Pocket money					

SECTION F Other Non-Food Expenditures

Did the household spend money on the following items since January 2013? Codes 1....Yes 2....No		If yes, how frequent were these items purchased? Codes 1...daily 2...weekly 3...monthly 4...quarterly 5...Other (specify)	Number of purchases per period? Fill P & M as instructed above!		How much was spent per item purchased?
item	Code		P	M	
Father's clothes and shoes					
Mother's clothes and shoes					
Children's clothes & shoes					
Clothes and shoes on others					
Pots					
Plate, spoons, cups					
Baskets					
Remittances					
Gifts					
Religious offerings					
Funeral expenses					
Wedding expenses					
Entertainment					
Other (specify)					

SECTION G

1. Over the last seven days, how many days did you consume the following foods?		2. In the past 30 days, how frequently did your household resort to using one/more of the following strategies in order to have access to food?	
	No. days	source	Code (2)
Maize meal (impuphu)			Skip the whole without eating
Rice			Reduce the amount of food
Bread (isinkwa)			Reduce number of meals a day
Flour			Borrow food/rely on help from friends
Sweet potatoes			Rely on less expensive/preferred food
Vegetables (imifino)			Purchase/ borrow food on credit
Fruits (izithelo)			Eat wild food/ hunt/ fish
Meat			Reduce adult food so children can eat
Fish/ sea food			Rely on casual labour
Eggs (amaqanda)			
milk			
Oil			
Sugar, tea			
spices			

Codes for source (1)

- 1...own production
- 2...borrowed
- 3...gifts from friends/family
- 4...beg for food
- 5...hunting, fishing
- 6...purchase from main shop
- 7...food assistance
- 8...other (specify)

Codes (2)

- 1...never
- 2...seldom (1-3 days per month)
- 3...sometimes (1-2 days per week)
- 4...often (3-6 days a week)
- 5...daily

SECTION H SOURCES OF INCOME

1. Is there any household member who receives state social security grant?.....(1)Yes,
(2) No (**go to Q4**)

Type of grant	Any household member receiving the listed grant <i>Code</i> 1..Yes 2..No	No of household members receiving this grant	How long have they been receiving the grant?	How do you normally use this grant in the household?	How has the grant improved the household?
Old age pension					
Disability grant					
Child Support					
Foster Child Grant					
Care dependency grant					
Other (specify)					

2. Do you use some of the income from social grants for agricultural activities? 1..Yes,
2..No
3. Do you pool income from social grants with other income sources in the household?
1..Yes (**go to Q4**), 2..No (**go to SECTION I**)

4. I will now ask questions about other sources of income other than state security grants. Let the members who were involved in a given income generating activity answer questions on that activity.

Source of income	1.Since the beginning of the year, did any of the member(s) obtain money through one of the listed sources	2.List the member(s) who obtained from this source	3.Normally the member(s) obtained money from this source at what frequency?	4.How many times did the member(s) obtain money from this source?	5.How much money does the member obtain per given time?
01 Formal work					
02 Casual work					
03 Gifts					
04 Loan					
06 Cash from selling crops					
07 cash from selling livestock					
08 other					

CODES

3. 1...Daily, 2..weekly, 3..monthly, 4..quartely, 5..annually, 6..other (specify)

06 1...maize, 2...beans, 3..sweet potatoes, 4..vegetables, 5..other (specify)

07 1...cattle, 2...poultry, 3...goat, 4...sheep, 5...pig, 6...other (specify)

5. 1....less than R2500, 2....between R2500 & R5000, 3....above R5000

SECTION I COPING STRATEGIES

Questions from (4.) should be asked for only the three most severe shocks as noted in question 2.

1.Since Jan 2013 has your family been affected by any of the following events	2.Rank three most significant shocks	3.In which month(s) did these three occur	4.How is the impact measured?	5.Estimate the value of loss due to the event (Rands)	6.What did you do to cope?	7.How long did it take to get back to normal again
01 drought						
02 flooding						
03 pest/disease that affected your crops before harvest						
04 pests led to storage losses						
05 pest/disease for livestock						
06 theft of livestock						
07 theft of production assets						
08 theft of cash						
09 destruction of houses						
10 death of adult members						
11 disablement of an adult member						
12 forced migration						
13 fire outbreak						

14 rise in food prices						
15. rise in input prices						
16 lack of capital						
17 social conflicts						
18 other						
19 theft of crops ready for harvest						

APPENDIX 2: The Results on the Socio Economic Status of the Study Area

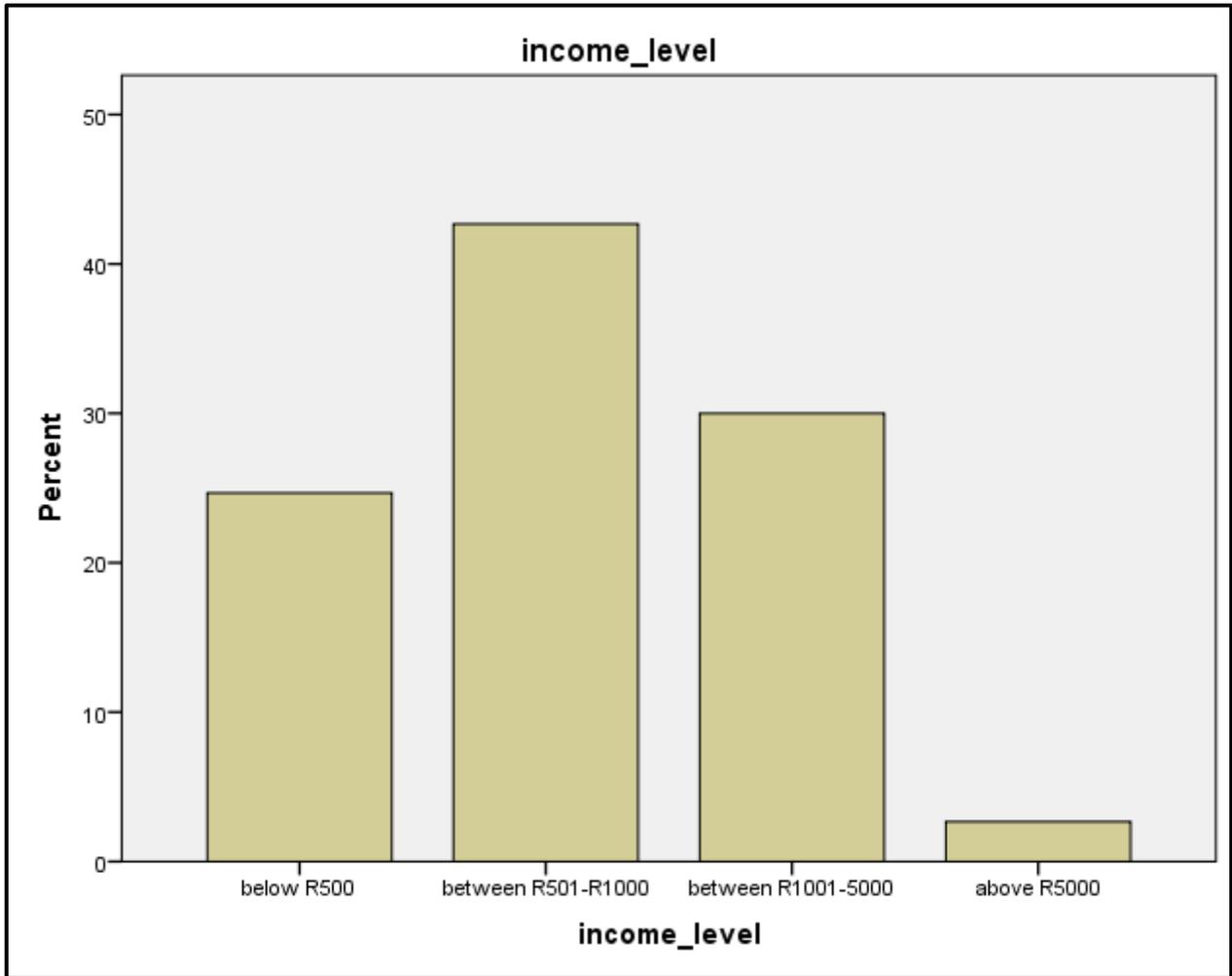
Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Ratio	150	0	1	.52	.244
Age	150	18	95	49.42	15.589
Agesqr	150	324	9025	2683.74	1704.077
Irrigation	150	0	1	.21	.406
agric	150	0	1	.65	.480
educ_level	150	0	12	7.23	3.754
hhead_sex	150	0	1	.50	.502
CSI	150	0	51	9.69	9.922
experience	150	0	30	2.97	5.901
Ext_services	150	0	1	.75	.436
FCS	150	7	80	40.83	17.744
RELY	150	0	4	1.01	.839
Numb_sick	150	0	2	.18	.435
tlu	150	0	17	1.80	2.961
Valid N (listwise)	150				

HP_RATIO					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	64	42.7	42.7	42.7
	1	28	18.7	18.7	61.3
	2	58	38.7	38.7	100.0
	Total	150	100.0	100.0	

FCS					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	32	21.3	21.3	21.3
	2	33	22.0	22.0	43.3
	3	85	56.7	56.7	100.0
	Total	150	100.0	100.0	

Income sources					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	farming	34	22.7	22.7	22.7
	formal employment	23	15.3	15.3	38.0
	hiring accommodation	12	8.0	8.0	46.0
	taxi operator	13	8.7	8.7	54.7
	sewing	24	16.0	16.0	70.7
	hawking/vendors	19	12.7	12.7	83.3
	furniture and craft	12	8.0	8.0	91.3
	building and repair	13	8.7	8.7	100.0
	Total	150	100.0	100.0	

income level					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	below R500	37	24.7	24.7	24.7
	between R501-R1000	64	42.7	42.7	67.3
	between R1001-5000	45	30.0	30.0	97.3
	above R5000	4	2.7	2.7	100.0
	Total	150	100.0	100.0	



Appendix 3: OLS Regression Results of Food Consumption Expenditure Function

```
. regress lnhhcons_per_capita HP_RATIO AGE AGESQR HHSEX EDUC AGRIC IRR EXP EXT_SERVICE TLU CSI FCS RELY NUM_SICK, vce(robust)
```

Linear regression

Number of obs = 150
 F(14, 135) = 15.98
 Prob > F = 0.0000
 R-squared = 0.6688
 Root MSE = .2748

lnhhcons_p~a	Robust		t	P> t	[95% Conf. Interval]	
	Coef.	Std. Err.				
HP_RATIO	.1533593	.0442822	3.46	0.001	.0657827	.240936
AGE	.0052325	.0023947	2.19	0.031	.0004966	.0099684
AGESQR	-.1470007	.0154314	-9.53	0.000	-.1775194	-.1164821
HHSEX	-.0047932	.0027994	-1.71	0.089	-.0103296	.0007432
EDUC	.1224892	.0599067	2.04	0.043	.0040122	.2409662
AGRIC	.0095612	.0084923	1.13	0.262	-.007234	.0263564
IRR	.0796131	.0753002	1.06	0.292	-.0693074	.2285336
EXP	.0079333	.0051503	1.54	0.126	-.0022523	.0181189
EXT_SERVICE	-.0193664	.0663483	-0.29	0.771	-.150583	.1118501
TLU	.0245052	.0081282	3.01	0.003	.0084302	.0405802
CSI	-.1281578	.0880831	-1.45	0.148	-.3023591	.0460434
FCS	.0053748	.0017665	3.04	0.003	.0018811	.0088684
RELY	.0527717	.0371863	1.42	0.158	-.0207714	.1263147
NUM_SICK	-.0991868	.0640671	-1.55	0.124	-.2258918	.0275182
_cons	5.312549	.1901066	27.95	0.000	4.936577	5.688521

```
. predict y
(option xb assumed; fitted values)
```

```
. predict residual, resid
```

```
. generate residsqr= residual^2
```

Appendix 4: Variance of the Error Term Explained by Household Characteristics

```
. regress residsqr HP_RATIO AGE AGESQR HHSEX EDUC AGRIC IRR EXP EXT_SERVICE TLU CSI FCS RELY NUM_SICK, vce(robust)
```

Linear regression

Number of obs = 150
F(14, 135) = 1.05
Prob > F = 0.4112
R-squared = 0.1214
Root MSE = .09975

residsqr	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
HP_RATIO	-.0039547	.0158054	-0.25	0.803	-.0352129	.0273036
AGE	.0010061	.0011702	0.86	0.391	-.0013082	.0033204
AGESQR	-.0011807	.0057007	-0.21	0.836	-.0124549	.0100936
HHSEX	.0001647	.0008707	0.19	0.850	-.0015573	.0018867
EDUC	.0198054	.0259529	0.76	0.447	-.0315214	.0711323
AGRIC	.0040211	.0035166	1.14	0.255	-.0029336	.0109758
IRR	.0235181	.0299248	0.79	0.433	-.0356639	.0827001
EXP	-.0014134	.0017845	-0.79	0.430	-.0049425	.0021158
EXT_SERVICE	-.0365906	.0243534	-1.50	0.135	-.0847542	.011573
TLU	.0001476	.0022853	0.06	0.949	-.0043721	.0046673
CSI	.0662902	.0259504	2.55	0.012	.0149682	.1176123
FCS	-.0004826	.0006008	-0.80	0.423	-.0016708	.0007055
RELY	.0063472	.0113965	0.56	0.578	-.0161915	.0288859
NUM_SICK	-.0161985	.0234905	-0.69	0.492	-.0626555	.0302584
_cons	.0232874	.0796534	0.29	0.770	-.1342425	.1808173

```
. predict var
(option xb assumed; fitted values)
```

Appendix 5: OLS Regression Results of Variance for Future Food Consumption

```
. regress residsqr HP_RATIO AGE AGESQR HHSEX EDUC AGRIC IRR EXP EXT_SERVICE TLU CSI FCS RELY NUM_SICK [aweight=1/var], vce(robust)
(sum of wgt is 5.0995e+03)
```

Linear regression

Number of obs = 150
F(14, 135) = 3.25
Prob > F = 0.0002
R-squared = 0.1582
Root MSE = .06201

residsqr	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
HP_RATIO	-.000298	.0144348	-0.02	0.984	-.0288457	.0282496
AGE	.0003824	.0006687	0.57	0.568	-.0009401	.0017049
AGESQR	.0035305	.0049521	0.71	0.477	-.0062632	.0133242
HHSEX	.0008188	.0007519	1.09	0.278	-.0006681	.0023058
EDUC	.0094376	.0161594	0.58	0.560	-.0225208	.041396
AGRIC	.0021777	.0017896	1.22	0.226	-.0013616	.005717
IRR	.0133905	.0215124	0.62	0.535	-.0291545	.0559355
EXP	-.0001598	.0011153	-0.14	0.886	-.0023655	.002046
EXT_SERVICE	-.0217514	.0190957	-1.14	0.257	-.0595169	.016014
TLU	-.0001211	.0016986	-0.07	0.943	-.0034803	.0032381
CSI	.0353975	.0241462	1.47	0.145	-.0123563	.0831513
FCS	-.0001519	.0005069	-0.30	0.765	-.0011544	.0008506
RELY	.0102658	.0083463	1.23	0.221	-.0062405	.0267721
NUM_SICK	-.0203926	.016421	-1.24	0.216	-.0528683	.0120831
_CONS	.0209445	.0519617	0.40	0.688	-.0818198	.1237089

```
. generate sqrrtvar =var^(1/2)
```

Appendix 6: OLS Regression Results for Future Household Food Consumption

```
. regress lnhhcons_per_capita HP_RATIO AGE AGESQR HHSEX EDUC AGRIC IRR EXP EXT_SERVICE TLU CSI FCS RELY NUM_SICK [aweight=1/sqrtrvar
> ], vce(robust)
(sum of wgt is 6.8432e+02)
```

```
Linear regression                                Number of obs = 150
                                                F( 14, 135) = 16.64
                                                Prob > F = 0.0000
                                                R-squared = 0.6469
                                                Root MSE = .25245
```

lnhhcons_p~a	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
HP_RATIO	.1443621	.0431488	3.35	0.001	.059027	.2296972
AGE	.0046624	.0021423	2.18	0.031	.0004256	.0088992
AGESQR	-.139907	.0146334	-9.56	0.000	-.1688474	-.1109666
HHSEX	-.0039217	.0026221	-1.50	0.137	-.0091073	.0012639
EDUC	.1026056	.0517955	1.98	0.050	.0001701	.2050411
AGRIC	.0097923	.0071973	1.36	0.176	-.0044417	.0240263
IRR	.0513744	.0704065	0.73	0.467	-.0878681	.1906169
EXP	.0037999	.0043514	0.87	0.384	-.0048058	.0124056
EXT_SERVICE	-.0197983	.0642258	-0.31	0.758	-.1468171	.1072205
TLU	.0276133	.0068033	4.06	0.000	.0141585	.0410681
CSI	-.1313823	.0838529	-1.57	0.119	-.2972176	.034453
FCS	.0051806	.0016683	3.11	0.002	.0018811	.00848
RELY	.0431668	.035517	1.22	0.226	-.0270749	.1134085
NUM_SICK	-.1007752	.0598691	-1.68	0.095	-.219178	.0176275
_cons	5.343059	.1715529	31.15	0.000	5.00378	5.682338

```
. predict yhat
(option xb assumed; fitted values)

. generate vi=normal((6.52-yhat)/sqrtrvar)

.
```

Appendix 7: Variance Inflation Factors for the Explanatory Variables

. estat vif		
Variable	VIF	1/VIF
AGE	2.19	0.457226
FCS	1.69	0.593006
AGRIC	1.68	0.596907
HHSEX	1.59	0.629560
NUM_SICK	1.59	0.629944
EXP	1.54	0.647940
TLU	1.51	0.664032
RELY	1.44	0.694269
IRR	1.39	0.720361
HP_RATIO	1.33	0.751095
AGESQR	1.33	0.753782
EDUC	1.28	0.784202
EXT_SERVICE	1.19	0.840329
CSI	1.18	0.849807
Mean VIF	1.49	

Appendix 8: Classification of UMzimkhulu Households by Vulnerability and Food Security Status

Food_sec * vuln Crosstabulation

Count		vuln		Total
		0	1	
Food_sec	0	47	17	64
	1	16	70	86
Total		63	87	150