Ex-ante and ex-post adjustment mechanisms to seasonality among the smallholder farmers in Mwanachingwala, Zambia

by

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DECLARATION

I, Phedelis Mazuba, declare that the thesis/dissertation, which I hereby submit for the degree of MSc (Agric) Economics at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

Signature: ..... **Date**.....

DEDICATION

This dissertation is dedicated to my lovely wife, Josphine Mwaba Mazuba, my lovely son, Hogan Mazuba, my parents and Sr. Andrea Hogan.

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ABSTRACT

In rain-fed farming systems, a poor harvest can have broad and overwhelming effects on affected households. Smallholder farmers have to ensure that they have adequate food from one harvest to the other and enough inputs for the next farming season. Households consume more just after the harvest and the consumption levels decline as they move away from the harvest season.

The study identified the ex-ante and ex-post adjustment mechanisms to seasonal food and input requirements. Special consideration was given to determine whether the probability of using a given adjustment mechanism to seasonality is the same in good, normal, poor and very poor years and whether household wealth has an influence on the use of adjustment mechanisms. Attention was also given to determining whether agricultural production and household wealth are reflected in observed seasonality in consumption.

The study used cross-sectional data from 225 randomly selected households. The study relied on non-parametric methods of data analysis because the required dependent variables could not meet the parametric assumptions.

The analysis showed that the probabilities of using some ex-ante and ex-post adjustment mechanisms for both food and input requirements by the non-poor households are not the same in

good, normal, poor and very poor years. However, the poor households' probability of using any of the identified ex-post adjustment mechanisms to seasonal input requirements is the same in all the years.

The study established that household wealth affects the use of ex-ante and ex-post adjustment mechanisms to seasonal input requirements and ex-post adjustment mechanisms to seasonal food requirements after good, normal, poor and very poor harvests. The study further revealed that agricultural production is reflected in household seasonal consumption. However, the study failed to find a relationship between consumption and agricultural production in the post-harvest season after good and normal harvests. The study also showed that household wealth is reflected in food consumption in all the seasons of normal, poor and very poor years. However, no relationship was found between food consumption and household wealth in the post-harvest and rainy seasons after good harvests.

The study further revealed that there is always a seasonal fall in consumption levels among households of all wealth strata despite the use of adjustment mechanisms. The situation worsens as we move from the good years towards the very poor years.

The study suggests that the use of one size fits all type of interventions to minimise the seasonality problem cannot adequately achieve the required results for all households. It is important to know the way households from each wealth stratum respond to the seasonality problem and why they respond in such a way. Programmes that encourage strategic planning, agricultural production and wealth creation are necessary to reduce the seasonality problem. Furthermore, mechanisms which ensure that the benefits from government interventions reach the poor households are necessary.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
CEEPA	Centre for Environmental Economics and Policy in Africa
df	Degrees of freedom
CSO	Central Statistical office
FAO	Food and Agriculture organisation
SEA	Standard Enumeration Area
SPSS	Statistical Package of the Social Sciences
RAHS	Research Institute for Humanity and Nature's Agricultural Household Survey

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

What do rural households do during the seasons when they don't have adequate food and don't have the money to buy food, and how do they prepare for such periods of the year? (Maxwell & Caldwell, 2008:2). The answers to these questions are the basis for this study.

Zambia has three main seasons: (a) a rainy season, which normally runs from November to April, (b) a cold season, which normally run from May to July and (c) a hot season which normally runs from August to October (Nyanga, Johnsen, Aune & Kalinda, 2011:76) Smallholder farmers rely heavily on the rainy season for their crop production, and harvest immediately after the rains (Saasa, 2003).

Zambia has three main agro-ecological zones (Zone I, Zone II and Zone III). Each agro-ecological zone has unique soil, ecological and socio-economic characteristics (Saasa, 2003). Figure 1.1 below shows Zambia's agro-ecological zones.

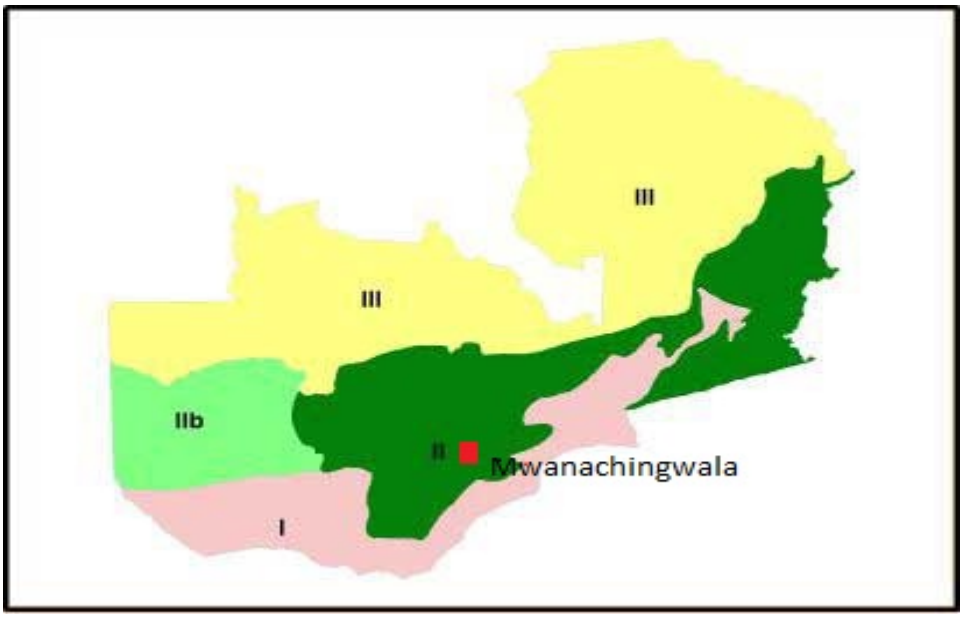

Figure 1.1: Agro-ecological zones of Zambia.
Source: Centre for Environmental Economics and Policy in Africa (CEEPA), (2006).

- Agro-ecological zone I lie in the southern and western part of Zambia and covers about 15% of the land area. Zone I receives less than 800mm of rainfall in a year.
- Agro-ecological zone II is a medium-rainfall region (800–1000 mm per rainy season).
- Agro-ecological zone III covers the northern part of the country and receives more than 10000mm of rainfall annually. The high rainfall received in zone III has led to the leaching of the soils.

The study was conducted in Mazabuka district. Mazabuka was purposively selected because it is prone to seasonal food shortages. Mazabuka, just like other places in southern, central and eastern Zambia, experiences seasonal hunger among rural households mostly between December and March. During this period the maize prices are at their highest level and rural incomes are low (Chitundu, Droppelmann, & Haggblade, 2006). Mazabuka is divided into four chiefdoms; Mwanachingwala, Naluama, Hanjalika and Mwenda. Each of the Chiefdoms is headed by a traditional ruler called a chief. Mwanachingwala was randomly selected to be the study area for this study.

As shown in Figure 1.1 above, Mwanachingwala falls in agro-ecological zone II. This zone has a rainfall period of 100 to 140 days and a temperature range of 17°C to 18°C from December to February. The probability of experiencing a drought in this agro-ecological zone ranges from medium to low. Zone II has the best agro-ecological conditions in Zambia in terms of rainfall, quality of the soil and lack of tsetse fly presence. The zone is also endowed with abundant irrigation potential and permits a diverse range of crop and livestock enterprises (Siegel, 2008; Saasa, 2003).

Agro-ecological zone II is the closest to Lusaka and other urban centres. The proximity to Lusaka and other urban centres has enabled agro-ecological zone II to receive more assistance from government, non-governmental organisations and donor organisations than the other two agro-ecological zones. Agro-ecological zone II is usually the first recipient of new agricultural innovations such as conservation farming and improved seeds. Maize is the staple crop in this region, but a wide range of other crops are grown, which include beans, groundnuts, sorghum, cassava, millet, sweet potatoes, sunflower, cotton, rice, tobacco, paprika and vegetables (such as tomatoes, cabbages and onions) and fruits (such as citrus, bananas, and guavas). Smallholder farmers keep livestock such as cattle, goats and chickens. Livestock produce from the smallholder farmers fails to command commercial market prices because of failure to attain the acceptable hygiene standards. Zone II represents about 42% of Zambia's national land area (Siegel, 2008; Saasa, 2003).

There is a widely held belief that smallholder[1] rural households are net sellers of maize in Zambia (Maize is Zambia's staple food). There is also a related notion that smallholder households are mostly self-sufficient in maize and only buy maize and/or maize meal in bad or catastrophic years. This notion has contributed to some of the government pricing policies that raise maize prices as a way of helping rural households. These perceptions can also be used to explain why very little attention is paid to the intra-rural grain markets (Zulu, Jayne & Beaver, 2007). In order to show that a good number of Zambia's smallholder farmers are not self-sufficient in maize, Zulu *et al.* (2007) categorise Zambia's rural households into 7 groups according to their maize production and marketing patterns:

[1] Smallholder farmers refer to farmers that use 0.1 to 20 hectares of land for agricultural production (Zulu *et al.*, 2007)

1. Rural households that are involved in the production and selling of maize but do not buy maize and/or maize meal. This category accounts for about 17% to 20% of the smallholder rural households.
2. Rural households that are involved in the production of maize and do not sell any of their produce but buy maize and/or maize meal. This category accounts for 25% of the smallholder rural households nationwide.
3. Households that are not involved in both the production and selling of maize but buy maize and/or maize meal. This group of farmers accounts for about 9% of the smallholder households in Zambia.
4. Households involved in the production of maize but that are not in the market either as buyers or sellers. This group of autarkic households accounts for about 37% to 40% of the smallholder farmers.
5. Households that are involved in the production, selling and buying of maize and/or maize meal. This category sells more than it buys during the course of the year. This category of net sellers accounts for about 5% of the total number of smallholder farmers.
6. Households that are involved in the production, selling and buying of maize and/or maize meal but buy more than they sell on the market during the course of the year. This group of households accounts for about 3% of the smallholder farming households.
7. Households involved in production, selling and buying of maize and/or maize meal with net sales which are equal to zero are very few.

It is important to note that fewer than 10% of households are involved in both buying and selling of maize in the course of the year, while at least 37% of households are net buyers of maize (25+9+3). These figures signify the importance of both food availability and food prices in the course of the year. Food availability and its associated prices vary during the course of the year. Only 37% to 40% of households are not really affected by annual fluctuations in grain prices. Grain prices are at their lowest level just after the harvest and they reach their peak just before the next harvest season. It is important to note that the above 7 categories are based on a normal year. Therefore, we would expect the figures to vary considerably for a poor harvest, catastrophic harvest or even a bumper harvest.

Production and consumption fluctuations are related to changes in seasons. For example, areas that lack marked seasons may experience livelihood problems throughout the year without sharp crises while areas with sharp seasonal distinctions may have periods of the year when life is relatively easy and times when lack of access to food reaches its pinnacle. Pastoralists and cultivators experience seasonal food shortages at different times of the year. Pastoralist communities experience the most difficult period of the year during the late dry season because water and pasture shortages for the animals are at their peak and milk yields tend to be low. Soon after the dry season, there is less work and more milk for pastoral communities. For rural households who depend on crops, food security and cash rely heavily on timely planting of crops. Rural poor farmers often plant late due to a lack of inputs such as seeds, fertiliser and draught power. However, in terms of food availability, the unhealthiest period of the year for crop dependent households is just before the harvest (Chambers, Longhurst & Pacey, 1981).

Seasonal changes in agricultural activities and household food consumption are important issues among agriculturally dependent households. Smallholder farmers are always faced with a seasonality problem, that is, they have to find mechanisms that would help them to smooth food consumption across seasons. Seasonality can be defined as the intra- and inter-year distinctions in seasons and the resultant effects of these distinctions on livelihood mechanisms (Thuranira-McKeever, Shaw, Machila, Eisler, Welburn & Maudlin, 2010:705).

1.2 PROBLEM STATEMENT

Seasonality in agricultural households arises as a result of changes in environmental patterns. This leads to high dependence on one harvest (in some cases two harvests) in a year. This has two implications for rural households: (a) annual household income becomes highly dependent on the size of the harvested produce, and a failed harvest can impoverish a poor household, a household with inadequate assets and savings, and (b) households that lack diversified livelihoods have to endure from one harvesting season to the next on agricultural produce harvested once or twice a year (Devereux, 2009). The high dependence on rain-fed agriculture makes the lives of rural households inseparable from the adverse effects of seasonality. The majority of small-scale farmers in Africa are located in rural areas and their

income and consumption patterns vary with seasons, sometimes very sharply (Paxson, 1993:70; Devereux, 2009).

The negative effects of seasonality are more extreme in sub-Saharan Africa (SSA) than in other developing parts of the world, partly because the practice of irrigation is not common among the rural households. The negative effects of slack irrigation processes are further exacerbated by climatic conditions, which are less predictable in sub-Saharan Africa (SSA) (Lipton, 1986). The pressure of seasonal production and consumption fluctuations are most felt in rural areas (Dostie, Haggblade, & Randriamamonjy, 2002:512).

To minimise the seasonal fall in consumption, households use a number of ex-ante mechanisms. To counter a fall in seasonal food consumption, households use some ex-post coping mechanisms. It is important to note that the season of the year when households are struggling to meet their food grain needs is the same time of the year when inputs are actually needed most for agricultural production. Therefore, seasonality poses important questions that are worth investigating. The following are some of the questions:

1. What do rural households do to minimise the expected seasonal fall in grain consumption?
2. What do rural households do to meet the expected purchase cost of agricultural inputs?
3. What do rural households do when their plans fail to significantly minimise the fall in grain consumption?
4. What do households do when their plans fail to adequately meet the purchase cost of agricultural inputs?

The key mechanism used to even out food consumption across seasons is to store food at the time of harvest. Ex-ante mechanisms are therefore the normal plans to store food, as well as all supplementary planned mechanisms which can help even out food consumption and make available purchasing power for inputs in the next season. At the time of the harvest, a farmer will be confronted with good, normal, poor or catastrophic harvest. When a harvest is poor or catastrophic, a farmer cannot store as much food as he/she had planned. In order to not go hungry, a farmer has to use additional mechanisms, which we will call ex-post adjustment

mechanisms. The ex-post adjustment mechanisms are largely the same as the ones discussed in the risk literature as ex-post mechanisms, but there may be some additional ones specifically dealing with seasonality. Examples of ex-ante mechanisms include:

- Storing food at harvest time
- Growing crops that have low seasonal specificity and moisture stress resistant varieties such as roots and tubers, e.g. Cassava
- Planting early maturing varieties
- Plan to sell livestock during the lean season to purchase food or inputs
- Plan to borrow money from merchants and money lenders for inputs or food
- Plan to receive remittances for inputs and/or food
- Plan to migrate to other areas in search of employment
- Plan to buy government subsidised inputs.

Examples of ex-post mechanisms to adjust to poorer harvests than anticipated include:

- Try to borrow more than planned to purchase inputs and/or food
- Finding more casual employment activities within the village than planned
- Do more migration for labour than normally planned
- Selling more livestock than normally planned
- Rely more on help from a friend or relative than was planned
- Reducing meal portions more than was normally planned
- Reduced number of meals eaten per day
- Skip entire days without eating
- Gather wild food (roots, tubers and fruits)
- Harvest immature crops
- Send household members to eat elsewhere
- Slaughter livestock to cover food deficit

Despite some studies highlighting the importance of food consumption seasonality among rural households in developing countries, many food programmes in developing countries do not adjust to the timing and harshness of food shortages mainly due to a lack of adequate knowledge on how rural households are affected by seasonality. For example, a report by the World Bank (2011) shows that India's food subsidy programmes do not allow households to roll over their monthly quota to deal with seasonal variation in prices. For an intervention to be successful in rural areas, among other things, the seasonality problem should be considered as part of the entire system dynamics of the rural population (Rajeswari, 2000:3339).

In Zambia, no comprehensive study has been done to understand the ex-ante and ex-post mechanisms to seasonal food shortages. Therefore, it can be concluded that the ex-ante and ex-post mechanisms to seasonality of rural households in Zambia are not well-known or understood.

1.3 RESEARCH OBJECTIVES

The primary objective of this study was to analyse the ex-ante and ex-post adjustment mechanisms to seasonal food and input requirements. The study was guided by the following specific objectives:

1. Determine whether there is a relationship between household wealth and household characteristics (household size, age of household head, gender of household head and education level of household head).
2. Identify rural households' ex-ante and ex-post adjustment mechanisms to seasonal food and input requirements in good, normal, poor and catastrophic years.
3. Determine whether adjustment mechanisms to seasonality differ by wealth of the household in good, normal, poor and very poor years.
4. Determine whether the probability of using the identified adjustment mechanism by households of a given wealth stratum is the same in good, normal, poor and very poor years.
5. Determine whether seasonal variation in agricultural production is reflected in food consumption.

6. Determine whether household wealth is reflected in seasonal food consumption.
7. Determine whether the adjustment mechanisms to seasonal variations of agricultural production are sufficient to prevent declines in food consumption that have adverse impacts on health in good, normal, poor and very poor (catastrophic) years.

1.4 STATEMENT OF HYPOTHESES

Zambia's agriculture has important seasonality dimensions, influencing production and consumption of rural households. It is against this background that this study tested the following hypotheses:

- The probability of using any of the given adjustment mechanisms to seasonality is the same in good, normal, poor and very poor years.
- Household wealth is related to the size of the household, age of the household head, gender of household head and education level of household head.
- Adjustment mechanisms employed by households faced with seasonal variations in production are sufficient to deal with food shortages and with the seasonal requirements for inputs in good and normal years, but not in poor and catastrophic years.
- Seasonal variation in agricultural production is reflected in depressed food consumption in poor and catastrophic years, but not in normal and good years.
- The adequacy of staple food meals is the same for all the three seasons of the year after a good, normal, poor or very poor harvest.
- Household wealth is not reflected in the average number of meals eaten per day in a season
- Household wealth does not affect the use of the adjustment mechanisms to seasonal food shortages and input requirements.

1.5 ACADEMIC VALUE AND CONTRIBUTION OF THE STUDY

Rural households in developing countries have a high reliance on agriculture for their survival despite agricultural activities being prone to seasonality. The extent to which seasonality affects smallholder farmers' livelihoods in Zambia still remains unclear.

In most rural areas of developing countries, the non-agricultural sector is too small to provide enough jobs to the unemployed, who in most cases are smallholder rural farmers and agricultural labourers. Moreover, the non-agricultural sector in rural areas is related to agricultural activities (Khandker, 2012:244).

Given that the agricultural sector in rural regions of developing countries is highly responsive to seasonality, information generated by this study will help to improve the understanding of seasonality among researchers, development agents and policy makers. Furthermore, having a good understanding of the effect of production and consumption seasonality on smallholder rural households is important in view of the fact that the scope for policy interventions to reduce the seasonality problem is dependent on having a good understanding of the existing mechanisms used to minimise the negative effects of seasonality.

Finally, for seasonal fluctuations to be reduced in food supply and consumption, the risk in production systems needs to be reduced for all rural households. Inappropriate technical interventions in rural areas increase variability and risk in both production and consumption. In order to reduce the adverse effects of seasonality, the application of appropriate interventions in rural areas is important. These can only be applied if development agents have a good understanding of the effects of seasonality on their target population (Longhurst, Chambers & Swift, 1986:69).

1.6 ORGANISATION OF THE STUDY

This document is divided into six chapters. Chapter One gives an introduction to the study. In this chapter, the background and problem statement, research objectives, research hypotheses and the justification of the study are given.

Chapter Two provides an extensive review of literature on seasonality and coping to smooth household income and consumption. The chapter also looks at the methods of data analysis and data sources that are commonly used in seasonality studies.

The third chapter provides a discussion on research design and methods. The chapter specifically looks at the strategy of inquiry, sampling, data collection and data analysis.

Chapter Four looks at the sample household characteristics and ex-ante and ex-post adjustment mechanisms to seasonal food and input requirements.

Chapter Five looks at whether wealth and agricultural production are reflected in seasonal food consumption. Finally, Chapter Six provides a summary, conclusions, recommendations and limitations of the study.

CHAPTER 2

SEASONALITY AND COPING MECHANISMS IN AGRICULTURE IN THE DEVELOPING WORLD

2.1 INTRODUCTION

Farming households face two sets of problems. The first involves trying to realise higher household income levels. Households use income for consumption, leisure and investment. The other set of problems involves how to smooth income and consumption over time, minimise future risks and disasters and find solutions on how to deal with the consequences of unexpected or inevitable calamities and risks. Households are expected to take into consideration both sets of problems when making household allocative and distributional decisions. Production decisions are related to higher income aspirations and readiness to minimise risks (Binswanger & Rosenzweig, 1986:505).

The discussion below is divided into the following aspects: production relations in agriculture, harvest and lean seasons, consumption seasonality, rural households' response to seasonality, household assets and consumption smoothing. These aspects underline the importance of seasonality among the rural households.

2.2 PRODUCTION RELATIONS IN AGRICULTURE

Rural annual variations in rainfall, sunshine and temperature levels lead to seasonal fluctuations of agricultural activities and production because of land immobility. Annual climatic variations cause fluctuations in food availability among the farming households. Seasonal need for credit arises in order to fill the gap between income and expenditure. Despite the need for credit, rural areas have poor or non-existent credit markets and, as a result, household food consumption is responsive to seasonal production. The food output level is uncertain during planting because of weather variations, insect infestation and disease. Neither the market prices of farm products nor of inputs are known during the time of making

production plans. Agricultural price is related to variations in weather conditions. Agricultural activities are dependent on weather and as a result cannot be known in advance with certainty. Any deviation of an agricultural activity from optimal timing affects yield negatively. Household life cycles and asset break-down have an effect on production as well. Household fixed assets may fail to perform. Machines can break down, animals may fall sick and buildings may fall down. Households may also fail to work for a number of reasons such as sickness, accidents and natural life cycles (Binswanger & Rosenzweig, 1986:513-514).

Crop and animal insurance is non-existent in most rural areas because of high information costs. The cost of gathering information required before entering into a contract is considered to be too high by insurance companies. For example, it is difficult to determine the yield at a time of planting from a given piece of land. There are differences in expected yields among farmers, even within small villages. The expected risk has to be determined for each farmer and/or field. Since deviations from the planned yield are common, loss assessments have to be carried out frequently. This is done in addition to the process of gathering information to determine yields. The other factors responsible for the absence of insurance markets in rural agriculture are moral hazard and adverse selection (Binswanger & Rosenzweig, 1986:514–515). Moral hazard is defined as “the risk caused by a change in conduct caused by an expectation of compensation for a negative outcome” while adverse selection refers to “a situation in which buyers have more information than sellers prior to purchase” (Kirsten, Dorward, Poulton & Vink, 2009:39). The insurance contract can lead to a reduction of incentives for fertiliser application, animal or plant husbandry and pest and disease control (Binswanger & Rosenzweig, 1986:515).

The other problem that insurers face is high risk covariance in agriculture. Crops or animals for all farmers sometimes do fail at the same time and this implies that the insurer needs high reserves at all times. For an individual farmer to write insurance contracts for his fellow farmers, he is supposed to have reserves equal to the insured value at all times. This leads to the degeneration of the insurance problem (Binswanger & Rosenzweig, 1986:515).

Just like insurance companies, banks rarely offer their services to rural farmers. There are two main problems that limit banks’ participation in rural agriculture. One of these is synchronic timing (two actions or events happening at the same time) and seasonality. If both the

depositor and the borrower were involved in agricultural production, the depositor would want to withdraw money at the beginning of the rainy season, the time the borrower would need to borrow finances for agricultural production. The other problem is the covariance of production yield risk, which leads to variations in default risks. Covariance of production yield leads to covariance of income. As a result of the problems faced by insurance firms and banks in rural areas, self-insurance becomes the preferred method among farming households to help minimise intra-annual fluctuations in consumption (Binswanger & Rosenzweig, 1986:516).

2.3 HARVEST AND LEAN SEASONS

This section looks at the harvest and lean seasons. The harvest season is the period that falls just after the crop growing season. This is the period when crops are ready for consumption and marketing. During the crop growing season, the income of agricultural households tend to have a low expected value and a low variance, while the harvest season tend to have income with a high expected value and a high variance (Paxson, 1993:47). The harvest season is also associated with low food prices, low malnutrition levels and local off-farm work (Devereux & Longhurst, 2009).

Sahn (1989) finds that seasonal food shortages ensue because as we move from one harvest to the other both stored food supplies and cash from the sale of crops get exhausted. He further finds that the household nutrition status is affected by seasonal food availability. Household consumption levels are high during the harvest season, the period which coincides with high household income. The consumption in the harvest season is not only affected by household harvest and income but by the information concerning future incomes as well. Poor rains in the growing season can cause reductions in food consumption even before the poor harvest season is realised. In situations where the growing season income of households is less variable than the harvest season income, the average fall in food consumption from the harvest season to the growing season would be smaller than the average fall in consumption from the growing season to the next harvest season. Naturally, households may consume less before the harvest season not because of income problems but because of uncertain expectations with regard to the harvest season income (Paxson, 1993:48-49). Farming

households sell most of their produce at harvest when food prices in rural areas are at their lowest levels and start buying food during the lean season (Devereux, 2009; Saha, 1994:267). Maize Seasonal price movement remains highly pronounced in Zambia. Just after the new harvest, maize prices fall to their lowest levels around July (Haggblade, 2006). Maize prices In Zambia vary as much as 40% between the harvest season and the lean season (Chapoto, Govereh, Haggblade & Jayne, 2010). Figure 2.1 below shows Retail prices of white maize grain for Kasempa, Kabwe and Kalomo districts of Zambia.

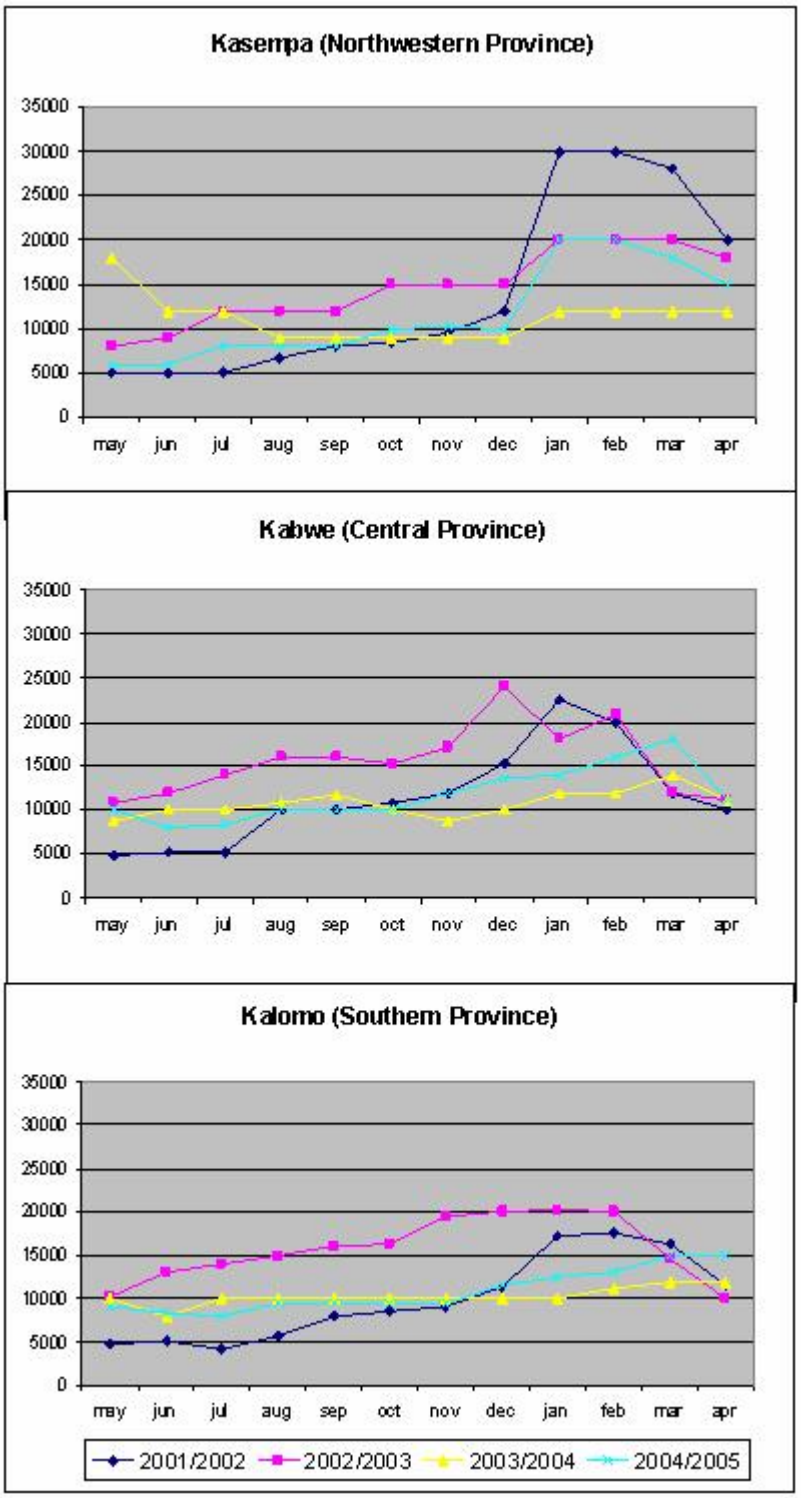

Figure 2.1: **Retail prices of white maize grain in three Zambian markets**
Source: Food and Agriculture Organisation (FAO) (2005).

The lean season is defined as a pre-harvest period when food stocks from the previous harvest have begun to run low. The worst part of the lean season is the period just before the next harvest season. This is the time when food stocks are at their lowest levels. The lean season is associated with low employment and income levels. During the lean season, food shortages

can even reach famine levels (Saha, 1994:267). Seasons affect rural households differently (Dostie *et al.*, 2002*;* Khandker, 2012; Jalan & Ravallion, 1999). Rural households eat close to the minimum nutritional threshold after the harvest. This is attributed to the fall in food prices. Seasonal decline in household consumption in the lean season is more pronounced among the poor households than among the rich because rich households have better access to better mechanisms for consumption smoothing (Dostie, *et al*., 2002:503). In addition, the hungry season is associated with severe to acute malnutrition levels and this compromises the human immune system. As result of rainfall and compromised immune systems, diseases such as diarrhoea, malaria and other water-borne diseases hit hard during this period. Diseases reduce household labour productivity and impose extra time and financial costs in looking after sick household members. The hungry (lean) season also poses psychological effects as household members experience high levels of stress and anxiety (Vaitla, Devereux & Swan, 2009:1–2). The hungry season is also associated with high food prices (Devereux & Longhurst, 2009). The figure below shows seasonality in severe acute malnutrition, malaria and rainfall levels in Niger, in 2007.

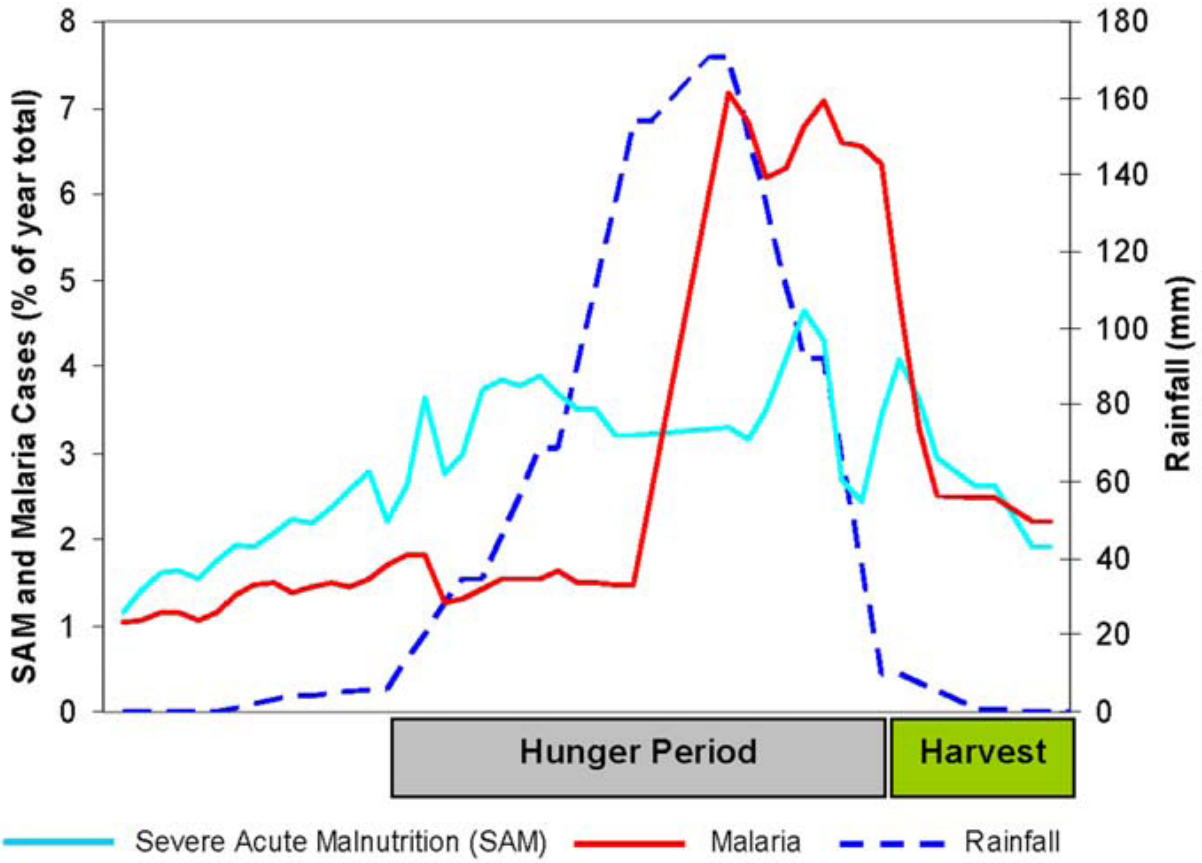

Figure 2.2: **Seasonality in severe acute malnutrition, malaria, and rainfall in Niger, 2007**
Source: Vaitla *et al*., (2009:2).

2.4 CONSUMPTION SEASONALITY

Having looked at the harvest and lean seasons, we now look at the research findings which try to explain the causes of consumption seasonality. When seasonal preferences and prices are similar across rural households, seasonal consumption patterns should also be alike across rural households, despite different seasonal income patterns. Conversely, when income seasonality is responsible for the observed seasonal consumption patterns, households with seasonal income patterns that differ will show different consumption patterns. When this happens, we can conclude that seasonal consumption tracks seasonal income across seasons (Paxson, 1993:40).

Devereux (2009:3) finds that the seasonality (in developing countries) that is observed in food prices is mostly as a result of seasonality in agricultural production. The patterns of staple food prices are predictable. Staple food prices are at their lowest levels just after the harvest. They reach their peak a month before the harvesting period, and then drop sharply as the new

produce reaches the market. Devereux also finds that there is an evident correlation between the amount of rainfall received and food prices.

Khandker (2012:251) argues that seasonal income is more important in explaining seasonal consumption than annual average income. To illustrate this, he shows that a 10% rise in seasonal income in rural Bangladesh leads to a 10.4% increase in household per capita consumption, while per capita food consumption increases by about 6%. Conversely, a 10% increase in average monthly income causes a 6.9% rise in per capita consumption and also leads to a 5.7% increase in per capita food consumption. Thus, Khandker (2012) demonstrates that seasonal consumption tracks seasonal income. This shows that families are not able to practice consumption smoothing with income across seasons. This finding is consistent with findings by other researchers (Basu & Wong, 2012:18; Kazianga & Udry, 2006).

Khandker (2012) finds that in Bangladesh the price of rice (staple food in Bangladesh) is lower in the pre-harvest season than in the other seasons, with the exception of one region, Rangpur. On the contrary, the real price of rice was the lowest throughout the year in the Rangpur region. Devereux (2009:4) finds that the prices of maize, the staple food in Malawi, and malnutrition rates among children in Malawi have a strong relationship. They are both low during the post-harvest months (months which run from May to October) but then start increasing mutually and reach a peak during the annual hungry season months, January to February, before they start declining when the new produce starts entering the market around the annual harvest period (March to April). Despite Devereux's finding in Malawi that there is a strong relationship between food prices and child malnutrition, Khandker (2012) fails to claim that seasonal fluctuations in food consumption are related to seasonality of food prices.

Bangladesh's rural households depend on crop income for their livelihoods. The dependence on crop income leads to seasonality of income. Seasonality of income and seasonality of food prices affect household food consumption differently; that is, a fall in income lowers food consumption while a fall in food prices raises consumption. The income effect on seasonality of consumption is more dominant than the price effect. Thus, the seasonal decline in food consumption that is observed during the pre-harvest season in Bangladesh is mainly due to the sharp fall in seasonal income rather than increases in food prices (Khandker, 2012:46).

Weekly food intake in rural areas in East Indonesia is 5.9% higher during the harvest season than in the lean season. Despite food intake being higher during the harvest season, food consumption expenditure is lower, mainly because food prices are at their lowest and households consume their own produce (Basu & Wong, 2012:16). Chaudhuri and Paxson (2002:4) find that there is evidence that seasonality in consumption does not track seasonality in income. This means that seasonality in income could not explain the observed seasonal fluctuations in consumption. They also find that consumption seasonality is quite similar for households with very different seasonal income levels. Consequently, they conclude that the observed seasonality in consumption is as a result of other factors, such as price and preferences. The study by Chaudhuri and Paxson (2002) is in contrast with those of Basu and Wong (2012) and Khandker (2012:251), who establish that seasonality in food consumption is influenced by seasonality in income. Basu and Wong (2012) also find that seasonality in food consumption cannot be explained by price seasonality. However, Basu and Wong (2012) and Chaudhuri and Paxson (2002) find similar results on non-food expenditures. In addition, Chaudhuri and Paxson (2002) find that seasonal income is related to food-related outcomes.

Compton, Wiggins and Keats (2010) find that there is a relationship between malnutrition and high food prices. They find that an increase in food prices leads to an increase in malnutrition. Malnutrition is particularly common among children in rural areas, where the majority of households are already wallowing in poverty. This finding is similar to Sahn(1989) who finds that the household nutritional status is influenced by the seasonal availability of food.

Khandker (2012) shows that consumption among the non-poor households is not necessarily more insured against seasonal changes in income than consumption among the poor households. This is in contrast with the results from other countries such as China, which show that consumption is better insured and protected among the rural non-poor households than among the rural poor households (Jalan & Ravallion, 1999:79). Muller (1997:9-10) finds that unlike rich households, poor households' consumption levels become more unstable as they move away from the harvest season.

Literature in this sub-section has shown that seasonality of food prices and income affects different places differently. In some places, changes in seasonal consumption can be explained by changes in seasonal income, while in other places the observed changes in

seasonal income fail to explain changes in seasonal consumption. When changes in seasonal income fail to explain observed changes in seasonal consumption, then other factors such as prices and household preferences may be the best variables to use in explaining the observed changes in seasonal consumption.

2.4.1 Food shortage, anticipation and gender

As previously stated, expected food consumption patterns differ across seasons. The number of rural households that expect food shortages during the lean season is more than double the number of households that expect food shortages during the harvesting season. The worries connected to anticipation of food shortage as well as experiences of shortages of food are themselves seasonal in nature. For example, a study from West Timor, Indonesia, has shown that during harvest season surveys, periods of food abundance, more than 33% of households foresee experiencing lack of adequate food during the lean season but only about 12% of households anticipate experiencing food shortages during the harvest season. Furthermore, in the harvest season, households are 11% less likely to report food shortages in the previous month. Maize and rice have different growing seasons and as a result, rice and maize farmers face different income and consumption patterns. However, both types of farmers show the same pattern in monthly non-food and festival expenditures (Basu & Wong, 2009).

A study from Ethiopia shows that seasonality affects female-headed households more than male-headed households. In other words, consumption seasonality is gendered. A survey found that 85.6% of households experienced food shortages during 2005/06. The occurrence was higher among female-headed households. The survey found that 97% of female-headed households suffered from food shortage while the percentage of male-headed households that had an experience of food shortage was 81%. Female households were consistently reporting higher food shortage levels, peaking at 66.70% in July while the percentage of male-headed households was at 57%. Nevertheless, male-headed households that face food shortages exceed female-headed households in absolute numbers (Devereux, Sabates-Wheeler, Tefera, & Taye, 2006:19). Table 2.1 below presents Devereux *et al*. (2006) findings in Ethiopia.

Table 2.1: Food shortages by month by household type (% of households)

Month	Male-headed	Female-headed	All households
March 2005	21.50	26.30	22.80
April 2005	33.60	35.00	34.00
May 2005	45.70	47.70	46.30
June 2005	52.00	60.20	54.30
July 2005	56.10	66.90	59.10
August 2005	47.40	63.20	51.80
September 2005	29.10	50.00	34.90
October 2005	5.80	21.40	10.10
November 2005	1.40	7.50	3.10
December 2005	1.90	7.50	3.40
January 2006	3.70	9.80	5.40
February 2006	9.70	15.80	11.40
March 2006	19.60	21.10	20.00
April 2006	22.80	21.80	22.50

Source: Devereux *et al.* (2006:66).

2.5 RURAL HOUSEHOLDS' RESPONSES TO SEASONALITY

This section discusses rural households' responses to seasonal fluctuations in consumption. Farming in rural areas of developing countries is 'subsistence-oriented' but we cannot classify most farming households in the 'subsistence farmers' category because their agricultural production levels fail to achieve self-sufficiency in most years and they, as a result, rely on other sources of income to fill the seasonal food deficit gap (Devereux, 2009).

"Africans do not starve, they 'cope'" (Seaman in Devereux, 2009:2). A number of studies have been done on how African rural households respond to food shortages (Chambers, 2006; Corbett, 1988; Devereux, 2009; Devereux *et al.*, 2006; Longhurst *et al.*, 1986; Regassa, 2011). Households faced with food shortages use the available mechanisms in a more predetermined order. The ranking of mechanisms adopted by households follow a pattern that is not different from the literature on household responses to drought and famine. Households prefer to adopt mechanisms that have minimal cost to the household and are easy to reverse, for example, reducing the portions of meals or reducing the number of meals consumed in a day (Corbett 1988:1100; Devereux *et al.*, 2006:20).

Studies on coping mechanisms show that only a small group of smallholder farmers have the capacity to cope with adverse seasonal changes in household food availability. Poor households resort to seasonal migration in search of employment. Smallholder farmers

employ a variety of adaptation options, which include sale of livestock, changing to other subsistence crops, wage labour and seasonal migration. These options constitute no more than short-term coping measures. Smallholder farmers also strive to employ coping mechanisms that would help them minimise their vulnerability to seasonal changes in food household. Some mechanisms that would offer a long-term solution to the seasonality problem, such as institutional credit and crop insurance, are rarely used by smallholder farmers because of procedural intricacies and stringent eligibility criteria, which may be compounded by lack of awareness (Hiremath, 2007).

The other coping mechanisms include reducing expenditure on non-food items, switching to cheap or substandard foods (including eating wild fruits and roots), reducing meal sizes, skipping meals and finding casual employment. In extreme situations, rural households resort to mechanisms such as withdrawing their children from school and postponing activities such as initiation ceremonies and funerals (Devereux, 2009:3).

Rural households also apply adaptive mechanisms such as changing cropping and planting practices (for instance, households may use mono-cropping, crops that have low seasonal specificity and moisture stress-resistant varieties such as roots and tubers), using of inter-household transfers and loans, buying food on credit, getting credit from moneylenders, migrating to other areas, households breaking up and marketing of inferior commodities. Rural households anticipate food shortages that vary across seasons. This enables them to exploit coping or adaptive mechanisms in a far from chaotic manner (Basu & Wong, 2012; Corbett, 1988:1100; Lipton, 1986).

Some studies show that reducing meal sizes is the most common strategy in the early days of food shortage. Households are rational consumers who try to avoid using mechanisms that would compromise their long-term income generating capacity, and as such the best possible mechanism is used at any given time. Household adjustment mechanisms do not remain static during the entire period of food shortage. Households give priority to mechanisms that would guarantee future asset accumulation to ensure their future survival rather than increasing present levels of consumption. Although households consider the future to be more important than the present, a time may come when the present becomes completely uncertain to ensure the survival of the household or some members of the household. When households reach

such a stage that present food consumption levels take precedence, they become vulnerable to selling important productive assets such as land and livestock. In other words, mechanisms that entail high cost to the household such as selling of key productive assets, compromising future income sources or social status[2] are espoused last, when other mechanisms have been exhausted (Devereux *et al*., 2006:14).

Maxwell and Caldwell (2008) say that their experience of using the coping strategy index has shown that households employ four types of food consumption coping mechanisms. The coping strategy index is a tool that "measures behaviour: the things that people do when they cannot access enough food".

- First, households may adjust their diet. For example, households may switch food consumption from favourite foods to cheaper, less attractive substitutes.
- Second, the household can try to enhance their food supplies using short-term mechanisms that are not sustainable over a long period. Good examples may include borrowing or purchasing on credit. More extreme examples include begging or eating wild foods, immature crops, or even seed stocks.
- Third, if the available food is still inadequate to meet needs after using the above mechanisms, households may attempt to reduce the size of the household that they have to provide food for by sending some of the household members elsewhere (a good example may be sending children to the neighbours' house when those neighbours are having their meals).
- Fourth, and most commonly, households can try to handle the food shortfall by rationing the available food to the household (cutting portion sizes or the number of meals, favouring certain household members over others, or going whole days without eating).

It is clear that the above stages of coping indicate a problem of food shortages and also show different degrees of severity of the problem. For example, the household that just switches

[2] Social status refers to honour attached to one's position in society (Wright, 2003:5)

from consuming maize to cassava is clearly less food insecure than the household where all the members go without consuming anything for the entire day (Maxwell & Caldwell, 2008).

Seasonality generates stress for farming households and manifests itself differently in different regions. The mechanisms that farming households adopt to deal with seasonality differ. However, research findings on coping mechanisms show common signs of stress such as selling food cheaply after harvest season and buying it back later at higher prices in subsequent seasons, rationing food consumption, or even selling assets like livestock during hungry seasons. Coping mechanisms and responses weaken the viability of farming and rural households (Devereux & Longhurst, 2009).

2.6 HOUSEHOLD ASSETS AND CONSUMPTION SMOOTHING

This section presents a discussion on household assets and consumption smoothing. In other words, the section looks at the importance of household assets in smoothing annual consumption across seasons.

There are virtually no credit markets in most rural areas in developing countries. As a result, most developing countries' smallholder rural farmers rarely have access to credit. Households are thus left with no other choice but to use household assets to smooth consumption. The assets that are commonly used for consumption smoothing include livestock holdings, tools, consumer durables, grain stocks and cash savings (Hoogeveen, 2003:261; Kazianga & Udry, 2006:429-430; Khandker, Khalily & Samad, 2010). Farmers sell no more than 10% of their grain produce in a normal year but sell virtually all their cash crop to pay off household loans and meet household necessities. During a normal year, household grain production comes close to satisfying the household needs for an average household (Swinton, 1988:130).
The sale of livestock is important during the lean season to provide food smoothing and buffering effects. Small livestock such as goat, sheep, pigs, hens and ducks are the commonly used buffers against food shortages (Chambers *et al*., 1981:229).

Hoogeveen (2003:260) finds that livestock and cash savings are the most common assets that households in rural Zimbabwe turn to during the times when they are faced with seasonal adverse conditions such as hunger. A study that was carried out in the Brazilian Amazon also

supports the finding by Chambers *et al*. (1981), Kazianga and Udry (2006) and Hoogeveen (2003) that livestock such as cattle, pigs and goats are kept by rural households as a form of liquid asset. Unlike grain prices that fluctuate, livestock prices do not show significant seasonal fluctuations because they rely heavily on markets outside the village (Siegmund-Schultze, Rischkowsky, da Veiga & King, 2007:747).

Despite claims that livestock is used to help rural households to get out of food shortage problems, data from rural areas of Burkina Faso show very little responsiveness of net livestock sales to seasonal income and consumption fluctuations even in times of high food shortages (Kazianga & Udry, 2006:429–430). However, Kristjanson, Krishna, Radeny, Kuan, Quilca, Sanchez-Urrel and Leon-Velarde (2007:295-306) find a positive relationship between animal sales and food shortages in the Peruvian Andes.

An examination of farm transactions over the year following the 1984 harvest in Niger finds a general tendency of selling livestock during the lean seasons in order to finance the purchase of cereals. During normal years, rural households in Southern Niger purchase on average the equivalent of 4% to 8% of their staple food production (that is, sorghum and millet), but in 1984–1985 (drought year) rural households in three of the villages that were studied were forced to buy sorghum and millet equal to 35% of their total production. To get the money they needed to finance the buying of cereals, households had to sell livestock and their cash crops stock. Some farmers prepare for adverse conditions lying ahead of them by selling livestock, especially cattle. There is a significant relationship between the areas that are hit most by food shortages and the number of livestock sold. Households that are hit most by adverse conditions sell relatively substantial numbers of livestock. Sale of assets such as land is not common during times of adverse conditions among rural households (Swinton, 1988:130–135).

Literature reviewed in this sub-section has shown that rural households turn to their livestock and cash savings during food shortages in order to find money to finance food purchases. Literature has also shown that unlike livestock, land is rarely sold in order to finance consumption gaps. The papers that have been reviewed have also shown that despite other regions showing that livestock is an important asset households turn to when faced with

adverse seasonal conditions, some areas show very little relationship between net livestock sales and consumption fluctuations.

2.7 DATA SOURCES AND ANALYSIS METHODS USED IN THE STUDY OF ADJUSTMENT MECHANISMS TO SEASONALITY

In the pursuit to understand the ex-ante and ex-post coping mechanisms to seasonality, researchers have invoked upon a number of methods to help them achieve their objective(s). This section presents the data sources and data analysis methods for the study of adjustment mechanisms to seasonality.

2.7.1 Data sources

The sources of data in the study of ex-ante and ex-post mechanisms to seasonality studies are limited to primary data sources and national socio-economic surveys. Lekprichakul (2009), in a study of ex-ante and ex-post risk coping strategies among the subsistence farmers of Southern and Eastern provinces of Zambia, uses the Research Institute for Humanity and Nature's Agricultural Household Survey (RAHS) data. The RAHS is a supplement to the Post-Harvest Survey (PHS) conducted on an annual basis by the Central Statistical Office (CSO) of Zambia. The sampling frame for the standard enumeration areas (SEAs) was based on Census of Population and Housing of 2000. The RAHS uses stratified random sampling where the probability of being included in the sample is proportional to its size in the first step. In the next step, a number of farming households living in selected SEA which cultivates on more than 0 hectares to no more than 15 hectares of land are selected. Lekprichakul's data had a 12.5% attrition rate. The attrition rate refers to the rate of reduction in the size of the required sample. The reasons for the failure to obtain complete responses are:

a. Some households moving out of the SEA
b. Non-contact, and
c. Some households were found to have been dissolved.

The RAHS does not provide data on the ex-ante coping mechanisms and its consumption. Unlike the study by Lekprichakul (2009), Devereux *et al*. (2006) use primary data to determine households' coping strategies in hungry seasons in Ethiopia.

2.7.2 Data analysis methods

Having looked at the sources of data in ex-ante and ex-post coping mechanism studies, we turn our attention to data analysis methods that are commonly used in such studies. Most of the literature that has been reviewed on the adjustment mechanisms to seasonality has relied on descriptive methods of data analysis (Corbett, 1988; Devereux, 1999; Devereux & Longhurst, 2009; Devereux & Næraa, 1996; Lekprichakul, 2009; Maxwell & Caldwell, 2008; Swinton, 1988) This could be attributed to the qualitative nature of the study.

2.8 CHAPTER SUMMARY

Chapter 2 provided a review of literature related to seasonality. The chapter opens with literature on production relations in agriculture and ends with data analysis methods. A farming household is faced with two problems. The first problem is trying to achieve higher income while the other problem deals with how best to smooth consumption across seasons in order to avoid a seasonal fall in consumption. Households use a number of mechanisms to avoid an adverse fall in household consumption. Both primary and secondary data have been used in studies that look at adjustment mechanisms to seasonality. The next chapter looks at research methods and procedures.

CHAPTER 3

RESEARCH METHODS AND PROCEDURES

3.1 INTRODUCTION

This chapter describes the research methods and procedures. Firstly, the context and units of analysis are described. Secondly, the sampling procedure is described. The sampling procedure shows how the sample size was determined and how the study entities were selected. Thirdly, the data collection process is described. A brief description of the questionnaire that was used for data collection is also given. Finally, the chapter gives a description of the tools for data processing, analysis and interpretation.

3.2 CONTEXT AND UNITS OF ANALYSIS

This study was conducted in Mazabuka district. For practical reasons, it was not possible to include all the rural areas of Mazabuka district. Out of the four chiefdoms (Mwanachingwala, Naluama, Mwenda and Hanjalika) in Mazabuka district, Mwanachingwala was randomly selected as the study area. Most rural areas in Mazabuka generally have similar type of livelihood activities, that is, crop production and livestock rearing (Seesa, 2003). Therefore, Mwanachingwala offers a good representation of Mazabuka rural. The study involved rural households only. The study did not include urban households, regardless of occupation. Mwanachingwala has a population of 60,746 (CSO, 2010). 60,746 include both people from rural and urban areas.

The local language for Mwanachingwala is Tonga (Mwinji, 2007) while the staple food for is maize and it is grown by most of the smallholder rural households. The most important local agricultural products among the smallholder farmers are maize, cattle, chickens and goats (in order of importance) (International Fund for Agricultural Development, 2002).

The average number of hectares of farm holding in Mwanachingwala for small-scale farmers is 2.2 hectares. Mixed farming is the main farming system practised in Mwanachingwala (Mwinji, 2007). The mixed farming system is the common farming system in Mwanachingwala area. Mixed farming system refers to a situation where crop production and livestock rearing form an integral component of a farming system. The main reasons for using a mixed farming system are (FAO, not dated):

- spreading of risks over both crops and livestock production,
- complementarity between crops and livestock and
- a flexibility that permits the alteration of crop / livestock ratios in expectation of opportunities, needs and risks.

Seasonal hunger is prevalent in Mwanachingwala area mostly between December and March. The severity of the problem differs from family to family depending on household income levels, assets and connections within and/or to the outside the village. The poverty levels in rural areas of Zambia are as high as 84%. The poor people of Mwanachingwala do not have sufficient access to social protection schemes, financial assets such as micro-finance, and skills development opportunities (Chitundu *et al.*, 2006).

3.3 SAMPLING

The study of seasonality is in principle a time series study because it requires data from different points in time. However, despite seasonality studies being considered as time series studies, some researchers have been able to study seasonality using cross-sectional data (Devereux & Næraa, 1996; Devereux, 2009).

Determination of a sample size is important in situations where there is no available data for the researcher to embark on a seasonality study of rural livelihoods. In line with this, Woodward (in Regassa, 2011:40) and Naing, Winn and Rusli (2006:9) use the following sampling equation to determine the sample size where prevalence of an important variable is known but the population size is not known:

$$\text{Sample size (n)} = \frac{P\,(1-P)\,Z^2}{d^2}$$

where:

Z statistic (*Z*): For the 95% confidence level

Z = 1.96

P = proportion of prevalence (from previous studies). Where P is not known it is advisable to use 50% since it gives the maximum sample size.

d = precision (in proportion of one; if 5%, d = 0.05).

The above formula for sample size determination was used in this study to determine the sample size because the rural population of Mwanachingwala is not known.

where:

Z = 1.96

d = 0.05

P = 0.83 (proportion of food insecure people in rural areas of Zambia (TheIDLgroup, 2002:11).

Applying the above formula, sample size (n) = 211. For contingency reasons, 14 households were added to the obtained sample size to make it 225.

The sampling was done in three steps. The researchers could not find a sampling frame for the study area. In the absence of a sampling frame, four schools were randomly selected in Mwanachingwala rural area. The headmasters provided the list of villages linked to each school. Two villages were randomly sampled from Mukuyu basic school while one village was randomly sampled from each of the other basic schools (Simwaba, Munenga and Mbiya). The five villages that were sampled are Mwenda, Chiyaba, Chimbololo, Hapela and Mwete. The final step involved simple random sampling of 45 households from each of the sampled villages. The village sampling frames were obtained from the headmen/women. Table 3.1 below provides the sampled respondents from the five villages.

Table 3.1: Sampled respondents

Village name	Number of households	Sample households
Chiyaba	71	45
Mwenda	101	45
Hapela	71	45
Chimbololo	110	45
Mwete	72	45
Total	**425**	**225**

Source: Own survey (2013).

3.4 DATA COLLECTION

The data that were used in this study were gathered using a structured questionnaire survey (see Appendix A). The data were collected in March 2013 and recall was used to report about the other seasons. The three seasons for this study were April–August (post-harvest) season, August–December season (land clearing and preparation period) and December–April (crop growing) season. The division of the year into these three periods is considered sufficient to capture the seasonal differences in consumption.

For logistical reasons, agricultural data is usually collected during a single visit to the household. Studies that rely on recall data rely on the assumption that households are able to remember the activities that happened in the past. Such studies also rely on the hypothesis of salience. “The Salience hypothesis states that events that are of greater salience to the respondent are less likely to be affected by recall decay” (Garon, 2013). During the focus group discussions it was found that household events that happened as far back as 1995 were still fresh in their memories. For example, the households that lived in the village for as far as 1995 still recalled that government had to bring yellow maize as relief food to save them from the hunger. In addition, they were also able to recall that Dr Guy Scott was by then the Minister of agriculture. During both focus group discussion and household interviews, households referred to the yellow maize as “Guy Scott”. Using the salience hypothesis and the assumption that households were able to recall activities that happened in the past, this study was able to rely on recall data.

Focus group discussions were conducted in order to have insight on the common ex-ante and ex-post adjustment mechanisms. Each focus group discussion comprised 10 households. In both focus group discussion meetings, households were able to recall that 1995, 2005, 2011

and 2012 were the most recent very poor year, poor year, good year and normal year respectively. The focus group discussions showed the data collection team that they were supposed to be exceptional in their probing skills in order to collect good data.

The study defined a year as a period from the onset of one harvest to the next harvest. In Zambia, farmers start their harvest in April. Therefore, in reference to this study, the year starts in April. In line with this definition, the year referred to as 1995 is a period that runs from April 1995 to March 1996. The definitions of the good, normal, poor and very poor years are as follows:

- The good year refers to the year with the most outstanding or the best harvest
- The normal year refers to the year when the majority of smallholder farmers obtain the usual or commonly attained yields
- The poor year refers to the year when households record average or below normal yields
- The very poor year (catastrophic year) refers to the year when there is total or close to total crop failure.

From the focus group discussions it was found that the most recent good, normal, poor and very poor years were 2011, 2012, 2005 and 1995 respectively. After the focus groups, the developed questionnaire was revisited and some refinements were made using the data obtained from the focus group discussions. The focus groups were followed by a questionnaire pre-test. The questionnaire pre-test was done in order to further refine the questionnaire to ensure that respondents had no problems in responding to questions.

Respondents were interviewed using the structured questionnaires. The high levels of illiteracy in rural areas have a negative effect on the quality of data collected. A questionnaire provided an efficient way of getting responses from a large sample since each respondent was asked the same questions. The questionnaire was specifically designed in order to maximise response rate, reliability and validity of the data (Saunders, Lewis & Thornhill, 2009: 361-362). The interviewer-administered structured questionnaire was chosen as it is appropriate in situations where there are high levels of illiteracy among the target population. The interviewer-administered structured questionnaires provide a face-to-face interaction between

the interviewer and the respondent. This interaction offers the distinct benefit of establishing a rapport between the interviewer and the respondent. Face-to-face interviews also offer an opportunity for the researcher to get clarification for ambiguous answers (Leedy & Ormrod, 2010:188–189). In situations where the sampled respondent refused to be interviewed, the interviewer substituted such respondents to ensure that the unknown bias that could be caused by refusals is minimised. In cases where substitution of respondents was needed, the selection process was done using a simple random sampling method. The interviewers were trained to ensure that they collect the best possible data from the respondents.

To help improve the quality of the data that were collected, both the household head and the spouse were interviewed together. In cases where the household head was married, he was interviewed alone but other available elderly members of the family were encouraged to participate. The respondents were interviewed from their homes. Before starting the interview, a statement was read aloud informing the respondent of his/her right to decline participation without encountering any negative consequence. Responses from respondents were confidential.

The 5 data collectors that were used in this study were given 2 days training to ensure that they understood the questions in the questionnaire and the ethical requirements. The training also ensured that data collection was standardised. A short duration for data collection is believed to be important to ensure that data are collected within the same stage of the season. In line with this requirement, the data collection process took only five (5) days.

3.4.1 Brief description of questionnaire content

The questionnaire was adequately prepared to meet the objectives of the study. It was divided into six sections. To effectively achieve the study objectives, determination of household assets, maize production and consumption, ex-ante and ex-post adjustment mechanisms to seasonal food shortages and input use were critical. The questionnaire was organised as follows:

Part A: Information on the household identification number, district name, village name and date of interview.

Part B: Household data such as sex, age and level of education of the household head, household main occupation, how long the household has lived there and size of the household.

Part C: Data on the household assets and their values, livestock sales and slaughter in the past 12 months, whether the household received remittances and cash gifts, cash credit, cash from rented land and cash from animal draft power. This part also gathers information on the main house; roofing, wall, door and floor materials as well as the value of the main house.

Part D: Data on household maize yields in 50kg bags, number of 50kg bags of maize stored, when the stock runs out, price of a 50kg bag of maize just after harvest and just before harvest, number of meals normally eaten and the adequacy of the staple food in each of the three seasons (April–August, August–December and December–April).

"Adequate" was defined to the respondents as a situation when the household was able to meet the staple food needs while inadequate was when the household had insufficient staple food to meet the household food requirements. Moderately adequate was defined as a situation where the staple food needs were just barely met. To get the average number of meals eaten per day, households were asked to recall the number of meals that they most often had in a particular season.

All the information mentioned in this part was gathered for all the four years, that is, normal year (2012), good year (2011), poor year (2005) and very poor year (1995). An effort was always made by the data collectors to ensure that respondents recall the events that occurred in the years that were studied.

Part E: Data on household off-farm labour activities for each of the years mentioned in Part D. The information includes the number of household members who worked for food, the number of household members who worked for cash and the number of household members who migrated in search of employment.

Part F: Data on the ex-ante and ex-post adjustment mechanisms to seasonal food shortages and input use. This information was gathered for each of the years mentioned in Part D. The households were asked to place themselves just after the harvest period of the particular year

that was being studied and say how they prepared for the inputs of the following crop growing seasons. For the ex-ante adjustment mechanisms to seasonal food requirements, households were asked to place themselves just after the harvest period of the particular year and start recalling how they had planned to meet the food shortages that were expected during the rainy seasons after a good harvest, normal harvest, poor harvest and very poor harvest. For the ex-post adjustment mechanisms to seasonal food requirements, households were asked to recall the harvest season of each of the years that were studied and then recall what they did when they run out of the staple food as they moved from the particular harvest seasonal to the next harvest. For example, as they moved from the 1995 harvest time to the 1996 harvest time. For the ex-post adjustment mechanisms to seasonal inputs requirements, households were asked to recall what they did to meet the input requirements for the crop growing season that followed a particular harvest when they fell short of the planned quantities of farming inputs.

3.5 DATA PROCESSING, ANALYSIS AND INTERPRETATION

3.5.1 Introduction

Data analysis refers to the ability to break down the data and clarify the nature of the component parts and the relationships between different variables (Saunders *et al.*, 2009:587). All researchers are required to apply logic in their work. When using quantitative research, the researcher looks at quantities of some variable. Researchers strive to measure the variables using acceptable methods. All other variables whose characteristics or qualities cannot be simplified to numeric values can be analysed using qualitative research techniques (Leedy & Ormrod, 2010:94).

Data from the questionnaires were coded and then entered into the Statistical Package of the Social Sciences (SPSS). When converting data into an electronic format, numbers were used instead of names as a label for each questionnaire to ensure confidentiality. The required statistical analyses were performed using SPSS.

3.5.2 Statistical methods of the study

Statistical methods are either parametric or non-parametric. When a wrong statistical method is used then invalid results and incorrect conclusions may be drawn from the study. Parametric methods are applied when data has an underlying normal distribution that permits for conclusions to be drawn as the shape can be mathematically described. The histogram and tests such as the Jarque-Bera statistic and Kolmogorov-Smirnov can be used to test for normality. Once the characteristics of the variables of interest are known, the next step is to consider the analysis to be performed (McCrum-Gardner, 2008:38; Park, 2008).

The dependent variables that were used in this study were non-numerical apart from the number of meals eaten per day. They were either nominal or ordinal. This means that all the variables of interest in this study were not normally distributed. As a result, the study depended entirely on non-parametric methods for hypothesis testing. Nominal variables refer to categorical variables that cannot be ranked (e.g., gender: male, female) while ordinal variables refer to variables that can be ranked but the distance between the categories cannot be quantified (e.g., income classes: upper, middle, lower). Despite, non-parametric methods being the most appropriate when parametric assumptions are violated, they are criticised for the following reasons (Siegel, 1957):

1. They are not as sensitive as their parametric counterparts when the parametric methods assumptions are met. Non-parametric methods require larger differences before the null hypothesis can be rejected.
2. They tend to waste information since strict numerical data are reduced to a qualitative form.
3. They tend to be less efficient than their parametric counterparts when parametric assumptions are met. As a result, larger sample sizes are needed to overcome information loss.

However, the asymptotic comparative efficiency of the non-parametric tests with respect to the parametric tests can be as high as 95.5% (Hollander & Wolfe, 1973). Subsequently, researchers have reasonably little to lose in many circumstances by employing non-parametric tests when the distribution is normal. However, when the data fails to meet the normality

assumption, tests based on parametric tests are less efficient than their non-parametric counterparts (Leech & Onwuegbuzie, 2002:13).

The following are the six reasons that are advanced for the use of non-parametric statistics: (a) need few assumptions about the underlying population from which the data are collected; (b) do not require the normality assumption; (c) are often easier to use than are their parametric counterparts; (d) are normally simple to comprehend; (e) are suitable when parametric techniques cannot be applied; and (f) are only faintly less efficient than parametric statistics under normality, while being far more efficient under non-normality (Hollander & Wolfe, 1973).

According to Johnson (1995:1999), even though non-parametric methods can be employed to estimate parameters, they are more suitable for hypothesis testing and used mostly for that purpose. Therefore, in this study, the non-parametric methods were used for hypothesis testing only. The following are the statistical methods that were used in this study:

1 Chi-square test

The chi-square test is used to compare proportions between two or more independent groups. Chi-square can also be used to investigate whether there is any association between two nominal variables. The assumptions underlying the use of a Chi-square test are that:

1. The sample must be randomly selected from the population.
2. The sample size, n, must be large enough so that the expected count in each cell is greater than or equal to 5.

The chi-square test gives the probability that the data could occur by chance. The chi-square test compares the observed value in the table with expected values if the two distributions are completely independent. The chi-square test uses categories which are mutually exclusive (each observation falls in one category or class interval) and not more than 25% of the cells in the table should have expected values of less than 5. The null hypothesis for the chi-square is that the two binary variables are unrelated; that there is no difference in the rates of “yes” between the two groups in the population (Saunders, *et al*., 2009:442).

The following is the formula for calculating the Chi-square statistic (Stigler, 2008):

$$x^2 = \sum \frac{(O-e)^2}{e}$$

where:

X^2	is chi-squared
$\sum$	stands for summation
O	is the observed values, and
E	is the expected values

The chi-square test was used in this study to determine whether household wealth is reflected in the use of a particular adjustment mechanism. The independent variable in this test was wealth, which is a categorical variable. It is either you are poor, middle-class or rich. These categories were generated using household value of assets. The dependent variable was the adjustment mechanism. The adjustment mechanism is nominal and has a binary response, that is, yes or no.

2 Kruskal–Wallis Test

Kruskal–Wallis test is the non-parametric alternative to one-way analysis of variance (ANOVA). It is used for ordinal, interval or ratio scale variables that fail to satisfy the normality assumption (McCrum-Gardner 2008:40). Kruskal-Wallis test follows a Chi-square distribution. The Kruskal-Wallis test is preferred when comparing more than two independent conditions in many circumstances and when the data do not meet the parametric assumptions, that is, normality and equality of variances. The assumptions that underlie the use of Kruskal–Wallis Test are (Vargha & Delaney, 1998):

1. The continuous distributions for the test variable are exactly the same
2. The sample is randomly obtained from the populations
3. The scores on the test variable are independent of each other.

The null hypothesis for the Kruskal-Wallis test is that that the k samples are from identical or same populations. (Siegel, 1956;184) The Kruskal-Wallis test is inadequate when comparing

conditions with unequal sample sizes. The formula for Kruskal Wallis test is (Science, Not dated):

$$\mathcal{K}W = \frac{12}{n(n+1)} \sum_{i=1}^{k} ni\,(Ri - R)^2$$

$$R = \frac{T}{N}$$

$$R_i = \frac{T_i}{n_i}$$

where:

T_i = sum of measures in column i

T = total sum of measures, that is, sum of T_i

n_i = number of measures in column i,

κ = number of columns

The null hypothesis for Kruskal Wallis test is stochastic homogeneity (Vargha & Delaney, 1998). When the computed value is less than the critical value (value obtained from statistical tables) you fail to reject the null hypothesis.

The Kruskal-Wallis test was used in this study to determine whether household agricultural production is reflected in seasonal household food consumption. This test was appropriate for this study since we were comparing three independent periods of the year (seasons) and the same sample was used across all the seasons in a given year. the sample that was used was also randomly obtained.

3 Friedman's test

Friedman's test is the non-parametric alternative of the repeated-measures analysis of variance. Friedman's test is used for ordinal or interval variables when the variable is not normally distributed (McCrum-Gardner, 2008:40). Friedman's test has an advantage over the repeated measures of variances since it can be applied to a wider range of situations. The use

of a normal distribution is an exception rather than a rule. Friedman's test uses ranks instead of the original quantitative values. Each set of values of the variable is arranged in order of size. In this way you do not need any assumption to be made on the original data since you are not using the original values (Friedman, 1937).

Friedman's test, just like all other non-parametric tests, does not make use of all the information provided since it depends entirely on ranks. This is the same reason that makes it able to be applied without assuming normality. Friedman (1937) did some analysis on the same data that met parametric assumptions using both analysis of variance and the method of ranks (Friedman test) and the tests yielded similar results. This showed that the loss of data when using a non-parametric test is not great. The assumptions underlying the use of Friedman test are (Friedman, 1937):

1. Each set of *K* observations represents a random sample from a given population and is independent of every other set of *K* observations.
2. The Chi-Square values for the Friedman test yield relatively accurate results to the extent that the sample size is large. The results for the tests should be fairly accurate if the sample size is 30 or greater.
3. The Distribution of the different scores between any pair of levels is continuous and symmetrical in the population. This assumption is necessary to circumvent ties and to guarantee that the test evaluates difference in medians rather than other characteristics of the distribution.

The following is the mathematical formula for Freidman test (Friedman, 1937):

$$F = \left(\frac{12}{N.K.(k+1)}\right).\sum R^2 - \left(3.N.(k+1)\right)$$

where:

N is total number of measures (n x k), n = number of subjects

k is number of measures per subject (number of columns)

R is sum of ranks for each of the k groups

The Friedman statistic follows a chi-square distribution. The null hypothesis states that the population medians are equal for the *K* levels of a factor. The null hypothesis is rejected if the computed F is greater than the critical F.

Friedman's test was used in this study to determine whether the adequacy of meals was the same across the three seasons of the year, April–August, August–December and December–April. Adequacy is a categorical variable with three responses; adequate, moderately adequate and inadequate.

4 Cochran's Q-test

Cochran's Q-test is used for nominal dichotomous data when you have more than two related groups. It tests whether the responses from a particular variable change over time. For example, it can be used to compare the proportion of pass/fail in a group of agricultural economics students for a series of five examinations (McCrum-Gardner, 2008:40). A person studying a variable with binary responses may want to test if the responses change over time (T). When time (T) = 2, McNemar test can be used while when time (T) > 2, Cochran's Q-test is used (Lewis & Baldwin, 1997).

The Cochran's Q-test is based on the following assumptions:

1. The sample size is large.
2. The sample was randomly obtained.
3. The outcomes of the treatments can be coded as binary responses (i.e., a "0" or "1") in a way that is common to all treatments within each block.

Cochran's Q-test is a common non-parametric significance test for comparing whether the marginal frequencies are equal (Yang, Sun & Hardin, 2011:1313–1314). In other words, Cochran's Q-test evaluates the equality of correlated observations when the dependent variable being analysed is dichotomous. It follows a chi-square distribution (Cochran, 1950). Cochran's Q-test tests the null hypothesis that the probability of success is the same in all rows.

The following is the mathematical expression for the Cochran's Q-test (National institute of standards and technology, 2005):

$$T = k(k-1)\frac{\sum_{j=1}^{k}\left(X_j - \frac{N}{k}\right)^2}{\sum_{i=1}^{b} X_i\,(k - X_i)}$$

where:

T = Cochran's Q-test statistic

k = the number of treatments

X_j = the column total for the j^{th} treatment

b = the number of blocks

X_i = the row total for the i^{th} block

N= the grand total

Cochran's Q-test was used in this study to determine whether the probability of using a given adjustment mechanism to seasonality was the same in good, normal, poor and very poor years. For the Cochran's Q-test to be applicable, each sample should contain exactly the same number of households. As a result of this condition, this test was done using the 106 households that existed in all the years under consideration.

3.6 CHAPTER SUMMARY

This chapter provided an understanding of the context and unit of analysis, sampling, data collection, data processing and analysis methods. All the data analysis methods that were used in this study were non-parametric. This is because none of the dependent variables that were being analysed followed the normal distribution.

CHAPTER 4

HOUSEHOLD CHARACTERISTICS AND ADJUSTMENT MECHANISMS TO SEASONALITY

4.1 INTRODUCTION

This section presents the results on household characteristics and adjustment mechanisms to seasonality of food consumption and input requirements. The chapter gives the ex-ante and ex-post adjustment mechanisms to both seasonal food and input requirements and then carries out statistical tests. The first test looks at whether the wealth of a household affects the adjustment mechanisms adopted and the second test looks at whether households' probabilities of using the adjustment mechanisms are the same in all the four season types.

4.2 HOUSEHOLD CHARACTERISTICS

Since one objective required the study to determine whether wealth affected the use of the adjustment mechanism, there was need to find a method to use which would help in producing the wealth categories.

The households can be divided into three groups according to the value of the household assets. The top 20% are referred to as rich. The middle 40% are referred to as the middle, while the bottom 40% are referred to as the poor (Filmer & Pritchett, 1998). This classification was applied to the study sample. Household wealth was calculated for each household by summing up the value of household assets. The assets that were used are houses, bicycles, vehicles, motor bikes, tractors, radios, Television sets, Fridges, grinding mill, drinking well, ploughs, land, cattle, donkeys, goats, pigs, chicken, guinea fowls and turkeys. The households were told to value their assets. For non-livestock assets, only data of household assets that were owned by the households and were in good working condition or temporarily out of order but are usable were collected. Probing was used in trying to get the real value of the asset. Households were asked questions like "what price would you be willing to sell this

asset (e.g. bicycle)". For a new asset, the households were encouraged to give the price at which they bought the asset. For livestock, depending on the size, prevailing market prices were used. Due to methodical and logistical limitations, the study assumed that the wealth status of a given household was the same during the years that were studied. This implies that a household that was referred to as rich in 2012 was also referred to as rich in the other years that were studied. Households that were not in existence in a particular year did not answer questions pertaining to that particular year. For example, households that were three years old in the village did not answer questions pertaining 1995 and 2005. In other words, such questions were not applicable to them. Table 4.1 below shows the number of respondents by wealth category for each of the four years being considered.

Table 4.1: Sample by wealth category

Wealth category	2012 (Normal year)	2011 (Good year)	2005 (Poor year)	1995 (Very poor year)
Rich	45	45	42	34
Middle	90	89	63	42
Poor	90	85	50	30
Total	**225**	**219**	**155**	**106**

Source: Survey data (2013).

The normal year (2012) has the highest number of households while the very poor year (1995) has the lowest number of households. The reason sampled household decreased further back in time is due to the data sampling procedure which did not put any minimum number of years of existence for a household to qualify to be in the sampling frame. This denotes that new households are continuously being introduced into the villages. Some new households are coming from other villages while the majority of new households are children from the existing households. As children from the existing households grow up, they leave their parents and are given land to start their own homes.

4.2.1 Land

Land is one of the most important assets among farming communities. Land is used for growing of crops and cattle grazing. Households sometimes rent part of their farm land in order to generate some income which can be used to buy inputs and meet other household needs. Land was measured in hectares (ha). The following table shows the land owned by the household by wealth category.

Table 4.2 Land by wealth category

Land (ha)	Rich		Middle		Poor	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Less than 5.01	26	57.78	72	80	87	96.67
5.01 - 10.00	7	15.56	9	10	3	3.33
10.01 - 15.00	1	2.22	5	5.56	0	0
15.01 - 20.00	2	4.44	0	0	0	0
20.01 - 25.00	2	4.44	0	0	0	0
Greater than 25.00	7	15.56	4	4.44	0	0
Total	45	100	90	100	90	100
Land per capita (ha)	1.02		0.49		0.25	

Source: Survey data (2013).

Table 4.2 shows that 96.6 percent of poor households own land less or equal to 5 hectares and none of the poor households own more than 10 hectares of land. Table 4.2 also shows that 20 percent of rich households own more than 20 hectares of land. Table 4.2 further shows that the rich households had the highest level of land per capita.

4.2.2 Cattle

Cattle in rural areas have many uses which include draught power, income generation (traction), enhancement of crop production through traction and manure, food and prestige. Sometimes cattle are sold in order to help meet input, food and other family needs. Table 4.3 below presents the number of cattle owned by household wealth category.

Table 4.3: Number of cattle owned by wealth category

Cattle	Rich		Middle		Poor	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
<= 5.00	8	17.78	56	62.22	90	100
6.00 - 10.00	4	8.89	22	24.44	0	0
11.00 - 15.00	3	6.67	7	7.78	0	0
16.00 - 20.00	9	20	2	2.22	0	0
21.00 - 25.00	2	4.44	1	1.11	0	0
26.00+	19	42.22	2	2.22	0	0
Total	45	100	90	100	90	100
Cattle per person	1.78		0.41		0.92	

Source: Survey data (2013).

Table 4.3 shows that none among the poor households own more than 5 cattle. On the other hand, the table shows that at least 46 percent of rich households awn more than 20 cattle. Table 4.3 further shows that the rich households have the highest number of cattle per capita.

4.2.3 Household size

A large family is a symbol of available labour for the household. The majority of households depend on agriculture for their livelihood and this means the larger the size of the household, the more labour is available for agricultural activities and this could lead to higher incomes and asset accumulation. However, the larger the family, the more food is required to feed it . Table 4.4 below gives the household size categories by wealth.

Table 4.4: Household size by wealth category

Household size	Rich		Middle		Poor	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
< 3	0	0	1	1.11	3	3.33
3 – 4	1	2.22	12	13.33	24	26.67
5 – 6	14	31.11	25	27.78	30	33.33
7 – 8	9	20	17	18.89	11	12.22
> 8	21	46.67	35	38.89	22	24.44
Average household size	**10.13**		**8.39**		**6.45**	
Total	**45**	**100**	**90**	**100**	**90**	**100**

Source: Survey data (2013).

Table 4.4 shows that among the rich households, 66.67% had household sizes with no fewer than 7 members while among the poor households only 36.44% of households had at least 7 members each. Table 4.4 seems to indicate that the larger the household size, the better off the household is in terms of wealth. A chi-square test was done to see whether there is a relationship between household size and wealth. The chi-square test (chi-square = 21.184, df = 8, p-value = 0.007) indicates a significant relationship at one (1) percent level of significance.

4.2.4 Age of household head

This section looks at the age of the household head. The older the household head, the more wealth they are expected to have accumulated. Table 4.5 below provides the age of the household head by wealth for the study sample.

Table 4.5: Age of household head (years)

Age range	Rich		Middle		Poor	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
< 30	0	0	12	13.33	20	22.22
30 – 40	14	31.11	36	40	33	36.67
41 – 50	10	22.22	21	23.33	18	20
51 – 60	10	22.22	10	11.11	8	8.89
> 60	11	24.44	11	12.22	11	12.22
Total	**45**	**100**	**90**	**100**	**90**	**100**
Average age (in years)	**51.76**		**42.40**		**41.17**	

Source: Survey data (2013).

Of the rich households, 46.66% are aged more than fifty (50) while among the poor households, 58.89% are less than forty-one (41) years old. This seems to indicate that there is a relationship between age of the household head and wealth. This could mean that the older the household heard, the higher the household wealth level. A chi-square test was used to help make a statistical conclusion. The chi-square test (chi-square = 19.546, df = 8, p-value = 0.012) indicates a significant relationship between household wealth and age of the household head at 5% level of significance.

4.2.3 Gender of household head

From the sample that was obtained, 85% (193) of households were headed by males while 14.2% (32) of households were headed by females. Table 4.6 below shows the gender of the household head by wealth category.

Table 4.6: Gender of the household head by wealth

Gender	Rich		Middle		Poor	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Male	40	88.89	78	86.67	75	83.33
Female	5	11.11	12	13.33	15	16.67
Total	**45**	**100**	**90**	**100**	**90**	**100**

Source: Survey data (2013).

It does not make sense to compare the percentages in a table because of the huge difference in the number of male-headed households compared to those headed by females. However, we can work out the proportion of each sexual category that falls in the rich and poor households: 20.73% of male-headed households are rich while 38.8% are poor. On the other hand, 15.63% of female-headed households are poor while 48.88% are rich. Given these proportions that have been worked out, it is difficult to tell whether gender of the household head is significantly related to household wealth. The chi-square test was done to determine whether there was a significant relationship between wealth and gender of the household head. The chi-square test (chi-square = 0.856, df = 2, p-value = 0.652) indicates that there is no significant relationship between gender of household head and household wealth at 5% level of significance.

4.2.4 Education level of household head

Educated people are likely to be more knowledgeable about income generating opportunities. As a result of this we expect a positive relationship between the household head's education level and household wealth. Table 4.7 below shows the education of the household head by wealth category.

Table 4.7: Education level of household head by wealth category

Education level	Rich		Middle		Poor	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
No formal education	4	8.89	9	10	4	4.44
Primary	20	44.44	42	46.67	52	57.78
Secondary	21	46.67	38	42.22	32	35.56
College	0	0	1	1.11	2	2.22
Total	**45**	**100**	**90**	**100**	**90**	**100**

Source: Survey data (2013).

Among the rich households, 46.67% had reached secondary level while 44.44% had only reached primary level. For the poor households, 35.56% had secondary level education while 57.78% had attained primary education. Among the middle households, 42.22% had secondary level education while 46.67% had primary level education. From these figures, it is difficult to say whether there is a relationship between household wealth and education level

of the household head. Intuitively, we expect more educated household heads to accumulate more wealth.

The chi-square test was used to determine whether there is a relationship between the education level of the household head and household wealth. The chi-square test (chi-square = 5.697, df = 6, p-value = 0.458) indicates that there is no significant relationship between the education level of the household head and household wealth at 5% level of significance.

4.2.5 Main occupation

Main occupation is defined as the household's principal income generating activity. The following table shows the household main occupation.

Table 4.8: Household main occupation

Main occupation	Frequency	Percent
Farmer	207	92
Civil servant	2	0.89
General worker	4	1.78
Business	8	3.56
Fisherman	1	0.44
Driver	1	0.44
Carpenter	1	0.44
Building contractor	1	0.44
Total	**225**	**100**

Source: Survey data (2013).

Since 92% of households depend on agriculture for as their main occupation, it is interesting to look at the plans households use to prevent seasonal food shortages and what they really do once they experience a seasonal food shortage. It is also interesting to look at the household plans on how to meet the input requirements and how they react when they reach the rainy season without adequate farming inputs despite planning for them in advance. Therefore, the remaining part of this chapter looks at the ex-ante and ex-post adjustment mechanisms to seasonal food and input requirements.

4.3 EX-ANTE ADJUSTMENT MECHANISMS TO SEASONAL FOOD REQUIREMENTS

Farming households use a number of ex-ante adjustment mechanisms to seasonal food requirements. As defined earlier, ex-ante mechanisms are the normal plans to store food, as well as all supplementary planned mechanisms which can help even out food consumption. Table 4.9 below presents the supplementary ex-ante adjustment mechanisms to seasonal food requirements.

Table 4.9: Ex-ante adjustment mechanisms to seasonal food shortage (% of households)

Mechanism	Good year (2011)			Normal year (2012)			Poor year (2005)			Very poor year (1995)		
	Rich	Middle	Poor	Rich	Middle	Poor	Rich	Middle	Poor	Rich	Middle	Poor
Plan to plant cassava	2.2	1.1	1.2	0	0	1.1	0	1.6	0	0	0	3.3
Plan to sell milk	28.9	28.1	16.5	33.3	27.8	17.8	33.3	33.3	16	23.5	35.7	16.7
Plan to plant early maturing varieties	75.6	75.3	74.1	77.8	78.9	76.7	76.2	77.8	78	70.6	61.9	83.7
Plan to sell livestock	31.1	29.2	24.7	31.1	28.9	31.1	47.6	47.6	38	44.1	38.1	53.3
Plan to borrow money within the village	22.2	31.5	31.8	28.9	41.1	48.9	21.4	30.2	32	17.6	31	30
Plan to borrow money outside the village	6.7	5.6	10.6	8.9	6.7	15.6	4.8	11.1	16	5.9	9.5	20
Plan to receive remittances within the village	6.7	7.9	7.1	6.7	4.4	11.1	2.4	4.8	8	8.8	9.5	6.7
Plan to receive remittances outside the village	13.3	6.7	9.4	17.8	11.1	15.6	23.8	15.9	18	35.3	19	13.3
Plan to migrate for work	6.7	10.1	12.9	8.9	12.2	15.6	16.7	6.3	18	11.8	2.4	20

Source: Survey data (2013).

Table 4.9 shows that the most commonly used supplementary ex-ante adjustment mechanism to seasonal food requirements is the plan to plant early maturing varieties. This could be attributed to households' knowledge that the most difficult period of the year is just before harvest. Researchers commonly refer to the rainy season as the hungry season. Therefore, planting early maturing varieties is seen as a measure that shortens the hungry season.

The results in Table 4.9 also show that the rich households have a higher proportion of households who plan to receive remittances outside the village than the non-poor households, both in the good and very poor years. On the other hand, the poor households have a higher proportion of those who plan to borrow money within the village than the rich households in both the good and very poor years. This means that the rich households have better or more links outside the village than the poor households

The results in Table 4.9 above seem to refute the hypothesis that both the wealthy and poor households use the same ex-ante adjustment mechanisms to seasonal food requirements. To determine whether ex-ante adjustment mechanisms to seasonal food requirements differ by wealth of the household, chi-square tests were used. The null hypothesis for the chi-square test is that the ex-ante adjustment mechanisms to seasonal food requirements do not differ by wealth of the household. The decision rule ($\alpha = 0.05$) is to reject the null hypothesis if the p-value is less than 0.05.

Table 4.10 below presents the chi-square statistics for ex-ante adjustment mechanisms to seasonal food requirements by wealth.

Table 4.10: Chi-square statistics for ex-ante adjustment mechanisms to seasonal food requirements by wealth

Mechanism	Good year (2011)			Normal year (2012)			Poor year (2005)			Very poor year (2005)		
	Chi-square	df	P-value	Chi-square	df	P-value	Chi-square	df	P-value	Chi-square	df	P-value
Plan to plant cassava	0.305	2	0.858	1.507	2	0.471	1.470	2	0.480	2.557	2	0.278
Plan to sell milk	4.070	2	0.131	4.553	2	0.103	5.077*	2	0.079	3.481	2	0.175
Plan to plant early maturing varieties	0.005	2	0.997	0.129	2	0.938	0.051	2	0.975	3.884	2	0.143
Plan to sell livestock	0.739	2	0.691	0.126	2	0.939	1.269	2	0.530	1.647	2	0.439
Plan to borrow money within the village	1.511	2	0.470	4.961	2	0.084*	1.419	2	0.492	1.988	2	0.370
Plan to borrow money outside the village	1.595	2	0.450	3.918	2	0.141	2.954	2	0.228	3.388	2	0.184
Plan to receive remittances within the village	0.076	2	0.963	2.927	2	0.231	1.507	2	0.471	0.191	2	0.909
Plan to receive remittances outside the village	1.578	2	0.454	1.312	2	0.519	1.068	2	0.586	4.901*	2	0.086
Plan to migrate for work	1.257	2	0.533	1.247	2	0.536	4.093	2	0.129	5.945*	2	0.051

Source: Survey data (2013). *** significant at 1%, **significant at 5%, *significant at 10%.

Table 4.10 shows that all the p-values for good, normal, poor and very poor years are greater than 0.05. This shows that we fail to reject the null hypothesis. Therefore, it can be concluded that ex-ante adjustment mechanisms to seasonal food requirements do not differ by wealth of the household in good, normal, poor and very poor years at 5% level of significance. In other words, there is no relationship between ex-ante adjustment mechanisms to seasonal food requirements and the wealth of the household. This means that the plans were overcome by the events that actually happened, namely a bad or very bad year.

4.4 EX-POST ADJUSTMENT MECHANISMS TO SEASONAL FOOD REQUIREMENTS

Rural households use a number of ex-post adjustment mechanisms when faced with seasonal food requirements. As shown in Chapter 1, ex-post adjustment mechanisms to seasonal food requirements are the actual actions households take when faced with seasonal food shortages. Table 4.11 below provides the ex-post mechanisms to seasonal food requirements that the study identified.

Table 4.11: Ex-post adjustment mechanisms to seasonal food requirements (% of household)

Mechanism	Good year			Normal year			Poor year			Very poor year		
	Rich	Middle	Poor	Rich	Middle	Poor	Rich	Middle	Poor	Rich	Middle	Poor
Borrow more money than planned	6.7	10.1	15.3	8.9	14.4	22.2	7.1	17.5	22	11.8	14.3	16.7
Find more casual employment activities than planned within the village	11.1	27	38.8	13.3	34.4	44.4	31	38.1	50	38.2	50	63.3
Do more migration for labour than normally planned	4.4	6.7	4.7	4.4	6.7	7.8	4.8	7.9	4	11.8	7.1	10
Sell more livestock than normally planned (e.g. cattle, goats, pigs and chickens)	42.2	36	30.6	44.4	50	32.2	42.9	55.6	32	41.2	42.9	43.3
Borrow more food than planned	2.2	6.7	5.9	2.2	6.7	14.4	4.8	4.8	10	8.8	7.1	16.7
Borrow more money than planned within the village	4.4	7.9	15.3	8.9	13.3	21.1	4.8	9.5	12	8.8	7.1	20
Borrow more money than planned outside the village	8.9	3.4	7.1	11.1	2.2	13.3	11.9	6.3	20	14.7	7.1	36.7
Sell more milk than planned	33.3	22.5	11.8	42.2	27.8	17.8	42.9	30.2	20	41.2	38.1	23.3
Rely on more help from a friend or relative than was planned	13.3	9	17.6	20	11.1	25.6	19	17.5	28	20.6	23.8	33.3
Reduce meal portions	13.3	16.9	29.4	15.6	21.1	32.2	33.3	54	52	44.1	64.3	80
Reduce number of meals eaten per day	15.6	21.3	29.4	17.8	22.2	27.8	35.7	63.5	54	44.1	71.4	76.7
Skip entire days without eating	4.4	1.1	4.7	4.4	5.6	6.7	16.7	12.7	30	32.4	28.6	60
Gather wild or natural products for food and/or selling	11.1	12.4	20	13.3	16.7	21.1	21.4	17.5	20	29.4	31	26.7
Harvest immature crops	4.4	10.1	18.8	6.7	10	26.7	19	28.6	32	29.4	28.6	40
Cut spending on non-food items	15.6	21.3	17.6	17.8	23.3	22.2	23.8	20.6	28	20.6	16.7	33.3
Withdraw children from school	2.2	0	2.4	0	0	4.4	4.8	3.2	8	8.8	4.8	26.7
Send household members to eat away	0	0	1.2	0	1.1	3.3	0	0	6	2.9	2.4	6.7
Slaughter livestock to cover food deficit	0	4.5	4.7	11.1	7.8	4.4	11.9	7.9	8	5.9	2.4	13.3
Postpone ceremonies such as weddings	2.2	0	1.2	4.4	0	2.2	0	0	2	5.9	0	3.3

Source: Survey data (2013).

Table 4.11 shows that finding more casual employment than planned is the most common adjustment mechanism to seasonal food requirements among the poor households in good, normal and poor years. However, in the very poor year, finding more casual employment than planned comes third, that is, after reducing meal sizes and reducing the number of meals eaten per day. This is probably because during the very poor year food becomes very scarce on the market and as a result prices increase. This reduces the purchasing power of a household's disposable income. Actually, during poor and very poor years, sometimes the household can have the money for food but food may not be there on the market. This leads households to give priority to reducing the meal sizes and number of meals eaten per day in order to ensure that they will have something to eat in the coming days. In such periods, the household members become prone to malnutrition and other food-related diseases due to the fall in household nutrition status (Sahn, 1989).

On the other hand, Table 4.11 shows that finding more casual labour than planned is not even among the top five adjustment mechanisms to seasonal food requirements among the rich households in the good, normal and poor years. However, finding casual employment becomes the fifth most important adjustment mechanism to seasonal food requirements among the rich households in the very poor year. This is because households prefer adjustment mechanisms that would not compromise their social status in the village. In practice, households try to avoid mechanisms that are likely to jeopardise their social status, but when faced with a catastrophic situation they are left with a limited set of choices and end up increasing the use of adjustment mechanisms such as casual employment despite their negative effects on the household's social status (Devereux *et al*., 2006).

Household wealth seems to be important in determining how far the household can go without adopting ex-post adjustment mechanisms to seasonal food requirements that are perceived to compromise its social status. Arising from this observation, the next task is to establish whether household wealth is important in explaining the adoption of ex-post adjustment mechanisms to seasonal food requirements. To do this, chi-square tests were carried out. The null hypothesis being tested is that the ex-post adjustment mechanisms to seasonal food requirements do not differ by wealth of the household. The decision rule is to reject the null hypothesis if the p-value is less than 0.05. The chi-square statistics that were generated from the tests are shown in Table 4.12 below.

Table 4.12: Chi-square statistics for ex-post adjustment mechanisms to seasonal food shortage by wealth

Mechanism	Good year (2011)			Normal year (2012)			Poor year (2005)			Very poor year (2005)		
	Chi-square	df	p-value	Chi-square	df	p-value	Chi-square	df	p-value	Chi-square	df	p-value
Borrow more money than planned	2.417	2	0.299	4.318	2	0.115	3.864	2	0.145	0.316	2	0.854
Find more casual employment activities than planned within the village	11.267***	2	0.004	12.902***	2	0.002	3.611	2	0.164	4.016	2	0.134
Do more migration for labour than normally planned	0.465	2	0.793	0.536	2	0.765	0.905	2	0.636	0.485	2	0.784
Sell more livestock than normally planned (e.g. cattle, goats, pigs and chickens)	1.788	2	0.409	6.011*	2	0.050	6.327**	2	0.042	0.035	2	0.983
Borrow more food than planned	1.222	2	0.543	6.448**	2	0.040	1.540	2	0.643	1.837	2	0.399
Borrow more money than planned within the village	4.622	2	0.099	4.762*	2	0.092	1.487	2	0.476	3.193	2	0.203
Borrow more money than planned outside the village	1.943	2	0.378	7.703**	2	0.021	4.836*	2	0.089	10.721***	2	0.005
Sell more milk than planned	8.724**	2	0.013	9.311**	2	0.010	5.646*	2	0.059	2.545	2	0.280
Rely on more help from a friend/relative than was planned	2.837	2	0.242	6.250**	2	0.044	2.021	2	0.364	1.465	2	0.481
Reduce meal portions	6.141**	2	0.046	5.414*	2	0.067	4.837*	2	0.089	8.855**	2	0.012
Reduce number of meals eaten per day	3.478	2	0.176	1.814	2	0.404	7.840**	2	0.020	8.944**	2	0.011
Skip entire days without eating	2.088	2	0.352	0.286	2	0.867	5.613**	2	0.060	8.133**	2	0.017
Gather wild or natural products for food/selling	2.676	2	0.262	1.368	2	0.505	0.274	2	0.872	0.156	2	0.925
Harvest immature crops	6.310**	2	0.043	12.946***	2	0.002	2.055	2	0.358	1.212	2	0.545
Cut spending on non-food items	0.764	2	0.682	0.561	2	0.755	0.832	2	0.660	2.896	2	0.235
Withdraw children from school	2.086	2	0.352	6.109**	2	0.047	1.345	2	0.510	8.354	2	0.015**
Send household members to eat away	1.584	2	0.453	2.291	2	0.318	6.424**	2	0.040	0.981	2	0.612
Slaughter livestock to cover food deficit	2.153	2	0.341	2.119	2	0.347	0.579	2	0.749	3.446	2	0.179
Postpone ceremonies such as weddings	1.737	2	0.419	3.563	2	0.168	2.114	2	0.348	2.403	2	0.301

Source: Survey data (2013). *** significant at 1%, **significant at 5%, *significant at 10%.

- **Good year**

The results in Table 4.12 show that finding more casual employment activities than planned within the village, reducing meal portions, selling more milk than planned and harvesting immature crops have p-values less than 0.05. This indicates rejection of the null hypothesis. Therefore, it can be concluded that these four ex-post adjustment mechanisms to seasonal food requirements differ by wealth of the household in a good year at 5% level of significance.

The higher the level of household wealth, the less attractive finding casual employment within the village becomes. This is because of the social stigma associated with casual employment. On the other hand, selling more milk than planned to fill seasonal food shortages is more common among the rich households in all the years. This is probably because more rich households own more cattle than their non-rich counterparts.

Finally, it is important to mention that Table 4.12 shows that some ex-ante adjustment mechanisms do not differ by the wealth of the households in the good year. Most of these adjustment mechanisms are probably perceived to have a minimal effect in compromising the household social status.

- **Normal year**

The results in Table 4.12 show that finding more casual employment activities within the village than planned, borrowing more food than planned, selling more milk than planned, borrowing more money than planned outside the village, relying on more help from friends or relatives than planned, harvesting immature crops and withdrawing children from school have p-values less than 0.05 in a normal year. This indicates rejection of the null hypothesis. Therefore, it can be concluded that these ex-post adjustment mechanisms to seasonal food requirements differ by wealth of the household in a normal year at 5% level of significance. However, Table 4.12 shows that some ex-post adjustment mechanisms to seasonal food requirements (those with p-values greater than 0.05) do not vary with household wealth.

The difference between the good year and the normal year is that in the normal year more ex-post adjustment mechanisms differ by household wealth than in the good year. This shows that the poor and non-poor respond differently to slight changes in food availability. Moreover, the poor households are affected more when there is a general fall in agricultural production and this is reflected in the way they respond to food shortages.

- **Poor year**

In the poor year, selling more livestock than normally planned, reducing the number of meals eaten per day and sending household members to eat away have p-values less than 0.05. This indicates rejection of the null hypothesis. Therefore, it can be concluded that these ex-post adjustment mechanisms to seasonal food requirements differ by wealth of the household in the poor year at 5% level of significance. It is important to note that selling more livestock than normally planned, reducing the number of meals eaten per day and sending household members to eat away did not differ by the household wealth in the good and normal years. Therefore, households with livestock, the majority being the rich, sell more livestock to meet the seasonal household food requirements in difficult years. On the other hand, a good number of the non-rich households are forced to reduce the number of meals eaten per day and they even send household members to eat away. Sending household members to eat away is not as common among the rich households as it is among the non-rich households because the rich households have a wider range of ex-post adjustment mechanisms. Household wealth is important in explaining how far a household can go in a poor year without adopting adjustment mechanisms that are perceived to compromise the household's social status.

- **Very poor year**

Table 4.12 shows that borrowing more money than planned outside the village, reducing meal portions, reducing the number of meals eaten per day, skipping entire days without eating and cutting spending on non-food items have p-values less than 0.05 in the very poor year. This indicates rejection of the null hypothesis. Therefore, it can be concluded that ex-post adjustment mechanisms to seasonal food requirements differ by wealth of the household in a very poor year at 5% level of significance.

Skipping entire days without eating and cutting spending on non-food items does not differ by household wealth in the good and normal years but it does in the poor and very poor years. It is important to note that in a poor or very poor year, food sometimes runs out completely on the market and households travel long distances looking for food. In the very poor year, more and more households find themselves in destitution. Corbett (1988) defines destitution as the inability of the household to meet subsistence food requirements. Household wealth is important in determining how far a household can go in the very poor year without falling into destitution.

The surprising result is that reducing meal portions can only be explained by household wealth in good and very poor years. In a good year, the majority of rich households produce enough food to see them through to the next harvest. This is not the case with the non-rich households. Therefore, the majority of poor households reduce their meal portions as a way of smoothing their consumption in a good year. In a very poor year, households from all strata show an increase in the proportion of households who reduce meal portions. However, reducing meal portions is more pronounced among the non-rich households because they have fewer mechanisms to use to minimise the fall in consumption than the rich households.

Having determined that household wealth has an influence on some ex-post adjustment mechanisms to seasonal food requirements, we now turn our attention to determining whether the probability of using a given ex-post adjustment mechanism to seasonal food requirements by households of a given wealth stratum is the same in good, normal, poor and very poor years. To do this, Cochran's Q-test was used. The null hypothesis being tested is that the probability of using the ex-post adjustment mechanism to seasonal food requirements by households is the same in good, normal, poor and very poor years. The decision rule ($\alpha = 0.05$) is to reject the null hypothesis if the p-value is less than 0.05. The rejection of the null hypothesis among households of a given stratum would mean that those households do not use the ex-post adjustment mechanisms to seasonal food requirements in all season types. Table 4.13 below shows the statistics that were generated from Cochran's Q-test.

Table 4.13: Cochran's Q statistics for ex-post adjustment mechanisms to seasonal food requirements by wealth

MECHANISM	Rich			Middle			Poor		
	Df	Cochran's Q	p-value	df	Cochran's Q	p-value	df	Cochran's Q	p-value
Find more casual employment activities than planned within the village	3	21.000***	0.000	3	16.174***	0.001	3	4.538	0.209
Do more migration for labour than normally planned	3	1.636	0.651	3	4.000	0.261	3	1.000	0.801
Sell more livestock than normally planned (e.g. cattle, goats, pigs, chickens)	3	0.429	0.934	3	14.430***	0.002	3	3.471	0.325
Borrow more food than planned	3	6.000	0.112	3	2.400	0.494	3	4.800	0.187
Borrow more money than planned within the village	3	2.538	0.468	3	0.545	0.909	3	1.875	0.599
Borrow more money than planned outside the village	3	0.692	0.875	3	1.435	0.697	3	15.000***	0.002
Sell more milk than planned	3	1.727	0.631	3	8.286**	0.040	3	2.111	0.550
Rely on more help from a friend or relative than was planned	3	6.231	0.101	3	11.857***	0.008	3	7.000*	0.072
Reduce meal portions	3	15.391***	0.002	3	31.227***	0.000	3	21.097***	0.000
Reduce the number of meals eaten per day	3	18.000***	0.000	3	53.059***	0.000	3	17.314***	0.001
Skip entire days without eating	3	16.846***	0.001	3	24.600***	0.000	3	36.616***	0.000
Gather wild or natural products for food and/or selling	3	7.800*	0.050	3	25.895***	0.000	3	4.371	0.224
Harvest immature crops	3	14.526***	0.002	3	23.595***	0.000	3	6.960*	0.073
Cut spending on non-food items	3	4.909	0.179	3	2.000	0.572	3	11.308**	0.010
Withdraw children from school	3	7.364*	0.061	3	6.000	0.112	3	8.032**	0.045
Send household members to eat away	3	3.000	0.392	3	16.171***	0.000	3	6.000	0.112
Slaughter livestock to cover food deficit	3	4.385	0.223	3	2.538	0.468	3	2.200	0.532
Postpone ceremonies such as weddings	3	4.714	0.194	-	-	-	3	1.000	0.801

Source: Survey data (2013). *** significant at 1%, **significant at 5%, *significant at 10%.

- **Rich households**

Table 4.13 shows that finding more casual employment activities than planned within the village, reducing meal portions, reducing the number of meals eaten per day, skipping entire days without eating and harvesting immature crops are the only ex-post adjustment mechanisms to seasonal food requirements that have p-values less than 0.05. This is an indication of the rejection of the null hypothesis for each of the five mechanisms. Therefore, it can be concluded that the probability of using any of these five ex-post adjustment mechanisms to seasonal food requirements by rich households is not the same across the four years.

Table 4.13 further shows that there is a predictable pattern in the adoption of these five adjustment mechanisms. The proportion of households using these five ex-post adjustment mechanisms to seasonal food requirements increases as we move from the good year to the very poor year. Rich households' likelihood of finding more casual employment activities than planned with the village to help minimise food shortages vary with the season type. Finding casual employment within the village is perceived to have a negative relationship with household social status in the village. However, despite the potential of casual employment within the village to compromise the household's social status, there is a rise in the proportion of households who adopt it as the food problem increases. This behaviour among the rich households can be explained by Devereux *et al*. (2006) who finds that when households reach a stage when present food consumption levels take precedence, they become vulnerable to using ex-post adjustment mechanisms to seasonal food requirements that were not attractive to the household.

- **Middle households**

From Table 4.13 it can be seen that finding more casual employment activities than planned within the village, selling more livestock than normally planned, selling more milk than planned, relying on more help from a friend or relative than was planned, skipping entire days without eating, gathering wild or natural products for food and/or selling, harvesting immature crops and sending household members to eat away, all have p-values less than 0.05. This indicates rejection of the null hypothesis and it can be concluded that the probability of

using any of these ex-post adjustment mechanisms by middle households is not the same in good, normal, poor and very poor years at 5% level of significance. By comparison, migrating more for work than normally planned, borrowing more food than planned, borrowing more money than planned within the village, borrowing more money than planned outside the village, cutting spending on non-food items, withdrawing children from school and slaughtering livestock to cover food deficit have p-values greater than 0.05. This indicates failure to reject the null hypothesis for each of these ex-post adjustment mechanisms to seasonal food requirements. Therefore, it can be concluded that the probability of using any of these ex-post adjustment mechanisms to seasonal food requirements by middle households is the same in good, normal, poor and very poor years at 5% level of significance.

It is important to note that no Cochran's Q statistic was generated for postponing ceremonies such as weddings among the middle households. This is because no middle household postponed any ceremony such as a wedding in order to meet food requirements in all the fours that were studied.

- **Poor households**

Table 4.13 shows that borrowing more money than planned outside the village, reducing meal portions, reducing number of meals eaten per day, skipping entire days without eating, cutting spending on non-food items and withdrawing children from school are the only ex-post adjustment mechanisms with p-values less than 0.05. This indicates rejection of the null hypothesis and it can be concluded that the probabilities of borrowing more money than planned outside the village, reducing meal portions, reducing number of meals eaten per day, skipping entire days without eating, cutting spending on non-food items and withdrawing children from school are not the same in good, normal, poor and very poor years. This means that the likelihood of using any of these mechanisms by poor households is related to staple food production levels.

The probability of finding more casual employment activities than planned within the village vary with the type of season among the non-poor household (middle and rich), while this is not the case among the poor households. This shows the importance of casual employment

among the poor households. Regardless of the season type, they need casual employment to meet their seasonal food requirements.

Our results on the use of ex-post adjustment mechanisms to food requirements are similar to Corbett (1988) but unlike her, we find that not all ex-post adjustment mechanisms show a distinct sequence. For example, we find that the proportions of poor households who sale livestock and find casual employment to meet the seasonal food requirements is the same in all the season types. Similarly, the proportions of rich households who sell livestock to meet their seasonal food requirements do not vary with season type. However, we agree with Corbett (1988) that the poorer households are more likely to use desperate means to meet their food requirements.

4.5 EX-ANTE ADJUSTMENT MECHANISMS TO SEASONAL INPUT REQUIREMENTS

Farming households make plans on how to meet the seasonal input requirements. As shown in Chapter One, these plans are referred to as ex-ante adjustment mechanisms to seasonal input requirements. The effectiveness of these plans has a direct effect on household food production. Table 4.14 below presents the ex-ante adjustment mechanisms to seasonal input requirements that were identified.

Table 4.14: Ex-ante adjustment mechanisms to seasonal input requirement (% of households)

Mechanism	Good year (2011)			Normal year (2012)			Poor year (2005)			Very poor year (1995)		
	Rich	Middle	Poor	Rich	Middle	Poor	Rich	Middle	Poor	Rich	Middle	Poor
Plan to save from grain crop sales	37.8	46.1	23.5	35.6	44.4	20	19	12.7	0	14.7	7.1	0
Plan to save from livestock sales	42.2	37.1	27.1	60	44.4	28.9	38.1	41.3.	26	29.4	35.7	30
Plan to borrow money within the village	4.4	14.6	22.4	11.1	18.9	30	7.1	11.1	22	8.8	7.1	26.7
Plan to borrow money outside the village	2.2	3.4	11.8	2.2	2.2	10	4.8	3.2	10	2.9	7.1	13.3
Plan to migrate in search of employment	6.7	11.2	9.4	6.7	14.4	12.2	11.9	12.7	16	5.9	9.5	10
Plan to receive remittances	17.8	9	23.5	13.3	11.1	25.6	28.6	30.2	36	44.1	33.3	40
Plan to work for fertiliser in other(s) farms	2.2	12.4	15.3	8.9	13.3	14.4	4.8	11.1	16	11.8	7.1	20
Plan to buy government subsidised inputs	80	53.9	48.2	82.2	58.9	54.4	54.8	30.2	34	26.1	7.1	36.7
Plan to save from milk sales	2.2	1.1	0	0	1.1	0	0	1.6	0	0	2.4	0

Source: Survey data (2013).

Table 4.14 shows that the four (4) most commonly used ex-ante adjustment mechanisms to seasonal input requirements by the rich households in all the four years are planning to save from grain crop sales, planning to save from livestock sales, planning to receive remittances and planning to buy government subsidised inputs. These are also the four (4) most common ex-ante adjustment mechanisms to seasonal input requirements among the poor households in the good year. However, despite the plan to save from grain crop sales being among the top four most common adjustment mechanisms for the rich households in all the years, none among the poor households use it in the poor and very poor years. Moreover, poor households have lower proportions of households who plan to save from grain crop stock sales to meet seasonal input requirements than the rich households in all the years under consideration. This means that food shortages among the poor households are overwhelming in the poor and very poor years, such that the poor households cannot manage to save from grain crop sales for input purchases.

Do ex-ante adjustment mechanisms to seasonal input requirements really differ by household wealth? To answer this question, we carried out some chi-square tests. The null hypothesis being tested was that the ex-ante adjustment mechanism to seasonal input requirements does not differ by wealth of the household. The decision rule ($\alpha = 0.05$) is to reject the null hypothesis if the p-value is less than 0.05. The rejection of the null hypothesis for the given ex-ante adjustment mechanism to seasonal input requirements would mean that wealth of the household is important in explaining the use of the ex-ante adjustment mechanism in a given season. The chi-square statistics are shown in Table 4.15 below.

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Table 4.15: Chi-square test statistics for ex-ante adjustment mechanisms to seasonal input requirements and wealth

Mechanism	Good year			Normal year			Poor year			Very poor year		
	Chi-square	df	p-value	Chi-square	Df	p-value	Chi-square	df	p-value	Chi-square	df	p-value
Plan to save from grain crop sales	9.748***	2	0.008	12.364***	2	0.002	9.593***	2	0.008	4.956*	2	0.084
Plan to save from livestock sales	3.538	2	0.170	12.573***	2	0.002	3.011	2	0.222	0.425	2	0.808
Plan to borrow money within the village	7.292**	2	0.026	7.018**	2	0.030	4.840*	2	0.089	6.658**	2	0.036
Plan to borrow money outside the village	6.765**	2	0.034	6.470**	2	0.039	2.489	2	0.288	2.483	2	0.289
Plan to migrate in search of employment	0.725	2	0.696	1.726	2	0.422	0.392	2	0.822	0.443	2	0.801
Plan to receive remittances	6.766**	2	0.034	7.181**	2	0.028	0.686	2	0.709	0.952	2	0.621
Plan to work for fertiliser on other farms	5.104*	2	0.078	0.851	2	0.653	2.954	2	0.228	2.700	2	0.259
Plan to buy government subsidised inputs	12.723****	2	0.002	10.333**	2	0.006	6.987**	2	0.030	9.649***	2	0.008
Plan to save from milk sales	0.305	2	0.858	0.504	2	0.777	1.470	2	0.480	1.538	2	0.463

Source: Survey data (2013). *** significant at 1%, **significant at 5%, *significant at 10%.

- **Good year**

Table 4.15 shows that among the ex-ante adjustment mechanisms to seasonal food requirements only planning to save from grain crop sales, planning to borrow money within the village, planning to borrow money outside the village and planning to buy government subsidised inputs have p-values less than 0.05. This indicates the rejection of the null hypothesis. Therefore, it can be concluded that these ex-ante adjustment mechanisms to seasonal input requirements differ by wealth of the household in a good year at 5% level of significance.

- **Normal year**

It can be seen from Table 4.15 that planning to save from grain crop sales, planning to save from livestock sales, planning to borrow money within the village, planning to borrow money outside the village, planning to receive remittances and planning to buy government subsidised inputs have p-values less than 0.05. This indicates rejection of the null hypothesis for these ex-ante adjustment mechanisms. Therefore, it can be concluded that these ex-ante adjustment mechanisms to seasonal input requirements differ by wealth of the household in a normal year at 5% level of significance. However, not all ex-ante adjustment mechanisms to seasonal input requirements differ by wealth of the household in a normal year (those with p-values greater than 0.05).

Unlike in the good year, in the normal year the plans to save from livestock sales and receive remittances can be explained by household wealth. This means that households know that they are not able to meet their input requirement from savings from grain sales as much as they do in the good year and as a result they turn more to livestock and other mechanisms to supplement the required cash to meet their input requirements. There is a higher number of households who plan to receive remittances in the normal year than the good year and the highest proportion of those who plan to receive remittances is among the poor. This shows that more poor households the non-poor turn to remittances to meet their seasonal input requirements than the non-poor.

- **Poor year**

Table 4.15 shows that only plan to save from grain crop sales and planning to buy government subsidised inputs have p-values less than 0.05 in the poor year. This indicates rejection of the null hypothesis for each of these two ex-ante adjustment mechanisms to seasonal input requirements. Therefore, it can be concluded that these two ex-ante adjustment mechanisms to seasonal input requirements differ by wealth of the household in a poor year at 5% level of significance. Table 4.14 above shows that no household among the poor households plans to save from crop stock sales to meet the seasonal input requirements during the poor year. In contrast, the results show that a number of non-poor households still plan to save from grain crop stock sales to meet their seasonal input requirements in the poor year. This reflects the differences in grain crop production levels between the poor and non-poor households.

- **Very poor year**

Table 4.15 shows that only planning to borrow money within the village and planning to buy government subsidised inputs have p-values less than 0.05 in the very poor year. This indicates rejection of the null hypothesis for each of these two ex-ante adjustment mechanisms to seasonal input requirements. Therefore, it can be concluded that these two ex-ante adjustment mechanisms to seasonal input requirements differ by wealth of the household in the very poor year at 5% level of significance.

Table 4.14 above has shown that the poor households have the highest proportion of households who plan to borrow money within the village and plan to buy government subsidised inputs in the very poor year. This result is surprising because agricultural production subsidies were removed by the government of Zambia in 1994, during the Structural Adjustment Programme (SAP) and were only reintroduced in 2003 (Saasa, 2003). This probably happened because of lack of perfect information among farmers concerning government policies. There was a lag in time between the time the government abolished subsidies and the time this reached the rural areas. The highest proportion of households who plan to buy government subsidised inputs in the very poor year is among the poor households. The rich households had higher proportions of households planning to buy subsidised inputs in the good (2011), normal (2012) and poor year (2005). The very poor year is the only year

where the proportion of poor households who planned to buy subsidised inputs was greater than the proportion of the rich households. This shows that the lack of information or the lag in time between the introduction of government policies and the time they reach the rural areas are more pronounced among the poor households than among the rich households

Having determined that household wealth affects the use of some ex-ante mechanisms to seasonal input requirements, we now turn our attention to try and determine whether the probability of using a given ex-ante adjustment mechanism to seasonal input requirements by households of a given wealth stratum is the same in good, normal, poor and very poor years. To do this, Cochran's Q-test was used. The null hypothesis being tested is that the probability of using a given ex-ante adjustment mechanism to seasonal input requirements by households of a given wealth stratum is the same in good, normal, poor and very poor years. The decision rule ($\alpha = 0.05$) is to reject the null hypothesis if the p-value is less than 0.05. The rejection of the null hypothesis for at least one adjustment mechanism would mean that households do not use the same ex-ante adjustment mechanism to seasonal input requirements in the four years. Table 4.16 below shows the statistics that were obtained from Cochran's Q-test.

Table 4.16: Cochran's Q statistics for ex-ante adjustment mechanisms to seasonal input requirements

MECHANISM	Rich			Middle			Poor		
	df	Cochran's Q	p-value	df	Cochran's Q	p-value	df	Cochran's Q	p-value
Plan to save from grain crop sales	3	6.207	0.102	3	46.437***	0.000	3	12.000***	0.007
Plan to save from livestock sales	3	11.143	0.011	3	0.541	0.910	3	0.571	0.903
Plan to borrow money within the village	3	7.200*	0.066	3	6.652*	0.084	3	2.613	0.455
Plan to borrow money outside the village	3	1.286	0.733	3	2.571	0.463	3	0.000	1.000
Plan to migrate in search of employment	3	2.400	0.494	3	3.857	0.277	3	0.000	1.000
Plan to receive remittances	3	19.457***	0.000	3	17.172***	0.001	3	11.000**	0.012
Plan to work for fertiliser on other farms	3	6.000	0.112	3	2.280	0.516	3	0.000	1.000
Plan to buy government subsidised inputs	3	40.588***	0.000	3	49.200***	0.000	3	30.000***	0.000
Plan to save from milk sales	3	3.000	0.397	3	0.000	1.000	-	-	-

Source: Survey data (2013). *** significant at 1%, **significant at 5%, *significant at 10%.

- **Rich households**

Table 4.16 shows that only the plan to receive remittances and the plan to buy government subsidised inputs have p-values less than 0.05. This is an indication of rejection of the null hypotheses for these two ex-ante adjustment mechanisms. Therefore, it can be concluded that the probability of using these ex-ante adjustment mechanisms to seasonal input requirements by rich households is not the same in good, normal, poor and very poor years, at 5% level of significance.

The likelihood of a household planning to receive remittances to meet the seasonal input requirements vary with the season type. There is an increase in the demand for remittances as we move from the good year to the very poor year (see Table 4.14 above). This means that when rich households are unable to meet the seasonal input requirements on their own, they look for help from friends and relatives.

- **Middle households**

Table 4.16 shows that only the plans to save from grain crop sales, receive remittances and buy government subsidised inputs have p-values less than 0.05 among the middle households. This is an indication of rejection of the null hypothesis. Therefore, it can be concluded that the probability of using any of these three ex-ante adjustment mechanisms to seasonal input requirements by middle households is not the same in good, normal, poor and very poor years at 5% level of significance. This result leads us to the conclusion that, just like the rich households, they do not use the same ex-ante adjustment mechanisms to seasonal input requirements in all seasonal types.

- **Poor households**

Table 4.16 shows that only the plans to save from grain crop sales, receive remittances and buy government subsidised inputs have p-values less than 0.05 among the poor households. This is an indication of rejection of the null hypothesis. Therefore, it can be concluded that the probability of using any of these three ex-ante adjustment mechanisms to seasonal input

requirements by poor households is not the same in good, normal, poor and very poor years. This result is similar to what was observed when we were looking at the middle households.

In summary, the wealthier a given household is, the higher the likelihood that it can plan to use savings from grain crop sales to meet its seasonal input requirements. The probability of households using savings from grain sales is the same for all years among the rich households. However, this is not the case among the non-rich households.

The plan to buy government subsidised inputs is the only adjustment mechanism whose probability of adoption is not the same in good, normal, poor and very poor years across all the wealth strata. The reasons behind this have already been explained above when we were looking at whether wealth is reflected in the use of ex-ante adjustment mechanisms to seasonal input requirements in the very poor year.

4.6 EX-POST ADJUSTMENT MECHANISMS TO SEASONAL INPUT REQUIREMENTS

When households fall short of the required quantities of farming inputs, they use some ex-post adjustment mechanisms to minimise the input shortage gap. As defined in Chapter One, ex-post adjustment mechanisms to seasonal input requirements refer to the actual actions households take when they fall short of the required farming inputs. Table 4.17 below provides the ex-post adjustment mechanisms to seasonal input requirement.

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Table 4.17: Ex-post adjustment mechanisms to seasonal input requirements (% of households)

Mechanism	Good year (2011)			Normal year (2012)			Poor year (2005)			Very poor year (1995)		
	Rich	Middle	Poor	Rich	Middle	Poor	Rich	Middle	Poor	Rich	Middle	Poor
Borrow more money than was planned within the village	17.8	34.8	36.5	31.1	43.3	53.3	23.8	23.8	30	20.6	21.4	36.7
Borrow more money than was planned outside the village	8.9	12.4	11.8	4.4	10	13.3	2.4	11.1	4	2.9	7.1	20
Ask for more remittances than was planned within the village	11.1	5.6	14.1	11.1	5.6	17.8	7.1	6.3	12	14.7	7.1	16.7
Ask for more remittances than was planned outside the village	6.7	5.6	14.1	8.9	8.9	18.9	16.7	12.7	20	23.5	21.4	10
Sell products such as firewood and charcoal	13.3	24.7	24.7	15.6	25.6	24.4	21.4	20.6	24	14.7	28.6	23.3
Buy fertiliser from households who obtain more subsidised fertiliser than they require	11.1	9	7.1	6.7	10	10	4.8	1.6	8	0	0	6.7
Sell more grain stock than planned	35.6	12.4	11.8	33.3	13.3	10	11.9	0	8	2.9	0	3.3
Sell more livestock than planned	40	32.6	16.5	60	37.8	18.9	45.2	31.7	24	41.2	23.8	30
Find more casual employment than planned from well to do households	15.6	36	42.4	13.3	38.9	53.3	23.8	50.8	58	14.7	59.5	56.7

Source: Survey data (2013).

The results in Table 4.17 show that the four (4) most common ex-post adjustment mechanisms to seasonal input requirements for the rich households in the good year are borrowing more money than was planned within the village, selling more livestock than planned, finding more casual employment than planned from well-to-do households and selling more grain stock than planned. In contrast, the four most common ex-post adjustment mechanisms to seasonal input requirements among the poor households in the good year are borrowing more money than was planned within the village, selling products such as firewood and charcoal, finding more casual employment than planned from well-to-do households and selling more grain stock than planned. Selling of products such as firewood and charcoal is not among the top four adjustment mechanisms for the rich households, even in the very poor year, despite it consistently being among the top four mechanisms among the poor households. However, the proportion of rich households who sell products such as firewood and charcoal increase as we move away from the good year to the very poor year. Selling of products such as firewood and charcoal is probably perceived as an inferior ex-post adjustment mechanism to seasonal input requirements, which would compromise the household social status and only becomes attractive in difficult times.

The results in Table 4.17 also show that finding more casual employment than planned from well-to-do households is more common among the poor households than among the rich households across all the years. This probably means that the rich households perceive casual employment as an inferior adjustment mechanism

Let us now determine whether ex-post adjustment mechanisms to seasonal input requirements differ by wealth of the household. To do this, chi-square tests were done. The null hypothesis for this test is that the given ex-post adjustment mechanism to seasonal input requirements do not differ by wealth of the household. The decision rule ($\alpha = 0.05$) is to reject the null hypothesis if the p-value is less than 0.05. The rejection of at least one null hypothesis would generally mean that household wealth is important in explaining the ex-post adjustment mechanisms to seasonal input requirements. The Chi-square statistics that were generated are shown in Table 4.18 below.

Table 4.18: Chi-square tests for ex-post adjustment mechanisms to seasonal input requirements and wealth

Mechanism	Good year (2011)			Normal year (2012)			Poor year (2005)			Very poor year (1995)		
	Chi-square	df	p-value	Chi-square	Df	p-value	Chi-square	df	p-value	Chi-square	df	p-value
Borrow more money than was planned within the village	5.295*	2	0.071	6.135**	2	0.047	0.678	2	0.713	2.769	2	0.250
Borrow more money than was planned outside the village	0.373	2	0.830	2.591	2	0.274	3.917	2	0.141	5.856*	2	0.054
Ask for more remittances than was planned within the village	3.547	2	0.170	6.588**	2	0.037	1.275	2	0.529	1.753	2	0.416
Ask for more remittances than was planned outside the village	4.200	2	0.122	4.810*	2	0.090	1.111	2	0.574	2.204	2	0.332
Sell products such as firewood and charcoal	2.666	2	0.264	1.838	2	0.399	0.193	2	0.908	2.074	2	0.355
Buy fertiliser from households who obtain subsidised fertiliser more than they require	0.628	2	0.730	0.473	2	0.790	2.666	2	0.264	5.164*	2	0.076
Sell more grain stock than planned	14.058***	2	0.001	12.946***	2	0.002	7.179***	2	0.028	1.351	2	0.509
Sell more livestock than planned	9.776***	2	0.008	23.028***	2	0.000	4.728*	2	0.094	2.668	2	0.263
Finding more casual employment than planned from well to do households	9.577***	2	0.008	20.104***	2	0.000	11.812***	2	0.003	21.614***	2	0.000

Source: Survey data (2013). *** significant at 1%, **significant at 5%, *significant at 10%.

- **Good year**

As can be seen from Table 4.18, only selling more grain stock than planned, selling more livestock than planned and finding more casual employment than planned from well to do households all have p-values less than 0.05 in the good year. This indicates the rejection of the null hypothesis for each of these three ex-post adjustment mechanisms to seasonal input requirements. Therefore, it can be concluded that the use of these three ex-post adjustment mechanisms to seasonal input requirements differs by wealth of the household in the good year at 5% level of significance.

The richer a given household is, the more likely that it would sell more grain and livestock than planned to meet the seasonal input requirements (refer to Table 4.17). This is probably because rich households generally produce more grain stock than their non-rich counterparts who produce mainly just for consumption. In addition, the rich households are generally more endowed with livestock. Therefore, selling of livestock to meet input requirements is common among rich households in the good year. On the other hand, finding casual employment to meet input requirements is more common among the poor households in the good year. This shows that the rich households have a wider range of ex-post adjustment mechanisms to seasonal input requirements than the non-rich households in the good year and as a result they have the luxury of avoiding the use of inferior mechanisms.

- **Normal year**

Table 4.18 shows that only borrowing more money than was planned within the village, asking for more remittances than was planned within the village, selling more grain stock than planned, selling more livestock than planned and finding more casual employment than planned from well-to-do households have p-values less than 0.05. This indicates the rejection of the null hypotheses for these adjustment mechanisms. Therefore, it can be concluded that the use of these five ex-post adjustment mechanisms to seasonal input requirements differ by wealth of the household in a normal year at 5% level of significance.

In addition to what we saw in the good year, borrowing more money and asking for more remittances than planned within the village to meet seasonal input requirements differ by

household wealth in the normal year. This shows that in a normal year more households adopt adjustment mechanisms that were considered inferior in the good year. The increases in households who borrow more money and ask for more remittances within the village are more pronounced among the poor households.

- **Poor year**

It can be seen from Table 4.18 that only selling more grain stock than planned and finding more casual employment than planned from well to do households have p-values less than 0.05 in the poor year. This shows rejection of the null hypothesis for these two adjustment mechanisms to seasonal input requirements. Therefore, it can be concluded that only the use of these two ex-post adjustment mechanisms to seasonal input requirements differ by wealth of the household in a poor yea at 5% level of significance.

Unlike in the normal year, borrowing more money than was planned within the village, and asking for more remittances than was planned within the village no longer differ by household wealth. This shows that, in a poor year, even rich households are forced to adopt mechanisms that were considered inferior in the normal year. This further means that during the poor year the majority of rural households suffer from the effects of a poor harvest such that it becomes difficult for both the poor and non-poor households to resist borrowing money and receiving remittances within the village.

- **Very poor year**

Table 4.18 shows that only finding more casual employment than planned from well-to-do households has a p-value less than 0.05 in a very poor year. This shows the rejection of the null hypothesis. Therefore, it can be concluded that finding more casual employment than planned from well-to-do households differs by wealth of the household in a very poor year. This shows that some households still consider finding casual employment from well-to-do households as an inferior ex-post adjustment mechanism to seasonal input requirements, even in the very poor year. Therefore, the richer the household is, the more likely that it would be able avoid finding casual employment from well-to-do households to meet the seasonal input requirements in the very poor year.

We have shown that the use of some ex-post adjustment mechanisms to seasonal input requirements differ by wealth of the household in good, normal, poor and very poor years. Let us now show whether the probability of using a given ex-post adjustment mechanisms to seasonal input requirements by households of a given wealth stratum is the same in good, normal, poor and very poor years. To do this, Cochran's Q-test was used. The null hypothesis being tested is that the probability of using a given ex-post adjustment mechanism to seasonal input requirements is the same in good, normal, poor and very poor years. The decision rule ($\alpha = 0.05$) is to reject the null hypothesis if p-value is less than 0.05. The rejection of the null hypothesis for at least one adjustment mechanism would mean the households in a given wealth stratum do not use the same ex-post adjustment mechanisms to seasonal input requirements in the four years. The results that were obtained from Cochran's Q-test are shown in Table 4.19 below.

Table 4.19: Cochran's Q statistics for ex-post adjustment mechanisms to seasonal input requirements

Mechanism	Rich			Middle			Poor		
	df	Cochran's Q	p-value	df	Cochran's Q	p-value	df	Cochran's Q	p-value
Borrow more money than was planned within the village	3	2.700	0.440	3	4.846	0.183	3	4.135	0.247
Borrow more money than was planned outside the village	3	6.000	0.112	3	3.923	0.270	3	6.000	0.112
Ask for more remittances than was planned within the village	3	3.000	0.392	3	1.333	0.271	3	7.000	0.72
Ask for more remittances than was planned outside the village	3	7.636*	0.054	3	3.818	0.282	3	0.692	0.875
Sell products such as firewood and charcoal	3	4.263	0.234	3	5.233	0.156	3	0.000	1.000
Buy fertiliser from households who obtain subsidised fertiliser more than they require	3	7.000*	0.072	3	4.714	0.194	3	2.400	0.494
Sell more grain stock than planned	3	14.850***	0.002	3	21.968***	0.000	3	3.273	0.351
Sell more livestock than planned	3	3.882	0.274	3	2.640	0.451	3	1.629	0.653
Find more casual employment than planned from well to do households	3	3.200	0.362	3	8.769**	0.033	3	2.189	0.534

Source: Survey data (2013). *** significant at 1%, **significant at 5%, *significant at 10%.

- **Rich households**

It can be seen from Table 4.19 that only selling more grain stock than planned has a p-value less than 0.05. This is an indication of rejection of the null hypothesis. Therefore, it can be concluded that the probability of selling more grain stock than planned to meet seasonal input requirements by rich households is not the same in good, normal, poor and very poor years at 5% level of significance. Selling more grain stocks than planned to meet seasonal input requirements is the only ex-post adjustment mechanism whose likelihood of being used by rich households is not the same in good, normal, poor and very poor years. This is not surprising because agriculture is the main source of livelihood for 92% of rural households. This means that the higher the level of grain production in a given year, the more grain would be sold to finance input requirements for the coming rain season. Consequently, agricultural production in a given year is affected by agricultural production from the preceding year. This highlights the importance of agriculture in rural areas.

- **Middle households**

Table 4.19 shows that only selling more grain stock than planned and finding more casual employment than planned from well-to-do households have p-values less than 0.05. This is an indication of rejection of the null hypothesis for each of these two ex-post adjustment mechanisms to seasonal food requirements. Therefore, it can be concluded that the proportion of middle households who use these two ex-post adjustment mechanisms to seasonal input requirements are not the same in good, normal, poor and very poor years among middle households at 5% level of significance. Just like rich households, the middle households' likelihood of selling more grain than planned to fill seasonal input requirements is not the same in the good, normal, poor and very poor years. However, unlike among the rich households, the probability of finding more casual employment in order to meet seasonal input requirements is not the same in good, normal, poor and very poor years among the middle households. This can be explained by differences in perceptions with regard to casual employment between the rich and the middle households. In addition, this can also be as a result of differences in availability and effectiveness of ex-post adjustment mechanisms to

seasonal input requirements. The rich households tend to have a wider range of ex-post adjustment mechanisms to seasonal food requirements to use.

- **Poor households**

Table 4.19 has shown that all the adjustment mechanisms to seasonal input requirements for the poor households have p-values greater than 0.05. This denotes failure to reject the null hypotheses for all the ex-post adjustment mechanisms to seasonal input requirements. Therefore, it can be concluded that the probability of using any of the ex-post adjustment mechanisms to seasonal input requirements by poor households is the same in good, normal, poor and very poor years at 5% level of significance. This means that poor households use the same ex-post adjustment mechanisms to seasonal input requirements regardless of type of season. This result is surprising, since we would not expect households to use the same ex-post adjustment mechanisms to seasonal input requirements, for example, after catastrophic (very poor) and bumper (good) harvests. This means that, in all the years, poor households' agricultural production is not sufficient to meet their seasonal input requirements.

4.7 CHAPTER SUMMARY

This chapter has analysed the characteristics of the sampled households and established that ninety-two (92) percent of the households rely on agriculture as their main source of income (livelihood). It has further been established that there is no significant relationship between household wealth and the household head's education level. However, it has been shown that there is a statistically significant relationship between household wealth and the size of the household.

The ex-ante and ex-post adjustment mechanisms to both seasonal food and input requirements have been presented. The statistical analysis showed that not all the ex-ante mechanisms to seasonal food requirements differ by wealth of the household in good, normal, poor and very poor year. The analysis has also shown that some of the ex-post adjustment mechanisms to seasonal food requirements do differ by the wealth of the household. The analysis further showed that some ex-ante and ex-post mechanisms to seasonal input requirements also differ

by the wealth of the household in good, normal, poor and very poor years. The analysis has further shown that some ex-ante and ex-post adjustment mechanisms have the same probability of being adopted in all the years (good, normal, poor and very poor) by a given stratum of households. Finally, it has been established that the poor households use the same ex-post adjustment mechanisms to seasonal input requirements in all the years.

CHAPTER 5

FOOD PRODUCTION AND CONSUMPTION SEASONALITY

5.1 INTRODUCTION

This chapter analyses changes in seasonal food consumption. Lack of any observed changes in consumption from one harvest season to the other would mean that the ex-ante and ex-post adjustment mechanisms to season food requirements are effective to prevent a seasonal fall in consumption. Since both the adequacy of the staple food meal and the number of meals eaten per day are considered important in analysing the consumption seasonality, this chapter looks at the seasonal patterns of both adequacy of staple food meals and number of meals eaten per day. This chapter also determines whether agricultural production and household wealth can be used to explain consumption seasonality.

5.2 SEASONALITY OF ADEQUACY OF STAPLE FOOD MEALS

This section presents results on household perception on the adequacy of meals in each of the three seasons of the year. Adequacy was measured as a categorical variable with three responses; adequate, moderately adequate and inadequate (see Part D in Appendix A). Statistical tests were done to determine whether adequacy of staple food meals was the same across all the seasons in good, normal, poor and very poor years. Friedman's test was used to determine whether the adequacy of staple food meals is the same across all the three seasons of the year. The null hypothesis is that the adequacy of staple food meals is the same across all the three seasons of the year. The decision rule ($\alpha = 0.05$) is to reject the null hypothesis if the p-value is less than 0.05. Failure to reject the null hypothesis would mean the ex-ante and ex-post adjustment mechanisms to season food requirements are effective enough to prevent a seasonal fall in consumption. Table 5.1 below provides the adequacy of household staple food meals and the associated Friedman statistics.

Table 5.1: Adequacy of staple food meals

Year	Adequacy	April–August		August–December		December–April		Friedman statistics		
		Frequency	Percent	Frequency	Percent	Frequency	Percent	Chi-square	df	p-value
Good	Adequate	136	62	114	52.1	107	48.9	39.749***	2	0.000
	Moderately adequate	76	34.7	93	42.5	91	41.6			
	Inadequate	7	3.2	12	5.5	21	9.6			
	Total	**219**	**100**	**219**	**100**	**219**	**100**			
Normal	Adequate	120	53.3	109	48.4	96	42.7	30.178***	2	0.000
	Moderately adequate	90	40.0	96	42.7	101	44.9			
	Inadequate	15	6.7	20	8.9	28	12.4			
	Total	**225**	**100**	**225**	**100**	**225**	**100**			
Poor	Adequate	30	19.4	25	16.1	21	13.5	38.769***	2	0.000
	Moderately adequate	80	51.6	76	49.0	59	38.1			
	Inadequate	45	29.0	54	34.8	75	48.4			
	Total	**155**	**100.0**	**155**	**100**	**155**	**100**			
Very poor	Adequate	8	7.5	8	7.5	7	6.6	41.906***	2	0.000
	Moderately adequate	35	33.0	28	26.4	23	21.7			
	Inadequate	63	59.4	70	66.0	76	71.7			
	Total	**106**	**100**	**106**	**100**	**106**	**100**			

Source: Survey data (2013). *** significant at 1%, **significant at 5%, *significant at 10%.

- **Good year**

The results in Table 5.1 show that sixty-two (62) percent of households had adequate staple food meals in the April–August season of the good year. The proportion of households that had inadequate staple food meals in the April–August, August–December and December–April seasons are 3.2%, 5.5% and 9.6% respectively. Friedman's test indicates the rejection of the null hypothesis. This shows that the observed differences in the adequacy of staple food meals in the three seasons of the good year are not just by chance. Therefore, we concluded that the adequacy of staple food meals is not the same across all the three seasons of a good year at a 5% level of significance. Therefore, the ex-ante and ex-post adjustment mechanisms to season food requirements are not effective enough to prevent a seasonal fall in consumption in a good year.

- **Normal year**

Table 5.1 shows that the proportion of households that have inadequate staple food meals in the April–August, August–December and December–April seasons of the normal year are 6.7%, 8.9% and 12.4% respectively. There is an increase in the proportion of households with inadequate staple food meals as we move away from the April–August (harvest) season to the December–April (rainy) season. This could be attributed to the depletion of food stocks as we move away from the harvest season. This implies that people who had adequate food meals in the August–April season may be forced to have smaller and smaller meal sizes as they approach the next harvest. Friedman's test indicates the rejection of the null hypothesis. Just like in the good year, this shows that the observed differences in the adequacy of staple food meals in the three seasons of the normal year are not just by chance. Therefore, it can be concluded that adequacy of staple food meals is not the same across all the three seasons of the normal year at 5% level of significance. Just like in the good year, the adjustment mechanisms to season food requirements are not effective enough to prevent a seasonal fall in consumption.

- **Poor year**

The results in Table 5.1 show that only 19.4% of households reported to have had adequate staple food meals in the April–August seasons of the poor year. This is in contrast to what we observed after the normal and good harvests where more than 50% of households reported having adequate staple food meals in the April–August season. The proportion of households that have inadequate staple food meals in the April–August, August–December and December–April seasons are 29.0%, 34.8% and 48.4% respectively. In determining whether the observed seasonal differences in adequacy of staple food meals are not by chance, Friedman's test indicates rejection of the null hypothesis. Just like in the good and normal years, this shows that the observed differences in the adequacy of staple food meals in the three seasons of the poor year are not just by chance. Therefore, we can conclude that adequacy of staple food meals is not the same across all the three seasons of the poor year at 5% level of significance. Therefore, just like in good and normal years, the ex-ante and ex-post adjustment mechanisms to season food requirements are not effective enough to prevent a seasonal fall in consumption.

- **Very poor year**

Table 5.1 shows that only 7.5% of households reported that they had adequate staple food meals in the April–August season of the very poor year. The proportion of households that have inadequate staple food meals in the April–August, August–December and December–April seasons are 59.4%, 66.0% and 71.7% respectively. The proportion of households who reported having adequate staple food meals is less than 8% in all the three seasons of the very poor year. Friedman's test (indicated rejection of the null hypothesis. Just like in the good, normal and poor years, this shows that the observed differences in the adequacy of staple food meals in the three seasons of the very poor year are not just by chance. Therefore, we can conclude that adequacy of staple food meals is not the same in all the three seasons of the very poor year at 5% level of significance. Just like in the good, normal and poor years, this means that the ex-ante and ex-post adjustment mechanisms to season food requirements are not effective enough to prevent a seasonal fall in consumption in the very poor year.

5.3 HOUSEHOLD WEALTH AND AVERAGE NUMBER OF MEALS EATEN PER DAY IN A SEASON

Reducing the number of meals is a common ex-post adjustment mechanism to seasonal food requirements. Just like the adequacy of staple food meals, a significant reduction in the average number of meals eaten per day is expected as we move away from the harvest period. In this section statistical tests are carried out to determine whether the observed differences in the number of meals eaten per day as we move from one season to the other is not just by chance. If we find that the seasonal differences in the number of meals eaten per day is not just by chance then it would further cement our conclusion from the previous section that adjustment mechanisms are not enough to prevent a seasonal fall in consumption. Such a result would further mean that households do not smooth their annual consumption. Table 5.2 below provides the average number of meals eaten per season for each stratum of households.

Table 5.2: Average number of meals per day

Year	Wealth stratum	Season		
		April–August	August–December	December-April
Good	Rich	2.96 (0.208)	2.89 (0.385)	2.80 (0.505)
	Middle	2.91 (0.288)	2.89 (0.414)	2.79 (0.446)
	Poor	2.86 (0.350)	2.64 (0.508)	2.69 (0.535)
	Pooled sample	2.90 (0.301)	2.79 (0.441)	2.75 (0.492)
Normal	Rich	2.98 (0.260)	2.87 (0.457)	2.82 (0.490)
	Middle	2.91 (0.286)	2.89 (0.412)	2.77 (0.451)
	Poor	2.83 (0.375)	2.63 (0.529)	2.63 (0.550)
	Pooled sample	2.89 (0.323)	2.77 (0.482)	2.90 (0.504)
Poor	Rich	2.64 (0.485)	2.52 (0.594)	2.45 (0.670)
	Middle	2.33 (0.622)	2.17 (0.636)	2.06 (0.669)
	Poor	2.26 (0.565)	2.06 (0.652)	1.86 (0.783)
	Pooled sample	2.39 (0.587)	2.23 (0.653)	2.10 (0.740)
Very poor	Rich	2.26 (0.751)	2.12 (0.808)	2.00 (0.853)
	Middle	1.88 (0.705)	1.67 (0.786)	1.60 (0.828)
	Poor	1.87 (0.681)	1.70 (0.750)	1.50 (0.777)
	Pooled sample	2.00 (0.730)	1.82 (0.802)	1.70 (0.841)

Source: Survey data (2013). (Figures in parentheses are standard deviations).

The figures in parentheses are standard deviations. For each stratum of wealth, the April–August season has the highest average number of meals eaten per day while December–April has the lowest average number of meals eaten per day. This shows that consumption seasonality exists in rural areas. Across all the years, the rich households have the highest

average number of meals in each season. It is either the rich households store enough food from their harvest or have more effective ex-post adjustment mechanisms to seasonal food requirements than the non-rich households.

Table 5.2 further shows that the standard deviations for all the three household strata increase as we move from one harvest season to the next harvest. This means that the differences in the number of meals eaten within a given stratum increase as we move away from the harvest season. This shows that even among the households of the same stratum the effectiveness of the adjustment mechanisms differ. The rich have the smallest standard deviation during the April–August season for the good, normal and poor season years while the poor households have the highest standard deviations for the April–August season of the same years. The results show a different picture in the very poor harvest year. In the very poor harvest year, the poor households have the lowest standard deviation in the April–August (post-harvest) season.

Let us now determine whether household wealth is reflected in the number of meals eaten in a given season. To do this, the Kruskal-Wallis test was used. As shown in Chapter 3, the Kruskal-Wallis test is a non-parametric alternative to ANOVA. ANOVA could not be applied here because the average number of meals eaten per day violates normality. Categorical variable class (rich, middle or poor) is the independent variable while the number of meals eaten per day in a given season is the dependent variable. The null hypothesis is that household wealth is not reflected in the number of meals eaten per day in a given season. The decision rule ($\alpha = 0.05$) is to reject the null hypothesis if the p-value is less than 0.05.
Table 5.3 below presents the Kruskal Wallis statistical tests on the relationship between average number of meals eaten in a season and household wealth.

Table 5.3: Kruskal Wallis test statistics for average number of meals eaten and wealth

Year type	Season	Test statistics		
		chi-square	df	p-value
Good (2011)	April–August	2.17	2	0.200
	August–December	18.668***	2	000
	December–April	2.399	2	0.301
Normal year(2012)	April–August	6.325**	2	0.042
	August–December	13.478***	2	0.001
	December–April	5.358*	2	0.069
Poor (2005)	April–August	10.859***	2	0.004
	August–December	12.836***	2	0.002
	December–April	14.930***	2	0.001
Very poor (1995)	April–August	7.101**	2	0.029
	August–December	7.163**	2	0.028
	December–April	7.343**	2	0.025

Source: Survey data (2013). *** significant at 1%, **significant at 5%, *significant at 10%.

- **Good year (2011)**

The Kruskal-Wallis test for the April–August season of the good year indicates failure to reject the null hypothesis. Therefore, we conclude that household wealth is not reflected in the number of meals eaten per day in the April–August season of the good year at the 5% level of significance. This result is not significant even at a 10% level of significance. This makes sense, since just after harvest there is high availability of food in the village and during this period food prices are also at their lowest. Therefore, households with poor yields are able to work for food or buy food cheaply from other households.

The Kruskal-Wallis test for the August–December season of the good year indicates rejection of the null hypothesis. Therefore, we conclude that household wealth is reflected in the number of meals eaten per day in the August–December season of a good year at the 5% level of significance. This result is in contrast to what we found in the April–August season of the good year. This shows that the effect of household wealth on the number of staple food meals eaten per day become more visible as we move away from one harvest season to the other.

The Kruskal-Wallis test for the December–April season of the good year indicates failure to reject the null hypothesis. Therefore, we conclude that household wealth is not reflected in the number of meals eaten per day in the December–April season of a good year at the 5% level of significance. This is because the wealthy households have to adjust their food consumption just before the harvest season.

- **Normal year (2012)**

The Kruskal-Wallis test for the April–August and August–December seasons of the normal year indicates rejection of the null hypothesis. Therefore, we can conclude that the household wealth is reflected in the number of meals eaten per day in both the April–August and the August–December seasons at the 5% level of significance. The Kruskal-Wallis test for the December–April season shows that household wealth is not reflected in the number of meals eaten per day in the December–April season of the normal year at the 5% level of significance. However, this result is significant at 10% level of significance.

- **Poor year (2005)**

The Kruskal-Wallis tests for April–August August–December and December–April seasons have p-values less than 0.05. This indicates the rejection of the null hypothesis. Therefore, we conclude that household wealth is reflected in the number of meals eaten per day in all the three seasons of the poor year at the 5% level of significance. This shows that the higher the wealth level of the given household, the higher the capacity of the household to prevent a fall in household consumption in a poor year.

- **Very poor year (1995)**

All the Kruskal-Wallis test results for the very poor year indicate rejection of the null hypothesis for each of the three seasons of the very poor year. Therefore, we conclude that household wealth is reflected in the number of meals eaten per day in all the three seasons of the very poor year at the 5% level of significance. Just like in the poor and normal years, the higher the wealth of the household, the higher the capacity of the household to prevent a fall in household consumption in the three seasons of the very poor year.

The statistical tests in this section have shown that wealth affects the number of meals eaten in all the seasons of the poor and very poor years. The results from the good year show that wealth cannot be used to explain the observed differences in the number of meals eaten in the April–August season and the December–April seasons. Most families have adequate food stocks in a good harvest year either from their own production or buying from the market

since prices are at their lowest at harvest season. The surprising observation for a good year is that despite wealth not being able to explain the observed differences in the number of meals eaten in the April–December and December–April seasons, it is able to explain for the August–December season. This is probably because the wealthy households have to adjust their consumption just before the harvest season.

5.4 HOUSEHOLD AGRICULTURAL PRODUCTION LEVEL AND AVERAGE NUMBER OF MEALS EATEN IN A SEASON

This section looks at the household agricultural production and the number of meals eaten per day in a season. Agricultural production data were collected as numerical but were converted into relatively small number of groups. Table 5.4 below gives the household agricultural production levels for the different years.

Table 5.4: Household maize output

Yield range (50kg)	Good year (2011)		Normal year (2012)		Poor year (2005)		Very poor year (1995)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
< 11	53	24.2	79	35.1	103	66.5	91	85.8
11 – 30	82	37.4	77	34.2	36	23.2	11	10.4
31 – 50	32	14.6	41	18.2	9	5.8	3	2.8
51 – 70	20	9.1	12	5.3	2	1.3	0	0
> 70	32	14.6	16	7.1	5	3.2	1	0.9
Total	219	100.0	225	100	155	100.0	106	100
Mean output	41.20 (52.89)		32.60 (66.85)		15.72 (36.61)		5.60 (13.18)	

Source: Survey data (2013). (Figures in parentheses are standard deviations).

It can be seen from Table 5.4 that the mean yield of maize keeps on decreasing as we move from a good year to a very poor year. The average household yields in 50 kg bags were 41.20, 32.60, 15.72 and 5.60 for the good harvest, normal harvest, poor harvest and very poor harvest respectively. The other important point to note is that as we move from the good year, the proportion of households getting less than 11 bags of maize keeps on increasing while the proportion of households getting 70 plus bags of maize keeps decreasing as expected. In a good year, the proportion of households who harvest less than 11 bags of maize is 53% while the proportion of those who produce less than 11 bags of maize is 91% in a very poor year.

Having seen that as many as 53% of households produce less than 11 bags of maize in a good year and the percentage goes as high as 91 in the very poor year, the next step is to determine whether agricultural production is reflected in seasonal food consumption. Since agriculture is the main occupation in rural areas, we expect agricultural production to be reflected in the number of meals consumed per day in a particular season. If agricultural production fails to reflect in food consumption, it would mean that households have effective adjustment mechanisms to seasonal food requirements. For the normal and good years we don't expect food production to be reflected in the seasonal consumption just after harvest, in the April–August season. Most households are expected to have enough food for consumption during the April–August seasons of good and normal years. However, we expect seasonal consumption to track agricultural production as we move away from the harvest seasons of the good and normal years.

To determine whether agricultural production is reflected in seasonal food consumption, the Kruskal-Wallis test was used. This non-parametric method is preferred to ANOVA because the number of meals eaten per day in a season violated the normality assumption. The null hypothesis being tested is that agricultural production is not reflected in seasonal food consumption. The following table presents the Kruskal-Wallis statistics. A significant test shows that seasonal consumption tracks agricultural production and this would be in agreement with Sahn (1989) who finds that households consume more just after harvest and their consumption levels dwindle as they move away from the harvest season.

Table 5.4: Kruskal-Wallis statistics for staple food output and seasonal consumption

Year	Season	Kruskal-Wallis test statistics		
		Chi-square	df	p-Value
Good	April–August	9.080*	4	0.059
	August–December	20.137***	4	0.000
	December-April	25.628***	4	0.000
Normal	April–August	6.726	4	0.151
	August–December	15.543***	4	0.004
	December-April	11.046**	**4**	0.026
Poor	April–August	21.523***	4	0.000
	August–December	29.867***	4	0.000
	December-April	29.952***	4	0.000
Very poor	April–August	18.678***	4	0.000
	August–December	18.774***	4	0.000
	December-April	20.164***	4	0.000

Source: Survey data (2013).

- **Good year**

The Kruskal-Wallis test results for the April–August season of the good year indicates a failure to reject the null hypothesis. Therefore, we conclude that agricultural production is not reflected in the number of meals eaten per day in the April–August season of the good year at 5% level of significance. This is according to our prior expectation. However, the result is significant at 10% level of significance. This shows that the relationship between agricultural production level and number of meals eaten per day is weak in the post-harvest season of the good year. During the harvest season, there are high levels of grain stock on the market and this leads to low food prices. Moreover, there is also high availability of casual employment opportunities within the village employment. As a result of high grain stocks on the market, low food prices and availability of casual employment opportunities in the village, the majority of households, regardless of their wealth, are able to meet the subsistence number of meals required per day.

The Kruskal-Wallis test results for the August–December and December–April seasons indicate rejection of the null hypothesis. Therefore, it can be concluded that agricultural production of the household is reflected in the number of meals eaten per day in both the August–December and December–April seasons of the good year at the 5% level of significance.

- **Normal year**

Just like in the April–August season of the good year, the Kruskal-Wallis test for April–August season of the normal year indicates a failure to reject the null hypothesis. However, unlike in the good year, this result is not significant even at 10% level of significance.

The Kruskal-Wallis test for the August–December and December–April seasons indicate rejection of the null hypotheses. Therefore, we conclude that agricultural production of the household is reflected in the number of meals eaten per day in both the August–December and December–April seasons of the normal year at the 5% level of significance. The results for the normal year are in agreement with a priori expectation. The good and normal years have similar consumption patterns at the 5% level of significance. This means that consumption

does not track agricultural production in the post-harvest seasons of the good and normal years. However, consumption tracks agricultural production as we move away from the post-harvest season.

- **Poor year**

Unlike in the good and normal years, the Kruskal-Wallis test results for the poor year show a rejection of the null hypothesis for all the three seasons of the poor year. Therefore, it can be concluded that household agricultural production is reflected in the number of meals eaten per day in all the three seasons of the poor year at the 5% level of significance. This result is in agreement with a priori expectation.

- **Very poor year**

Just like in the poor season, the Kruskal-Wallis tests show a rejection of the null hypothesis for all three seasons of the very poor year Therefore, just like in the poor year, we can conclude that the household agricultural production is reflected in the number of meals eaten per day in all the three seasons of the very poor year at 5% level of significance. This result is in agreement with a priori expectation. The good and normal years have similar consumption patterns at the 5% level of significance. This shows that consumption tracks agricultural production in all the seasons of the poor and very poor years while consumption does not track agricultural production in the post-harvest seasons of the good and normal years.

5.5 CHAPTER SUMMARY

The analysis in this chapter has shown that the adequacy of staple food meals is not the same in the three seasons of each of the years that were studied (good, normal, poor and very poor). It has also been found that household wealth is reflected in the number of meals eaten per day in all the three seasons of the normal, poor and very poor years. However, in the good year, wealth is only reflected in the number of meals eaten per day in the August–December season.

It has further been shown that differences in the number of meals eaten per day in all three seasons of the poor and very poor years are influenced by household agricultural production, while for the good and normal years, agricultural production is reflected in the number of meals eaten per day in the August–December and December–April seasons but not in the April–August (post-harvest) season. This shows that consumption tracks agricultural production in all the seasons of the poor and very poor years. In contrast, consumption does not track agricultural production in the post-harvest seasons of the good and normal years. However, consumption tracks agricultural production as we move away from the post-harvest seasons of the good and normal years.

The findings in this chapter are similar to Paxson, (1993) who finds that households consume less before the harvest season. Paxson (1993) further finds that households may consume less before the harvest season not because of income problems but because of uncertain expectations with regard to the harvest season. Higher agricultural output for an agricultural dependent household is expected to lead to higher income and consumption levels.

CHAPTER 6

SUMMARY, CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

6.1 SUMMARY AND CONCLUSIONS

Zambia is one of the world's less developed economies. The majority of rural households depend on agriculture for their livelihoods. Despite rural households being the major suppliers of maize grain stock in Zambia, 37% of rural households are net buyers of maize grain and/or maize meal. What do rural households do during the seasons when they don't have adequate food and don't have the money to buy food, and how do they prepare for such periods of the year? The answers to these questions were the basis for this study.

Seasonality in agricultural households arises as a result of changes in environmental patterns. This leads to high dependence on one harvest (in some cases two harvests) in a year. This has two implications for rural households: (a) annual household income becomes highly dependent on the size of the harvested produce, and a failed harvest can impoverish a poor household, a household with inadequate assets and savings, and (b) households that lack diversified livelihoods have to endure from one harvesting season to the next on agricultural produce harvested once or twice a year. The high dependence on rain-fed agriculture makes the lives of rural households inseparable from the adverse effects of seasonality. The majority of small-scale farmers in Africa are located in rural areas and their income and consumption patterns vary with seasons, sometimes very sharply (Devereux, 2009).

The negative effects of seasonality are more extreme in sub-Saharan Africa than in other developing parts of the world, partly because the practice of irrigation is not common among rural households. The negative effects of slack irrigation practices are further exacerbated by unpredictable climatic conditions. The pressure of seasonal production and consumption fluctuations are most felt in rural areas.

To minimise the seasonal fall in consumption, households use a number of ex-ante mechanisms, while to counter a fall in seasonal food consumption, households use some ex-post adjustment mechanisms. It is important to note that the season of the year when households are struggling to meet their food grain needs, is the same time of the year when inputs are actually needed most for agricultural production. Therefore, seasonality poses important questions that are worth investigating. The following are some of the questions:

1. What do rural households do to minimise the expected seasonal fall in grain consumption?
2. What do rural households do to meet the expected purchase cost of agricultural inputs?
3. What do rural households do when their plans fail to significantly minimise the fall in grain consumption?
4. What do households do when their plans fail to adequately meet the purchase cost of agricultural inputs?

The key mechanism used to even out food consumption across seasons is to store food at the time of harvest. Ex-ante mechanisms are therefore the normal plans to store food, as well as all supplementary planned mechanisms which can help even out food consumption and make available purchasing power for inputs in the next season. At the time of the harvest, a farmer will be confronted with a normal, good, poor or catastrophic harvest. When a harvest is poor or catastrophic, a farmer cannot store as much food as he/she had planned. In order to not go hungry, a farmer has to use additional mechanisms, which we call ex-post adjustment mechanisms. The ex-post adjustment mechanisms are largely the same as the ones discussed in the risk literature as ex-post mechanisms, but there may be some additional ones specifically dealing with seasonality.

In Zambia, no comprehensive studies have been done to understand the ex-ante and ex-post mechanisms to seasonal food and input requirements. The following are the five specific objectives that guided this study:

1. Identify rural households' ex-ante and ex-post adjustment mechanisms to seasonality in food consumption and purchase costs of inputs in good, normal, poor and very poor (catastrophic) years.
2. Determine whether adjustment mechanisms to seasonality differ systematically by wealth of the household in good, normal, poor and very poor years.
3. Determine whether the households use the same ex-ante and ex-post adjustment mechanisms in good, normal, poor and very poor years.
4. Determine whether seasonal variation in agricultural production is reflected in food consumption.
5. Determine whether household wealth is reflected in seasonal food consumption
6. Determine whether the adjustment mechanisms to seasonal variations of agricultural production are sufficient to prevent declines in food consumption that have adverse impacts on health in good, normal, poor and catastrophic years.

The study was based on a sample of 225 rural households in Mwanachingwala. Two focus group discussions were conducted before data collection in order to have insight into the common ex-ante and ex-post adjustment mechanisms. The focus group discussions also helped in determining the most recent normal, good, poor and very poor years. An interviewer-administered structured questionnaire was used to collect the required data. The households were categorised into three groups according to the value of their household assets. The top 20% were referred to as rich. The middle 40% were referred to as the middle, while the bottom 40% were referred to as the poor. The study established that 92% of the households rely on agriculture as their main source of livelihood. The study employed non-parametric tests (the chi-square test, Friedman's test, the Kruskal-Wallis test and Cochran's Q-test) because the variables that were used could not meet the parametric assumptions.

6.1.1 Ex-ante adjustment mechanisms to seasonality

The supplementary ex-ante adjustment mechanisms to seasonal food requirements that were identified in this study are plans to plant cassava, sell milk, plant early maturing varieties, sell livestock, borrow money within the village, borrow money outside the village, receive remittances within the village and receive remittances outside the village. The plan to plant

early maturing varieties was the most common ex-ante adjustment mechanism to seasonal food requirements. The study also revealed that less than 4% of households use cassava as an ex-ante adjustment mechanism.

The ex-ante adjustment mechanisms to seasonal input requirement that were identified in this study are plans to save from grain sales, save from livestock sales, borrow from within the village, borrow money outside the village, migrate in search of employment, receive remittances, work for fertiliser on other farms, buy government subsidised inputs and saving from milk sales.

6.1.2 Ex-post adjustment mechanisms to seasonality

The ex-post adjustment mechanisms to seasonal food requirements that were identified in this study are borrowing more money than planned, finding more casual employment activities than planned within the village, doing more migration for labour than normally planned, selling more livestock than normally planned (e.g. cattle, goats, pigs and chickens), borrowing more food than planned, borrowing more money than planned within the village, borrowing more money than planned from outside the village, selling more milk than planned, reducing meal portions, reducing the number of meals eaten per day, skipping entire days without eating, gathering wild or natural products for food and/or selling, harvesting immature crops, cutting spending on non-food items, withdrawing children from school, sending household members to eat away, slaughtering livestock to cover food deficits and postponing ceremonies such as weddings.

The identified ex-post adjustment mechanisms to seasonal input requirements were borrowing more money than was planned within the village, borrowing more money than was planned from outside the village, asking for more remittances than was planned within the village, asking for more remittances than was planned outside the village, selling products such as firewood and charcoal, buying fertiliser from households who obtain more subsidised fertiliser than they require, selling more grain stock than planned, selling more livestock than planned and finding more casual employment than planned from well-to-do households.

6.1.3 Adjustment mechanisms and household wealth

The study showed that some ex-post adjustment mechanisms to seasonal food requirements as well as some ex-ante and ex-post adjustment mechanisms to seasonal input requirements in good, normal, poor and very poor years differ by wealth of the household. Households are endowed with a number of adjustment mechanisms and wealth plays an important part in determining which mechanisms are adopted by a household. For example, the empirical data have shown that selling of livestock to meet either input or food shortfall is more common among the rich households, while finding casual labour and migrating in search of employment in order to meet food and input requirements are more common among the non-rich households.

The study showed that none of the ex-ante adjustment mechanisms to seasonal food requirements differ by wealth of the household. This means that the plans were overcome by the events that actually happened, namely a bad or very bad year.

6.1.4 Differences in adjustment mechanisms across different years

The analysis has shown that the probabilities of using some ex-ante and ex-post adjustment mechanisms to both seasonal food requirements and input requirements are not the same in good, normal, poor and very poor years for the non-poor households. This means that the non-poor households do not use the same ex-ante and ex-post adjustment mechanisms to seasonal food requirements nor the ex-ante adjustment mechanisms to seasonal input requirements in good, normal, poor and very poor years.

Our results on the use of ex-post adjustment mechanisms to food requirements are similar to Corbett (1988) who finds that households show a distinct sequence in the adoption of ex-post adjustment mechanisms to food requirements. However, unlike her, we find that not all ex-post adjustment mechanisms show a distinct sequence. For example, we find that the proportions of poor households who sale livestock and find casual employment to meet the seasonal food requirements are the same in all the season types. Similarly, the proportions of rich households who sell livestock to meet their seasonal food requirements do not vary with

season type. However, we agree with Corbett (1988) that the poorer households are more likely to use desperate means to meet their food requirements.

The study has further established that the poor households' probability of using any of the ex-post adjustment mechanisms to seasonal input requirements is the same in all the years. This means the poor households use the same ex-post adjustment mechanisms to seasonal input requirements. This is because the poor households have limited options of ex-post adjustment mechanisms to seasonal input requirements.

6.1.5 Agricultural production and seasonal food consumption

The study has shown that seasonal variation in agricultural production is reflected in the number of meals eaten per day in all three seasons of the poor and very poor years. However, for the good and normal years, agricultural production is reflected in the number of meals eaten per day in the August–December and December–April seasons but not in the April–August season (post-harvest season). The lack of reflection of agricultural production in the number of meals eaten in the April–August (post-harvest) season in the good and normal year is attributed to the abundance of food just after harvest. During this period, food is also relatively cheap and households with poor output can afford to buy food or work for food. As a result, the household's level of production is not really a factor in determining the number of meals eaten, but as we move away from the harvest season, food stocks start to be depleted and the prices start rising. Once stocks start running short and food prices start increasing, the household level of agricultural production becomes an important factor in explaining the consumption levels. In other words, consumption does not track agricultural production in the post-harvest seasons of the good and normal years. However, consumption tracks agricultural production as we move away from the post-harvest season.

In the poor and very poor years, the low levels of production and high food prices coupled with uncertainties of future food availability force households to have low consumption levels, starting from the harvesting period until the next harvest, and as a result food production is reflected in the number of meals eaten per day in all three seasons. This shows that consumption tracks agricultural production in all the seasons of the poor and very poor years.

6.1.6 Relationship between wealth and seasonal food consumption

The study has shown that household wealth is reflected in the number of meals eaten per day in all the seasons of the normal, poor and very poor years. This finding is similar to that of Dostie *et al*. (2002), who find that seasonal food consumption affects the poor households more than the non-poor. However, in a good year, wealth is reflected in the number of meals eaten per day only in the August–December season. In the normal, poor and very poor years, wealth is reflected in all three seasons because the uncertainties with regard to future availability of food for the majority of households continue from the day of harvest up to the next harvest. The uncertainties are worsened if farmers expect a poor or very poor harvest in the next season. In times of uncertainties, rich households have a wider range of adjustment mechanisms to choose from than the poor households.

In the good year, wealth is not reflected in the April–December (post-harvest) season, because the majority of households have adequate amounts of food and even those without adequate amounts of food from their own harvests are able to meet their consumption needs due to low prices of staple food and availability of casual employment opportunities around the harvesting time. As the households move away from the harvest season, they start to reduce their consumption due to future uncertainties, and as a result wealth becomes a factor in determining their consumption levels. Just before the next harvest, wealth is again not reflected in consumption. This is because the wealthy households also have to adjust their food consumption just before the harvest season.

6.1.7 Do adjustment mechanisms prevent a decline in food consumption?

It has been shown in this study that the adequacy of staple food meals is not the same in all three seasons of each of the years that were studied (good, normal, poor and very poor). The study has further established that there is always a seasonal fall in the number of meals and adequacy of staple food meals taken per day despite the use of adjustment mechanisms in good, normal, poor and very poor years. The situation worsens as we move from the good years to the very poor years. The seasonality in consumption as we move from one harvest season to the other happens in all the years despite the use of adjustment mechanisms. This shows that the adjustment mechanisms to seasonal variations of agricultural production are

not sufficient to prevent declines in food consumption that have adverse impacts on health in good, normal, poor and catastrophic years. This further tells us that households do not smooth the annual food consumption.

6.2 RECOMMENDATIONS AND LIMITATIONS

The problem of seasonality is real among rural households. The problem of seasonal food and input shortages affects households from all the wealth strata. However, the seasonality problem affects the poor households more than the rich households. This is mainly because the poor households have limited options of adjustment mechanisms to use. The analysis has further shown that the ex-ante and ex-post adjustment mechanisms to seasonality are not sufficient to prevent seasonal food and input shortages. Therefore, based on these findings, the study suggests that the use of one size fits all type of interventions in rural areas to minimise the seasonality problem cannot adequately achieve the required results for all households from different wealth classes. It is important to understand the way households from each wealth stratum respond to seasonal food and input requirements and why they respond in such a way before introducing an intervention to help them. Government investment strategies and policies that support strategic planning, agricultural production and wealth creation in rural areas are necessary measures to help reduce the seasonality problem. Provision of loans with flexible repayment conditions can be helpful in reducing seasonal food and input shortages. Mechanisms which ensure that the benefits from government interventions reach the weaker members of the community, the poor households, are needed to be put in place. In the short run, government should provide cash transfers or food to household members that are vulnerable to seasonal food shortages.

The study has limitations which future studies should take into consideration. The study's first limitation was the use of cross-sectional data due to lack of panel data. Future studies should use data collected at different points in time (panel data). This can reduce the reliance on the use of recall data and can produce better results. The other limitation was the use of non-parametric tests only. As a result of this limitation, the study could not estimate any parameters but relied on hypothesis testing. Future research should employ parametric

methods so that some parameters can be estimated. However, despite these limitations the study generated important information.

LIST OF REFERENCES

Basu, K. & Wong, M. 2012. *Evaluating seasonal food security programs in East Indonesia*. [Online] Available from: http://apps.olin.wustl.edu/cres/research/calendar/files/WongPaper.pdf [Accessed: 2012-04-10].

Binswanger, H.P. & Rosenzweig, M.R. 1986. Behavioral and material determinants of production relations in agriculture. *Journal of Development Studies*, 22(3):503-539.

Central Statistical Office (CSO). 2011. Zambia *2010 census of population and housing preliminary report.* Lusaka: Central Statistical Office. [Online] Available from: http://unstats.un.org/unsd/demographic/sources/census/2010_phc/Zambia/PreliminaryReport.pdf [Accessed: 2012-03-26].

Centre for Environmental Economics and Policy in Africa (CEEPA). 2006. *Climate change and African agriculture.* [Online] Available from: http://www.ceepa.co.za/docs/POLICY%20NOTE%2027.pdf [Accessed 2013-10-24].

Chambers, R. 2006. *Vulnerability, coping and policy*. [Online] Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1759-5436.2006.tb00284.x/pdf [Accessed: 2012-03-26].

Chambers, R., Longhurst, R & Pacey, A. (eds.). 1981. *Seasonal dimensions to rural poverty*. London: Francis Pinter Publishers.

Chapoto, A., Govereh, J., Haggblade, S & Jayne, T. 2010. *Staple food prices in Zambia*. [Online] Available from: http://ageconsearch.umn.edu /bitstream /58556/2/AAMP_Maputo_23_Zambia_ppr.pdf [Accessed 2013-10-24].

Chaudhuri, S. & Paxson, C. 2002. *Smoothing consumption under income seasonality: buffer stocks vs. credit markets*. Discussion Paper No. 0102-54. New York: Columbia University. [Online] Available from: http://academiccommons.columbia.edu/catalog/ac:112896 [Accessed: 2012-03-26].

Chitundu, M., Droppelmann, K & Haggblade, S. 2006. *Value chain task force approach for managing private-public partnerships: Zambia's task force on acceleration of cassava utilization.* [Online] Available from: http://fsg.afre.msu.edu/zambia/wp_21.pdf [Accessed 2013-10-24].

Cochran, W.G. 1950. The comparison of percentages in matched samples. *Biometrika*, 37(3/4):256–266. [Online] Available from: http://www.jstor.org/stable/2332378 [Accessed: 2013-04-16].

Compton, J., Wiggins, S. & Keats, S. 2010. *Impact of the global food crisis on the poor: what is the evidence?* London: Overseas Development Institute.

Corbett, J. 1988. Famine and household coping strategies. *World Development*, 16(9):1099–1112.

Devereux, S. 1999. '*Making less last longer: informal': safety nets in Malawi*. [Online] Available from: http://www.ids.ac.uk/files/Dp373.pdf [Accessed: 2012-09-13].

Devereux, S. 2009. *Seasonality and social protection in Africa: growth and social protection.* Future Agricultures Consortium working paper No. 011. Brighton: University of Sussex.

Devereux, S & Longhurst, R. 2009. *Seasonal neglect? Aseasonality in agricultural project design.* [Online] Available from: www.future-agricultures.org/.../997-seasonal-neglect-aseasonality [Accessed: 2012-02-19].

Devereux, S. & Næraa, T. 1996. Drought and survival in rural Namibia. *Journal of Southern African Studies*, 22(3):421-440. [Online] Available from: http://www.jstor.org/stable/pdfplus/2637312.pdf?acceptTC=true [Accessed: 2012-02-19].

Devereux, S., Sabates-Wheeler, R., Tefera, M. & Taye, H. 2006. *Ethiopia's productive safety net programme (PSNP): trends in PSNP transfers within targeted households*. [Online] Available from: http://www.ids.ac.uk/files/PSNPEthiopia.pdf [Accessed: 2012-02-19].

Dostie, B., Haggblade, S. & Randriamamonjy, J. 2002. Seasonal poverty in Madagascar: magnitude and solutions. *Food Policy*, 27:493–518.

Filmer, D., Pritchett, L. H., 1998. *The effect of household wealth on educational attainment: demographic and health survey evidence*. [Online] Available from: http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/1998/11/17/000178830_98111170352408/Rendered/PDF/multi_page.pdf [Accessed: 2012-04-11].

Food and Agriculture Organisation (FAO). 2005. *Special report: crop and food supply assessment mission to Zambia.* [Online] Available from: http://www.fao.org/docrep/ 008/j5511e/j5 511e00.HTM [Accessed 2013-10-24].

Food and Agriculture Organisation (FAO). Not dated. *Definition of Mixed Systems.* [Online] Available from: http://www.fao.org/ag/ag ainfo/ programmes/en/lead / toolbox/Grazing/Def MixSy.htm [Accessed: 2013-10-24].

Friedman, M. 1937. The use of ranks to avoid the assumption of normality implicit in the analysis of variance. *Journal of the American Statistical Association*, 32(200):675–701.

Garon, T. 2013. *Reliability of Self-Reported Data–Recall Bias*. [Online] Available from: http://www.financialaccess.org/blog/2013/03/reliability-self-reported-data-%E2%80%93-recall-bias [Accessed 2013-10-24].

Gujarat, D.N. & Porter, D.C. 2009. *Basic econometrics*. 5th ed. New York: Mc Graw Hill.

Haggblade, S. 2006. *Maize price projections for Zambia's 2006/07 marketing season*. [Online] Available from: http://fsg.afre.msu.edu/zambia/ps15.pdf [Accessed 2013-10-24].

Hiremath, B.N. 2007. *The changing faces of rural livelihoods in India*. [Online] Available from: http://www.empowerpoor.org/downloads/livelihoods.pdf [Accessed: 2012-8-24].

Hollander, M., & Wolfe, D.A. 1973. *Nonparametric statistical methods*. New York: John Wiley & Sons.

Hoogeveen, H. 2003. Evidence of informal insurance in rural Zimbabwe. *Journal of African Economies*, 11(2):249–278.

International Fund for Agricultural Development. 2002. *Gender and poverty targeting in market linkage operations: synthesis report*. [Online] Available from: http://www.ifad.org/genderpf/pdf/synthesis.pdf [Accessed: 2012-03-29].

Jalan, J. & Ravallion, M. 1999. Are the poor less well insured? Evidence on vulnerability to income risk in rural China. *Journal of Development Economics*, 58:61–81.

Johnson, D.H. 1995. Statistical sirens: the allure of nonparametric. *Ecological Society of America*, 76(6):1998–2000.

Kazianga, H. & Udry, C. 2006. Consumption smoothing? Livestock, insurance and drought in rural Burkina Faso. *Journal of Development Economics* 79:413–446.

Khandker, S.R. 2012. Seasonality of income and poverty in Bangladesh. *Journal of Development Economics*, 97:244–256.

Kirsten, J.F., Dorward, A.R., Poulton, C. & Vink, N. 2009. *Institutional economics perspectives on African agricultural development*. Washington, DC: International Food Policy Research Institute.

Khandker, S.R., Khalily, M.A.B. & Samad, H.A. 2010. *Seasonal and extreme poverty in Bangladesh: evaluating an ultra-poor microfinance project*. Washington DC: World Bank.

Kristjanson, P., Krishna, A., Radeny, M., Kuan, J., Quilca, G., Sanchez-Urrelo, A. & Leon-Velarde, C. 2007. Poverty dynamics and the role of livestock in the Peruvian Andes. *Agricultural Systems*, 94:294–308.

Leech, N.L. & Onwuegbuzie, A.J. 2002. *A call for greater use of nonparametric statistics*. [Online] Available from: http://www.eric.ed.gov/PDFS/ED471346.pdf [Accessed: 2013-04-10].

Leedy, P.D. & Ormrod, J.E. 2010. *Practical research*. 9th ed. Upper Saddle River, New Jersey: Pearson.

Lekprichakul, T. 2009. *Ex-ante and ex-post risk coping strategies: how do subsistence farmers in Southern and Eastern province of Zambia cope?* Kyoto: Research Institute for Humanity and Nature. [Online] Available from: http://www.chikyu.ac.jp/resilience/files /ReportFY2008/ResilienceProject_Report2009_16.pdf [Accessed: 2012-8-24].

Lewis, J. & Baldwin, J. 1997. *Statistical package for improved analysis of Hillslope monitoring data collected as part of the Board of Forestry's long-term monitoring program.* [Online] Available from: http://www.fs.fed.us/psw/publications/lewis/LewisHMP.pdf [Accessed: 2013-01-24].

Lipton, M. 1986. *Seasonality and ultrapoverty*. [Online] Available from: http://www.ids.ac.uk/files/dmfile/Lipton17.3final.pdf [Accessed: 2012-03-29].

Longhurst, R., Chambers, R. & Swift, J .1986. *Seasonality and poverty: Implications for policy and research.* [Online] Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1759-5436.1986.mp17003010.x/pdf [Accessed: 2012-03-29].

Maxwell, D. & Caldwell, R. 2008. *The coping strategies index: a tool for rapid measurement of household food security and the impact of food aid programs in humanitarian emergencies.* Rome: Food and Agriculture Organisation.

McCrum-Gardner, E. 2008. Which is the correct statistical test to use? *British Journal of Oral and Maxillofacial Surgery*, 46:38–4.

Muller, C. 2000. *Transient-seasonal and chronic poverty of peasants: evidence from Rwanda*. Oxford: Centre for the Study of African Economies, University of Oxford.

Mwinji, P. 2007. *An analysis of the effect of formal and informal institutions of water resources management on rural livelihoods in Mwanachingwala, Zambia*. Unpublished master's thesis. Harare: University of Zimbabwe. [Online] Available from:

http://ir.uz.ac.zw/jspui/bitstream/10646/1011/1/Priscilla%20Mwinji.pdf [Accessed: 2013-4-24].

Naing, L., Winn, T. & Rusli, B.N. 2006. Practical Issues in calculating the sample size for prevalence studies. *Archives of Orofacial Sciences*, 1:9–14.

National Institute of Standards and Technology. 2005. *Cochran test.* [Online] Available from: http://www.itl.nist.gov/div898/software/dataplot/refman1/auxillar/cochran.htm [Accessed 2013-10-24].

Nyanga, P.H., Johnsen, F.H., Aune, J.B. & Kalinda, T.H. 2011. Smallholder farmers' perceptions of climate change and conservation agriculture: evidence from Zambia. *Journal of Sustainable Development*, 4(4):73–85.

Park, H.M. 2008. *Univariate analysis and normality test using SAS, Stata, and SPSS.* [Online] Available from: http://www.indiana.edu/~statmath/stat/all/normality/normality.pdf [Accessed: 2013-4-24].

Paxson, C.H. 1993. Consumption and income seasonality in Thailand. *Journal of Political Economy*, 101(1):39–72.

Rajeswari, S.R. 2000. Countering seasonal rural problems: integrated participatory information system. *Economic and Political Weekly*, 35(37):3335–3342.

Regassa, N. 2011. Small-holder farmers' coping strategies to household food insecurity and hunger in Southern Ethiopia. *Ethiopian Journal of Environmental Studies and Management*, 4(1):39–48.

Saasa, O. 2003. *Agricultural intensification in Zambia: the role of policies and policy processes*. Lusaka: Institute of Economic and Social Research.

Saha, A. 1994. A two-season agricultural household model of output and price uncertainty. *Journal of Development Economics*, 45:245–269.

Sahn 1989. *Seasonal variability in third world agriculture*. [Online] Available from: http://www.ifpri.org/sites/default/files/pubs/pubs/books/sahn89/sahn89.pdf [Accessed 2013-10-24].

Saunders, M., Lewis, P. & Thornhill, A. 2009. *Research methods for business students*. 5th ed. Harlow, Essex: Prentice Hall.

Science. Not dated. *Kruskal & Wallis test.* [Online] Available from: http://www.adscience.eu/uploads/ckfiles/files/html_files/StatEL/statel_kruskal_wallis_test.htm [Accessed 2013-10-24].

Sigel, P.B. 2008. *Profile of Zambia's smallholders: where and who are the potential beneficiaries of agricultural commercialization?* Washington D.C: World Bank.

Siegel, S. 1957. Nonparametric statistics. *The American Statistician*, 11(3):13–19. [Online] Available from: http://www.mun.ca/biology/quant/siegel.pdf [Accessed: 2013-4-24].

Siegmund-Schultze, M., Rischkowsky, B., da Veiga, J.B. & King, J.M. 2007. Cattle are cash generating assets for mixed smallholder farms in the Eastern Amazon. *Agricultural Systems*, 94:738–749.

Stigler, S.M. 2008. Karl Pearson's theoretical errors and the advances they inspired. *Statistical science*, 23(2):261-272. [Online] Available from: http://arxiv.org/pdf/0808.4032.pdf [Accessed 2013-10-24].

Swinton, S.M. 1988. Drought survival tactics of studies of subsistence farmers in Niger. *Agricultural Ecology*, 94:738–749.

TheIDLgroup. 2002. *An assessment of trends in the Zambian agriculture sector*. [Online] Available from: http://www.odi.org.uk/work/projects/03-food-security-forum/docs/zambia.pdf [Accessed: 2012-02-29].

Thuranira-McKeever, C., Shaw, A., Machila, N., Eisler, M., Welburn, S. & Maudlin, I. 2010. Seasonal influences on livestock keeping in a sedentary crop–livestock system. *Tropical Animal Health Production*, 42:705–717.

United Nations Development Programme (UNDP). 2011. An integrated package of MDGs services in eastern Zambia. [Online] Available from: http://www.undp.org/content/dam/undp/library/Poverty%20Reduction/MDG%20Strategies/Zambia(2011nov)_Web.pdf [Accessed: 2013-10-24].

Vaitla, B., Devereux, S., Swan, S.H. 2009. Seasonal hunger: a neglected problem with proven solutions. *PLoS Medicine*, 6(6):1–4.

Vargha, A. & Delaney, H.D. 1998. The Kruskal-Wallis test and stochastic homogeneity. *Journal of Educational and Behavioral Statistics*, 23(2):170–192.

World Bank. 2011. *Social protection for a changing India*. Washington DC: World Bank.

Wright, E.O. 2003. *Social class*. [Online] Available from: http://www.ssc.wisc.edu-/~wright/Social%20Class%20--%20Sage.pdf [Accessed: 2012-02-29].

Yang, Z., Sun, X. & Hardin, J.W. 2011. Testing marginal homogeneity in clustered matched-pair data. *Journal of Statistical Planning and Inference*, 141:1313–1318.

Zulu, B., Jayne, T.S. & Beaver, M. 2007. *Smallholder household maize production and marketing behaviour in Zambia and its implication for policy*. [Online] Available from: http://fsg.afre.msu.edu/zambia/ps20.pdf [Accessed: 2012-02-29].

APPENDIX A: QUESTIONNAIRE

Ex-ante and ex-post adjustment mechanisms to seasonality among the smallholder farmers in Mwanachingwala, Zambia

PART A. GENERAL INFORMATION

1. Household identification number.....

2. District.....

3. Village.....

4. Name of interviewer.....

5. Date of interview.....

PART B. HOUSEHOLD HEAD

6. Sex male ( ) female ( )

7. Age.....

8. Highest Education level attained.....

9. Main occupation.....

10. **What is your household size? Please specify below**

Household members	Number
Adults aged 65 and above	
Adults aged between 16 and 64 years of age	
Children below 16 years of age	

11. How long have you lived here?.....years

PART C. HOUSEHOLD ASSETS

12. Do you own any of the following assets?

	1.Yes 0.No	How many?	How much could you sell them for? (all of them)
A bicycle			
Car /vehicle			
Motor bike			
Tractor			
Radio			
Television set			
Stove			
Fridge			
Grinding meal			
Drinking well			
Ploughs			
Land (ha)			
Cattle			
Donkeys			
Goats			
Pigs			
Chickens			
Other birds			

13. Did you receive the following in the last 12 months? Please tick where appropriate

	April –August	August–December	December–April
Remittances and cash gifts			
Cash credit			
Cash from rented land			
Cash from animal draft power			

14. Livestock Sales in the last year

Livestock type	April–August		August–December		December–April	
	Number	Price	Number	Price	Number	Price
Cattle						
Goat						
Pig						
Chicken						
Other birds						

15. Number of Livestock slaughtered for household consumption in the last year

Livestock type	April–August	August–December	December–April (2013)
Cattle			
Goat			
Pig			
Chicken			
Other birds			

16. Main house. Circle where appropriate

Roofing Material	Wall Material	Door Material	Floor Material
a. Iron /metal	a. Burnt brick	a. Standard door frame with door	a. Cement floor
b. Asbestos	b. Concrete blocks	b. Traditional	b. Concrete
c. Corrugated iron sheets	c. Mud brick	c. Other	c. Mud
d. Grass/straw	d. Pole bamboo		d. Bare earth
e. Others	e. Mud		e. Other

17. What would it cost to replace your house? .....

PART D. STAPLE FOOD PRODUCTION AND CONSUMPTION

18.

		Normal year (2012)	Good year (2011)	Poor year (2005)	Very poor year (1995)	Remarks
1.	How many 50kg bags of maize do you normally produce? (if other measures are used please convert them to 50kg)					
2.	How many 50kg bags of maize do you normally store in...?					
3.	When does your maize stock run out?					
4.	What is the price of a 50kg bag of maize just after harvest?					
5.	What is the price of a 50kg bag of maize just before harvest?					
6.	How many meals do you normally have per day from April–August					
7.	Adequacy of staple needs, April–August. (codes: 1. Adequate 2. Moderately adequate 3. Inadequate)					
8.	How many meals do you normally have per day from August to December?					
9.	Adequacy of staple food, August–Dec (codes: 1. Adequate 2. Moderately adequate 3. Inadequate)					
10.	How many meals do you normally have per day from Dec to April?					
11.	Adequacy of staple food meals, Dec–April (codes: 1. Adequate 2. Moderately adequate 3. Inadequate)					

PART E. OFF-FARM LABOUR ACTIVITIES

19. We would like to know if any household member has earned salaried employment or informal labour activities

	Normal year (2012)	Good year (2011)	Poor year (2005)	Very poor year (1995)	Remarks
1) How many household members worked for food in other people's fields?					
2) How many household members worked for cash in other people's fields?					
3) How many household members went to work on the mines, sugar plantations, in town, or as truck drivers?					

PART F. EX-ANTE AND EX-POST COPING MECHANISMS

20 How do you prepare for the food problems experienced during the rainy season? (Tick where appropriate)

		Normal year (2012)	Good year (2011)	Poor year (2005)	Very poor year (1995)	Remarks
a. Plan to plant cassava						
b. Plan to sell milk						
c. Planting early maturing varieties						
d. Plan to sell livestock						
e. Plan to borrow money for food purchases from .....**WITHIN** the village	Friends					
	Relatives					
	Merchants					
	Moneylenders					
f. Plan to borrow money for food purchases from .....**OUTSIDE** the village	Friends					
	Relatives					
	Merchants					
	Moneylenders					
g. Plan to receive remittances from.... **WITHIN** the village	Relatives					
	Friends					
h. Plan to receive remittances from.... **OUTSIDE** the village	Relatives					
	Friends					
i. Plan to migrate to other areas in search of employment						
j. Other(s) specify						

21 What do you do when your food stocks run out earlier than planned to ensure that you have food until the next harvest? (Tick where appropriate)

		Normal year (2012)	Good year (2011)	Poor year (2005)	Very poor year (1995)	Remarks
a) Finding more casual employment activities within the village than planned						
b) Do more migration for labour than normally planned						
c) Selling more livestock (cattle, goat, pig and chicken) than normally planned						
d) Borrow food more than planned ,	Friends					
	Relatives					
e) Borrow more money than planned from .....**WITHIN** the village	Friends					
	Relatives					
	Merchants					
	Moneylenders					
f) Borrow more money than planned from ..... **OUTSIDE** the village	Friends					
	Relatives					
	Merchants					
	Moneylenders					
a) Sell more milk than planned						
b) Rely on more help from a friend or relative than was planned						
c) Reduce meal portions						
d) Reduce number of meals eaten per day						
e) Skip entire days without eating						

f)	Gather wild or natural products (roots, fish, tubers and fruits) for food and/or selling						
g)	Harvest immature crops						
h)	Cutting spending on non-food items,						
i)	Withdrawing children from school						
j)	Send household members to eat from.....	Relatives					
		friends					
k)	Slaughter livestock to cover food deficit						
l)	Postponing ceremonies such as weddings						
m)	Other(s) Specify						

22 How do you prepare for the purchase of inputs for the following season? (Tick where appropriate)

			Normal year (2012)	Good year (2011)	Poor year (2005)	Very poor year (1995)	Remarks
a)	Plan to save from grain crop sales						
b)	Plan to save from livestock sales						
c)	Plan to borrow money from.....**WITHIN** the village	Friends					
		Relatives					
		Merchants					
		Moneylenders					
d)	Plan to borrow money to purchase inputs from.....**OUTSIDE** the village	Friends					
		Relatives					
		Merchants					
		Moneylenders					
e)	Plan to migrate in search for employment						
f)	Plan to receive on remittances						
g)	Plan to work for fertiliser in other(s) farms						
h)	Plan to buy government subsidised inputs						
i)	Other(s) Specify						

23 What do you do when you fall short of the planned quantities of farming inputs during the crop growing season (Tick where appropriate)

		Normal year (2012)	Good year (2011)	Poor year (2005)	Very poor year (1995)	Remarks
a)	Borrow more money than was planned from.....**within** the village	Friends				
		Relatives				
		Merchants				
		Moneylenders				
b)	Borrow more money than was planned from.....**outside** the village	Friends				
		Relatives				
		Merchants				
		Moneylenders				
c)	Ask for more remittances than what was planned from .....**WITHIN** the village	Relatives				
		Friends				
d)	Ask for more remittances than what was planned from .....**OUTSIDE** the village	Relatives				
		Friends				
		Friends				
e)	Sell products such as firewood and charcoal					
f)	Buy fertiliser from households who obtain subsidised fertiliser more than they require.					
g)	Sell more grain stock than planned					
h)	Sell more livestock than planned					
i)	Find casual employment from well to do households					
j)	Others (specify)					

Thank you for your participation in this study.