An analysis of farmers' preferences for crop insurance: a case of maize farmers in Swaziland

by

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DECLARATION OF ORIGINALITY

I hereby declare that this dissertation which I submit for the degree of MSc Agric (Agricultural Economics) at the University of Pretoria is my own work and it has not been previously submitted by me for a degree at this or any institution of higher learning.

Signature……..
Nobuhle Duduzile Mbonane
Date…….

Approved by:
Signature……..
Dr M.N. Makhura

DEDICATION

I dedicate this work to all agricultural economics students, researchers and farmers on the African continent.

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ABSTRACT

The uncertain nature of agricultural production makes risk management essential in providing farmers with protection against potential losses. Crop insurance is a sustainable risk management tool that ensures the sustainability of agricultural enterprises by reducing income risks. The main focus has been on the supply and penetration of crop insurance, with limited attention paid to the demand and to farmers' preferences for crop insurance. In Swaziland, the crop insurance industry is still under-developed; hence, an empirical gap exists in knowledge of farmers' preferences for crop insurance. This study identifies the conditions that farmers prefer to accept with regard to crop insurance, as well as the factors that influence them in purchasing it. It provides an understanding of the need of farming households for crop insurance, and seeks to identify the best ways of protecting farmers' livelihoods from agricultural risks. It also provides an account of the effects of ineffective risk management strategies. The study employed descriptive statistics to analyse primary data: snowballing sampling methods were used to collect survey data from 150 households in the Hhohho and Lubombo regions of Swaziland. Results show that 52% of the sampled households expressed an interest in purchasing crop insurance; the other 48% were not interested in purchasing crop insurance and gave reasons for this. The probit model was used to determine the factors that influence the likelihood of farmers indicating an interest in purchasing crop insurance: these included gender, marital status, occupation, education, location, savings and farming experience. Farmers based their preferences on crop insurance features such as risk cover, coverage levels and the nature of cover, compensation and

premiums. Binary logistic regressions were used to identify factors that influence farmers' preferences regarding crop-insurance features. Respondents preferred the multi-peril crop insurance cover, higher coverage levels, lower premiums and compensation based on market price. They also wanted their coverage to include both crops and livestock, and to be involved in the designing of crop insurance programmes. A lack of farmer education regarding the purpose and benefits of crop insurance was one of the causes of farmers' lack of interest in purchasing crop insurance. Evidence from this study indicated that farmers in the Lubombo region were more interested in crop insurance than farmers in the Hhohho region. This was predictable, considering that the more risk or uncertainty farmers face, the more likely they are to show an interest in purchasing a sustainable risk management strategy like crop insurance. Farmers are currently more responsive to crop insurance and their preferences are important in informing the ex-ante design process and finding ways of improving crop insurance programmes in Swaziland. This study recommends education for farmers on the role and benefits of crop insurance; it also suggests that the Swazi government to consider implementing crop insurance subsidies and engage with insurance providers to tailor programmes to meet the needs and constraints faced by farmers. Understanding farmers' preferences for particular attributes of crop insurance is imperative in informing and designing improved insurance contracts.

Keywords: binary logistic, interest to purchase, maize farmers, preferences for crop insurance, probit model, risk, Swaziland.

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LIST OF ABBREVIATIONS AND ACRONYMS

CE	-	Choice Experiment
CI	-	Crop Insurance
CIMMYT	-	Centro Internacional de Mejoramiento de Maiz y Trigo
FAO	-	Food and Agricultural Organization
FESA	-	Food Early Solution for Africa
FANRPAN	-	Food, Agriculture and Natural Resources Policy Analysis Network
ICRISAT	-	International Crop Research Institute for the Semi-Arid Tropics
MNL	-	Multinomial Logit
NMC	-	National Maize Corporation
OECD	-	Organization for Economic Cooperation and Development
ROSCAs	-	Rotating Savings and Credit Associations
RPL	-	Random Parameter Logit
RUT	-	Random Utility Theory
SRIC	-	Swaziland Royal Insurance Corporation
SNL	-	Swazi Nation Land
TDL	-	Title Deed Land
US	-	United States
WTP	-	Willingness to Pay

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Agriculture is an important sector in sub-Saharan Africa, serving as a stimulus for growth and the provision of food security, and assisting in poverty reduction (Food and Agricultural Organization (FAO), 2000). However, food insecurity and poverty remain pressing issues in the sub-Saharan region. According to Cervantes-Godoy *et al.* (2013), the reasons for food insecurity and poverty are the susceptibility of agriculture to production, policy and price risks which impact farmers' income and welfare. The smallholder agricultural sector in many countries is the largest contributor to rural economies and to the livelihoods of the majority of the population (FAO, 2005).

Agricultural production is subject to various risks, including drought, outbreaks of disease and floods, among others. Climate change is also one of the predominant sources of production risks (Ramiro, 2009). Such risks are experienced by farmers in both developing and developed countries, but they frequently have different consequences in different places (World Bank, 2005). They can influence production choices, agricultural production or farm incomes and can subsequently affect the livelihood of people dependent on agriculture. Furthermore, they may impede future investments and the growth of agricultural businesses. It is therefore imperative to gain a detailed understanding of how these risks affect agricultural production and how they can be mitigated.

Smallholder farmers often face challenges caused by uncertain weather conditions, insecure land ownership and restricted access to capital and other farm inputs. Considering the risks associated with agricultural production, banks are unlikely to lend to farmers in disaster-prone areas if the shocks can, potentially, result to loan defaults (The Guardian, 2014). Improving smallholder maize production is a vital strategy in addressing the roots of poverty and food insecurity.

1.2 MAIZE PRODUCTION IN SWAZILAND

Swaziland is a small, landlocked country with a total land area of 17 364 square kilometres. It is predominantly rural, with the majority of the population dependent on subsistence agriculture for their livelihoods. Its land-tenure system consists of the Swazi Nation Land (SNL) and the Title Deed Land (TDL). The SNL is held in trust for the Swazi people by traditional authorities; about 90% of maize is grown under this system, according to which farmers have the right to use the land for agriculture but cannot use it as collateral for obtaining credit or other inputs. The TDL is owned by private companies and individual people (Magagula *et al.*, 2007).

Maize is the staple food and the most dominant crop of the Swazi people (Sihlongonyane *et al.*, 2014). The production of maize is used to measure food availability. Any maize shortages in the country increase the proportion of the population that subsists below the minimum level of dietary energy consumption. According to the National Maize Corporation (2016), food production in the country has declined in recent years and the country depends on food imports to overcome production insufficiencies. Most maize farmers have no access to irrigation, so they are heavily dependent on rainfall and their production fluctuates, depending on prevalent weather conditions. Yields vary between the four agro-climatic zones (the Highveld, Middleveld, Lowveld and Lubombo Plateau). The Highveld region has the highest yields and the Middleveld is the moist region (MOA, 2013). The Highveld and Middleveld are the highest maize-producing regions in the country.

There was a major decline of 47% in the area planted for maize from 2014/15 to 2015/16 (National Maize Corporation (NMC), 2016). This was despite the Government's intervention in providing input subsidies to the highest maize-growing areas in the country. Maize production declined drastically, by 59%, from 2014/15 to 2015/16. On the other hand, consumption of white maize increased by about 1.2%. There was a national deficit in maize, so the deficit was catered for with 28,043 metric tonnes of maize imports. The country's self-sufficiency in maize production declined from 62.2% in 2014/15 to 25.2% in 2015/16.

The huge decline in maize production in the country was caused mainly by the El Niño drought that hit the country in the production year 2015/16 (NMC, 2016). Maize production is susceptible to disasters such as droughts, which cause farmers to suffer from massive losses. It is therefore imperative to find sustainable risk management strategies, such as crop insurance (CI), that can ensure the sustainability of agricultural enterprises, since farming.

1.3 THE ROLE OF CROP INSURANCE

Farmers use various risk management tools, ranging from the diversification of farm products to financial instruments such as agricultural insurance, which has been available for many years to provide protection against losses from agricultural risks. It is a risk management tool used to hedge against contingent losses: it transfers the risk of loss from one entity to another in exchange for a premium, in order to prevent a large and possibly devastating loss to farmers. Agricultural insurance has the potential and capacity to address some of the constraints faced by farmers by reducing uncertainty and by changing farmers' behaviour. It is not limited to crop insurance but includes livestock, aquaculture, forestry and greenhouses (Ramiro, 2009).

Crop insurance is one instrument where participant farmers pay premiums and receive claims in cases of losses against insured events (Rao *et al.,* 2006), so that they are compensated for crop-yield losses through payment of an indemnity. Farmers are then able to manage fluctuations in revenue caused by both price and yield volatility. The payouts they receive help them in consumption smoothing and to prevent the potential sale of assets. In developing countries, not only are crop insurance programmes in place to provide cover against potential losses but also to promote other farm goals such as improving farmer's access to credit, promoting the production of high-quality crops and providing more stability in the agricultural sector, which enables farmers to invest in riskier but potentially more productive activities (FAO, 2016).

It is important to understand a producer's behaviour when faced with risks, since risk perception plays a vital role in production and investment behaviour of agricultural producers (Abebaw *et al.,* 2006) and an improvement in risk management in agriculture has a high potential for enhancing productivity (World Bank, 2005). Crop insurance makes a significant contribution to the sustainability of agricultural businesses, and with the frequent occurrence of events such as droughts, farmers are likely to be responsive to opportunities for crop insurance. Instead of losing their produce, they may be more willing to take action to insure their livelihood. However, crop insurance markets remain less developed in developing economies (Smith and Glauber, 2012), so that lessons can be drawn for developing crop insurance markets in developing countries from countries where such markets are better developed.

1.4 AGRICULTURAL INSURANCE IN DIFFERENT COUNTRIES

Agricultural insurance markets were first initiated over 200 years ago in Europe, in the form of privately offered cover against peril events such as hail and livestock mortality. Early insurance schemes were mainly provided by small, mutual companies which offered coverage on single or named perils (Gardner and Kramer, 1986). However, the rapid expansion and development in the range and scope of insurance products have only occurred over the past 50 years. This expansion has taken place as a result of extensive governments support, subsidised premiums, public provision of reinsurance services and subsidised delivery and loss adjustments expenses (Mahul and Stutley, 2010).

Smith and Glauber (2012) reported that, in many developed countries, agricultural insurance is now offered along with other domestic support programmes and index-based insurance products. Of these, the United States' crop insurance programme is the largest in premium volume in the world, and such programmes are also available in countries such as Canada, Spain, Italy and Japan. However, in countries such as Slovenia, Austria, France and Netherlands, these programmes are still being introduced and expanded (Council of the European Union, 2011).

Smith and Glauber (2012) report that insurance policies offered in developed countries fall into the following three broad categories: specific/named perils, multiple peril/all-risk products and index-based products. Specific-peril products provide protection against farm losses caused by clearly specified perils such as drought and hail. Multiple-peril products provide coverage against farm crop losses from many perils, as opposed to a small, clearly specified set of perils. Index-based insurance products are essentially derivatives that farmers can use to insure their crops against shortfalls in a weather-based, satellite-based, area (county) yield or a plant-growth index.

Specific peril insurance products have also been offered by the private sector in many countries such as Germany, Spain, Sweden and the United Kingdom. However, other governments, such that of the USA, have offered subsidised specific-peril products at the state level; France has also offered them at the national level, to provide cover against crop losses from hail (Organisation for Economic Cooperation and Development, 2011; Kramer, 1983). According to Smith and Glauber (2012), the private insurance sector has not been successful in offering multi-peril products commercially due to the high monitoring costs and moral hazard problems. When index products are subsidised, more farmers are willing to

purchase them, especially when they are not competing with similarly subsidised multiple-peril products in countries such as the United States (US) and Canada.

In developing countries, several governments have tried to promote crop insurance and other types of agricultural insurance by providing agricultural premium subsidies. This has made them move from small-scale pilot programmes to large-scale agricultural insurance programmes. In China, with the support of the provincial and central government, the agricultural insurance market in the country was able to grow dramatically, to become the second largest market after the United States, in the year 2008 (Mahul and Stutley, 2010). In the Philippines, agricultural insurance has been available for decades and multiple-peril crop insurance has been subsidised by the government to provide cover for crops such as rice and corn. According to Bangsal (2012), when farmers access agricultural credit from the Land Bank of the Philippines, it is compulsory for them to have crop insurance. Shashi Kiran and Umesh (2012) report that in India, the national agricultural insurance scheme provides cover a range of crops. This insurance scheme is compulsory for farmers who have loans and is voluntary for other farmers. Since 2003, weather index-based insurance has been adopted in India in a number of states and is subsidised by the government.

In most African countries, even though agricultural insurance for smallholder farmers is mainly based on small pilot studies and limited literature is available relating to them, weather index-based insurance has been used as a viable risk management tool. In Nigeria, an agricultural insurance scheme (NAIS) is accessible to all groups of farmers and provides cover against perils such as drought, fire, wind, pests and diseases. The sum insured under this scheme is computed using the expected revenue from the expected yield (Nnadi *et al*., 2013). This scheme is also linked to credit and loan scheme providers; therefore, it is mandatory for farmers to take loans from these providers (Aina and Omunona, 2012).

It is reported that weather index-based insurance has huge potential for managing agricultural risks (Food Early Solution for Africa, 2014). However, challenges exist in terms of improving its design. Involving farmers in the design process would give them an incentive to purchase the insurance.

In Southern Africa, only South Africa has had agricultural insurance as a risk management tool for almost a century. According to Burger (1962), in 1916 a group of farmers in the Western Cape Province founded their own organisation for insuring wheat stacks against fire. The second-largest crop insurance scheme was established by farmers in Ficksburg in 1929;

they ran a small, unregistered mutual concern for the farmers (Doyer, 2013). Companies such as the Land Bank provide agricultural insurance in South Africa. Progress in helping emerging farmers with agriculture has been very slow, mainly because of the lack of adequate support services, including agricultural insurance (Land Bank, 2013).

In Malawi, a three-phase drought index-based insurance programme was introduced in 2005. It is coupled with credit for improved farm inputs such as seeds and fertiliser. In the event of a drought, the farmer pays a fraction of the loan and the insurance company pays the rests of it (World Bank, 2011). In Kenya, the largest weather index-based insurance is the Kilimo Salama maize rainfall index product. This insurance product was developed by the Syngenta Foundation for Sustainable Agriculture in conjunction with a mobile service network. The mobile network is able to track weather forecasts and provide farmers with opportunities to call in and receive information from call agents with regard to insurance and farming advice. This scheme is financially supported through investments in weather stations and 50% premium subsidies by Syngenta (World Bank, 2011).

In Swaziland, agriculture remains an important sector of the economy and farmers are encouraged to take up agricultural insurance to safeguard their investments. Companies such as Lidwala and the Swaziland Royal Insurance Corporation (SRIC) offer agricultural insurance covering both livestock and crop insurance. They provide cover on maize, sugarcane and baby vegetables against perils such as drought, hail, fire, frost damage, windstorm and uncontrollable pests and diseases. These companies usually require that the following be recorded: the location of fields, the type of crops planted, the basis of the cover selected, confirmation that the fields are fenced, farm projections showing the expected revenue and the total costs incurred (SRIC, 2016). The uptake of agricultural insurance has remained low over the years (SRIC, 2016). Farmers who usually have crop insurance are sugarcane farmers, mainly because they are mandatorily required to obtain it when getting credit from financial institutions. The agricultural insurance industry in Swaziland is still underdeveloped; therefore, it is critical to understand the demand side of crop insurance and determine what can be done to improve the farmers' interest in purchasing it.

1.5 STATEMENT OF THE PROBLEM

Considering that maize is Swaziland's staple food, its availability and accessibility is a useful indicator of food security in the country. Smallholder farmers have always been its major producers of maize; however, smallholder maize production has been low in recent years. Maize production incurs risks and uncertainties which lead to huge losses to farmers, including shortage of rainfall and unpredictable weather patterns. The El Niño drought in 2015/2016 affected maize production and led to a major decline of about 59% in the production of maize. There were widespread crop losses and reduced yields, rendering it one of the worst maize production years in recorded history. A major decline was also reported in the area that was planted compared to that of the previous year, despite the fact that the government provided input subsidies to farmers in high maize-producing areas (NMC, 2016). The frequency of disasters such as drought affects most farmers who are solely dependent on farming for their livelihoods.

To provide protection against potential losses and to ensure the sustainability of agricultural enterprises, crop insurance is available in Swaziland (SRIC, 2016); however, there is generally a very low rate of crop insurance adoption by farmers in the country (SRIC, 2016). Those farmers who take crop insurance are usually mandatorily required to do so, like the sugarcane farmers mentioned in Section 1.4. The problem is that smallholder maize farmers in Swaziland have not been taking out crop insurance, so they have no sustainable strategies to cope with future losses. Although some farmers may employ coping mechanisms to mitigate their risks, including savings, the use of less risky technologies and credit loans, these have limited potential to do so, and when disasters strike, farmers tend to suffer great losses (Maleika and Kuriakose, 2008). However, it has been shown that crop insurance can be beneficial to farmers in ways other simply providing a means of mitigating risks (World Bank, 2011).

Risk mitigation is an important factor within the agricultural sector and there is an enormous and urgent need to find a viable, cost-effective and sustainable solution to mitigate risks associated with the natural disasters that affect the maize industry. Farmers' preferences should be incorporated at the design stage of crop insurance packages in order to ensure that crop insurance products are appropriate. The question is, how can maize farmers be made to adopt crop insurance so that they are best able to cope in disasters, since maize is such an important crop? With prior knowledge of particular farmers' profiles, it might be possible to

align those specific risks with suitable interventions in order to cater for the needs of farmers in the different regions (Bekele, 2004). However, farmers are usually excluded from some of the programmes and their needs, constraints and priorities are not properly considered. Obviously, the success of crop insurance is highly dependent on the acceptable level of demand for it among farmers.

Specifically, the questions are:

1. Are maize farmers interested in purchasing crop insurance to cover their crops against uncertainties?
2. What are the conditions under which farmers prefer to purchase crop insurance?
3. What are the factors that influence farmers' interest in crop insurance?
4. What are the factors that influence the likelihood of farmers' purchasing crop insurance?
5. What can be done to make crop insurance more acceptable to farmers and increase their interest in purchasing it?

1.6 OBJECTIVES OF THE STUDY

The main aim of the study was to determine farmers' preferences for crop insurance in Swaziland.

The specific objectives were:

1. To determine if maize farmers were interested in purchasing crop insurance.
2. To identify the features that farmers' preferred that would make them decide to take crop insurance.
3. To identify the factors that influenced their preferences for crop insurance.
4. To identify factors that increased the likelihood of farmers purchasing crop insurance.
5. To identify ways of improving farmers' acceptance of crop insurance.

1.7 RELEVANCE OF THE STUDY

The sustainability of crop insurance depends on its purchase and repurchase, year after year. Its success is highly dependent on an acceptable level of demand among farmers, their capabilities and their interest in purchasing the product. Most of the focus has been directed

towards examining the supply and penetration of crop insurance, with less emphasis on investigating whether there is a demand for crop insurance or on the reasons for farmers' preferences for crop insurance. This is what this study seeks to address: to assist the government and the crop insurance industry in acknowledging the importance of farmers' attitudes towards crop insurance.

Furthermore, this study seeks to motivate policy-makers to consider crop insurance support policies, since an awareness of crop insurance demand will facilitate insurance service providers to structure policies according to the needs of farmers. The study will also contribute to the body of knowledge on crop insurance, particularly in Swaziland, where the crop insurance industry is still under-developed. The purpose is to provide an understanding of farm households' need for crop insurance and to identify the best ways of protecting farmers' livelihoods from agricultural risks and the effects of ineffective risk management strategies.

1.8 LIMITATIONS OF THE STUDY

This study investigated maize farmers' preferences for crop insurance in Swaziland, focusing on the identification of underlying factors that influenced maize farmers' decisions to purchase crop insurance and the conditions under which they prefer to do so. The study only focused on maize farmers, since maize is the staple crop in Swaziland.

1.9 THESIS OUTLINE

This thesis is organised into six chapters. The next chapter provides a review of the relevant literature on farmers' preferences for crop insurance, factors influencing farmers' interest in purchasing crop insurance, the demand for crop insurance and drivers of crop insurance supply. Chapter 3 describes the study area, methods and procedures applied in this study. Chapter 4 presents the characteristics of surplus maize producers' results. Chapter 5 presents the empirical results of the study and Chapter 6 concludes by summarising the findings of the study, discussing its implications and providing recommendations for government policy.

CHAPTER 2

RISK AND INSURANCE IN AGRICULTURE

2.1 INTRODUCTION

The previous chapter provided an introduction and background to the study. This chapter reviews relevant studies on farmers' preferences for crop insurance and the factors influencing their interest in purchasing it. The chapter begins by discussing the nature of risk; in particular, it reviews risks, risk management strategies and crop insurance, as well as the supply and demand of crop insurance. It then presents a theoretical framework for risks and insurance; finally, it reviews the empirical literature on farmer's interest in the purchase of crop insurance.

2.2 THE NATURE OF RISK

Farmers are faced with a myriad of risks year after year, such as yield, price and resource risks, which make their production and incomes unstable. This section therefore discusses the risks associated with agricultural production.

2.2.1 What is risk?

Risk can generally be defined as the probability or threat of damage, injury, loss, or any other undesirable event caused by internal or external vulnerabilities which can be avoided by taking preventive actions (Business Dictionary, 2018). It can also be defined as the result of the probability of an undesirable event occurring, and the assessment of the expected harm resulting from the event. According to Hardaker *et al.* (2004), risk in finance is defined as the possibility of variations in actual returns on an investment from an expected return, even when those returns are positive outcomes, while risk in agriculture is defined as a situation where the probability of an event is known (such as the burning down of a farm storage facility) but the actual value of the occurrence of the event is unknown. Holton and Glyn (2004) argue that, for risk to occur, two things are needed. The first is uncertainty about the potential outcome and the second is that the outcomes have to matter regarding the provision of utility.

2.2.2 Types of risks

Risks can be categorised into risks that affect businesses, such as market, operational and environmental risks such as natural disasters. In agriculture, a farm business is faced with production, price and resource risks. Hazards such as natural disasters often lead to a major decline or total loss of food production for consumption and income. Levels of risk can be categorised into individual/household risks (micro), community/group risks (meso) and national/region risks (macro). Idiosyncratic risks, which affect an individual farmer, may include individual illness, personal hazards such as the death of livestock, limited access to credit, disability and the loss of non-farm income. These risks can also be categorised according to their degree of correlation across households, the severity of the losses that are sustained and how frequently they occur (Abebe and Bogale, 2014). In agriculture, greater concern is on the community (meso) level of risk, while the impact is experienced most severely at the household level (micro). There are also region-wide risks which can be grouped into output and price risks (Mishra, 1996). These include the occurrence of floods, drought, price fluctuations, pests and diseases (Cervantes-Godoy, 2013).

2.2.3 Risks in agriculture

Agricultural production faces numerous risks including production, price and resource risks, which makes yields and income unpredictable, year after year. The major risks in agriculture are production, marketing, financial, institutional and human risks (FAO, 2008). Production risks may be caused by unpredictable weather (such as drought), or by outbreaks of pests or diseases, which may cause massive losses in yield. Farmers usually produce without complete certainty about the success of their production. Marketing risks may be caused by changes in market prices, which are beyond the farmers' control. The price of farm products is usually determined by the supply, demand and the cost of production. When farmers plant their crops or raise their livestock, they are uncertain about the prices they will receive for their products (USDA, 2016).

Financial risks may be caused by uncertainty about future interest rates and farmers' ability to generate income for loan repayment. The high interest rates on loans may reduce smallholders' ability to repay loans. Institutional risks may be caused by unpredictable changes in the provision of services from institutions that provide support for farmers. Human risks may be caused by illnesses or deaths that affect families; these risks may disrupt farm performance (FAO, 2008). Understanding the effects of risks on agriculture is therefore

imperative, because agriculture is an important contributor to the economy of most developing countries (FAO, 2005).

2.3 EFFECTS OF RISKS ON AGRICULTURE

In developing countries, the impact of risks severely affects poor farmers. Risk is prevalent in agriculture and affects different aspects of it, including production, commercialisation, profitability, consumption and food security.

2.3.1 Effects of risks on agricultural production

Farming is dependent on biological processes that are susceptible to weather, pests and diseases (FAO, 2008), while drought, floods and hail can cause losses in yield and income which affect the sustainability of agricultural businesses. Mullera *et al.* (2011) assessed the climate change risks on agriculture in Africa and projected that climate change will weaken agricultural production further, especially for the majority of smallholder farmers in developing African countries, who depend on rain-fed agriculture and have low adaptive capacity. This decline in production will obviously affect food security. Climate change is worsening the challenges faced by the agricultural sector, which is already struggling to cope with a rising demand for food and renewable energy (Organization for Economic Cooperation and Development (OECD), 2015).

Price volatility, variable weather, policy changes, personal risks and unexpected institutional changes strongly influence the decisions farmers make in relation to input use, technology adoption and investment in agriculture. Production and price risks are the major hindrances to investment in initiatives such as land improvement, inputs, irrigation and purchase of farm equipment (FAO, 2016). Unmanaged risks can result in a cycle of shock which makes farming very risky, for example, the outbreak of diseases can lead to huge losses, followed by high prices and starvation. It was found that droughts are the main production constraint in Southern Africa and were a major concern when they hit in countries such as South Africa, Swaziland, Lesotho and Zimbabwe in 1991/1992 and 1984/1985, when they had a significant impact on the production of maize, the staple crop in the region (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), 2003).

Risk also affects the adoption of technology. Ellis (1998) argues that risk causes unwillingness or slowness in farmers' adoption of agricultural innovations. Farmers' decisions are highly affected by the potential risks which affect the productivity, growth and development of the agricultural sector. Lack of innovative technologies like crop insurance and affordable credit makes risk management imperative for smallholder farmers in most developing countries (Besley, 1995). Empirical literature indicates that the presence of risks reduces farmers' willingness to make high return investments if there is the possibility of loss (Gadhim *et al*., 2005). Agricultural risks therefore affect commercialisation.

2.3.2 Effects of agricultural risks on market participation and commercialisation

The low risks associated with subsistence farming are a major reason why smallholder farmers prefer not to progress or expand their investments into high-return farming businesses. However, this impedes their potential to get higher returns from commercialisation (FAO, 2016). They perceive food markets as involving risks and fluctuating market prices which lead to a lack of household food security, since their market-oriented resource allocation may be affected by the unreliability of food markets (Von Braun *et al*., 1994; Govereh *et al*., 1999). According to Makhura (1994), farmers tend to allocate resources to commercial activities up to a level where the disutility from additional risk equals the marginal utility derived from the consumption of market goods. Farmers' decisions regarding commercialisation can therefore be influenced by their attitude towards risk. Farmers can be categorised into three types: risk-takers, risk-neutral and risk-averters.

Risk-takers prefer taking chances when there is a possibility of making a higher outcome, even though there may still be the possibility of making less money. They choose alternatives with potential gains rather than protecting themselves from potential losses (FAO, 2016). Risk-takers are more willing to adopt modern technologies which may increase their productivity in terms of output levels and commercial sales. Hence, risk-takers are more willing to accept the inconsistencies in prices associated with commercialisation (Makhura, 1994). On the other hand, risk-averters prefer less speculative prospects: they are more willing to forgo a portion of their income in order to reduce the probability of a loss or a low income. They try to avoid risks and this suggests that they are less willing to accept the price variations associated with commercial activities (FAO, 2016). Risk-neutral decisions lie between risk-taking and risk aversion.

Riwthong *et al.* (2016) report that, with commercialisation, market prices and diseases become the most predominant risks faced by farmers. Farmers tend to utilise inputs such as pesticides instead of risk mitigation strategies such as crop diversification. It is reported that most farmers in sub-Saharan Africa practise subsistence agriculture and that they face challenges in gaining income from market surpluses (World Bank, 2005). Weak agricultural commodity markets tend to stagnate the agricultural sector and do not encourage commercialisation. Diao and Hazell (2004) argue that, due to the downward trends in world prices, the increased production of traditional export crops has not led to much growth in farm incomes.

Bienabe *et al*. (2004) point out that small-scale farmers face difficulties in transitioning to a commercial food system and that there is limited support for farmers by governments because of policy reforms and fiscal and governance problems. Another reason is that small-scale farmers are unable to meet the private standards of food quality and food safety standards set by larger retailers, food processors and exporters. With the increasing global commercialisation of agriculture and food systems, the food industry is becoming increasingly dominated by the large agribusiness firms that constitute the main market players; this means a decline in the influence of farmers in the market (Reardon and Berdegue, 2002). Baloyi (2010) argues that smallholder farmers face difficulties when it comes to competing in the market environment because they find it difficult to physically access markets, resulting in a decline in the profitability of their farms.

2.3.3 Effects of agricultural risks on farm profitability

Agriculture is the source of income and food security for most farmers in developing countries. The main objective of a farmer is to increase his farm income and to reduce its variability. According to De Janvry and Sadoulet (1995), farmers are mainly concerned with income variability and income stability is not necessarily brought about by price stabilisation.

Higher profits are usually associated with higher risks and it is important to manage risks effectively. It has been illustrated that, in order to succeed, farmers need to generate more profit and be more competitive (FAO, 2016). Appropriate risk management is more effective and better farming opportunities occur when farmers have a clear understanding of the farming environment and when they are aware of potential problems and know how to decrease their effects.

Low farm profitability is a major problem in most developing countries because of its adverse effects on food security. It limits the supply of food and, because of low farm incomes, rural households have limited access to food (Aung, 2011; Kuku *et al*., 2011).

2.3.4 Effects of agricultural risks on consumption

Agricultural risks affect farm production decisions, risk management strategies, long-term investment and access to financial services, all of which have an influence on consumption smoothing. Shocks such as droughts, which may lead to food price hikes, can have a considerable effect on household food access, thus affecting the stability of food security. Most poor households in developing countries may be more affected by the rise in food commodity prices. In most poor households, food makes up a large share of total expenditure, as less processed food is consumed compared with high-income households, which are only marginally affected by food-price hikes because food constitutes a smaller share of expenditure. This is also because more affluent households consume more processed foods, which means that they spend less on raw commodities (such as wheat) (FAO, 2016).

Slater, Holmes and Mathers (2014) report that poor households tend to spend a large share of their income on food. The occurrence of unfavourable events such as droughts, floods and outbreaks of disease can lead to a reduction in farm income. This, in turn, results in households reducing their capital in order to maintain food intake, and also resorting to selling assets such as land and livestock. According to Morduch (1995), in a perfect case, where the market system is fully functional, farmers should be able to diversify away all risk so that households are not vulnerable to idiosyncratic shocks and their consumption levels are not affected by them. When farmers have access to credit markets, transitory income shocks can be smoothed away by savings and borrowings, and thus have no effect on household consumption patterns.

With full markets, households should make income-generating choices that will produce the highest expected value and use after-shock mechanisms such as insurance and credit to achieve the desired consumption smoothing. For perfect consumption smoothing, the production and consumption decisions should be separable production choices which maximise returns without the concern about risk. Binswanger and Rosenzweig (1993) find that in the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) villages where the top wealth quartile of households is found, households are not constrained

in relation to borrowing and insuring. They do not have to adjust their production choices or contractual arrangements for income smoothing.

2.3.5 Effects of agricultural risks on food security

Global food security is a pressing issue for humanity. Agricultural risks and uncertainties disrupt production and food security (FAO, 2016). Agricultural risks are among the major poverty traps. Poor households, which are mainly dependent on agricultural production when faced with these risks, end up being trapped in a vicious cycle of poverty that is difficult to escape.

Africa is one of the regions of the world that is most affected by food production variability and food price volatility. The latter has created risks and uncertainties for producers, processors and traders, resulting in an increase in food insecurity for consumers. The eradication of extreme poverty and hunger is the first goal of the sustainable development goals (UN, 2015). Agricultural production is essential for achieving food security (Nayyar and Dreier, 2012; Godfray *et al*., 2010). Increasing investments in the agricultural sector are needed to boost food security and production and also to restrain the harmful effects of climate change (FAO, 2015).

Nelson *et al.* (2009) report that climate change has a potential to transform food production, particularly food patterns and the productivity of crops, livestock and fishery systems. It also has the potential to reconstruct food distribution markets and food access. However, rural and urban communities' adaptive capacity is usually faced with economic and social shocks which needs ongoing, strong support (Adger *et al*., 2007).

According to Godfray *et al*. (2010), the effects of climate change will cause more difficulties to the millions of people for whom attaining food security is already a huge problem. This affects food and agricultural development and the adoption of technology in developing countries (FAO, 2016). Risk management is therefore imperative in coping with the adverse effects of risks.

2.4 RISK MANAGEMENT

Hubbard (2009) defines risk management as the identification, assessment and prioritisation of risk, followed by the economical and coordinated application of resources to monitor, reduce and control the probability and impact of undesirable occurrences. The main objective in managing risk is to ensure that uncertainty does not deflect from business goals. Risk management has two main aspects: first, anticipating that an undesirable event may occur and taking preventive measures, where possible, to reduce the chances of that event occurring; secondly, it involves taking action to reduce the adverse impact should the event occur. The actions taken to manage risk involve a cost, which may be the amount of resources tied up to ensure that the farmer can effectively manage his risk (FAO, 2016).

In agricultural production, it is imperative for farmers to identify the sources of risks in order to be able to choose the appropriate risk management strategy. According to Pennings *et al.* (2008), factors such as age, farm size and attitude to risk determine farmers' choice of risk management strategies. The different farming systems, farm sizes and farm incomes differentiate farmers' responses. Risk management strategies can be classified as ex-ante and ex-post risk management strategies (Korir, 2011).

2.4.1 Ex-ante risk management strategies

Ex-ante risk management strategies are the actions taken in advance by farmers to minimise the probability of unfavourable events occurring. Farmers are more concerned about reducing the possibility of losing their income, so they might adopt strategies such as income diversification, in which they combine various activities with low covariance, such as planting crops that require different inputs and amounts of water in cases of drought. Farmers may also use income diversification, specialisation and electing a modifying environment to manage risks. Self-sufficiency has also been recognised as an important risk management strategy for dealing with food insecurity (Yassin, 2011).

2.4.2 Ex-post risk management strategies

Ex-post risk management strategies act as risk treatment tools; they are the actions taken by farmers to cope with risk after an unfavourable event has occurred. They include self-insurance acquired through precautionary savings and informal, group-based risk-sharing mechanisms designed to provide support to group members when they face hardship

(Dercon, 2002). Other ex-post strategies used by farmers include diversification through income-earning activities, reduced food consumption and expenditure, borrowing and reliance on external help from cooperatives and family members. When faced with income risks, some farmers may even decide to sell assets accumulated in the business to cope with the sudden shocks (Kwadzo *et al*., 2013; Machetta, 2011).

2.5 RISK MANAGEMENT THROUGH INSURANCE

Insurance is an effective tool for managing risks. When a specific risk is identified and quantified, a farmer can seek insurance cover for his farm against potentially devastating shocks. The insurance company assesses the nature of the risks and bases the premiums on the risks. The more likely the event is to happen, the higher the premium will be (Kahan, 2013). Therefore, understanding how insurance works and how farmers are compensated is important in risk management and the adoption of crop insurance.

2.5.1 What is insurance?

Anderson & Brown (2005) define insurance as a signed agreement between two parties. One party (the insured) agrees to pay a predetermined payment called the premium to the other party (the insurer). The insurer must agree to pay a claim or benefit to the insured upon the occurrence of a specified loss. When charging the premiums, the insurer considers the expected losses and the potential variation from the insurance pool and assesses whether they will be sufficient to cover all the estimated claim payments. Insurance does not reduce the probability of an event occurring, but it decreases the effect of the event on the financial status of the enterprise (Danso-Abbeam *et al*., 2014).

2.5.2 Agricultural insurance

Agricultural insurance is not that different from other types of insurance, except that it is specific to agriculture. By providing cover against financial losses, it helps farmers to cope with income shocks and to manage them efficiently (Nnadi *et al*., 2013). Agricultural insurance lowers the effects of the risks faced by farmers by compensating them for losses, thus allowing them to invest more in agriculture in order to gain increased income (Nahvi *et al*., 2014). According to Brown and Churchill (1999), a household which has a high possibility of losing its income and assets due to risks followed by a limited chance of

recovery is more likely to purchase agricultural insurance. Agricultural insurance can be divided into crop insurance and livestock insurance. Livestock insurance can be purchased by farmers to protect their livestock against risks such as sickness and death. However, this study focuses on crop insurance.

2.6 TYPES OF CROP INSURANCE

Crop insurance can be purchased by farmers, ranchers and others to protect their farms against losses caused either by natural disasters (drought, floods and hail) and a potential loss of revenue due to the decline in market prices for agricultural commodities (Insurance Fact Book, 2017). Crop insurance can be classified into two major groups, indemnity-based and index-based insurance.

2.6.1 Indemnity-based insurance

Indemnity-based insurance comprises multi-peril crop insurance, which is made up of peril and yield insurance. This type of insurance focuses on the actual loss incurred by a farmer and ensures that claim repayments are paid in relation to the loss. It involves careful inspection of the damage to ensure corresponding indemnity calculation. The insurance cover depends on a specific classification, which can cover only a single peril or multi-perils. Single peril insurance provides cover against a named peril, whilst multi-peril crop insurance covers all perils affecting production, excluding specific perils not indicated in the insurance contract (Ellis, 2016). Usually, the sum insured is based on either the expected crop revenue or the production costs (Tsikirayi *et al*., 2013). However, indemnity-based insurance is associated with adverse selection and moral hazard, high administration and transaction costs problems (Binswanger-Mkhize, 2012; Jones *et al*., 2009). Evidence from literature indicates the failure of indemnity-based insurance in most developing and developed countries (Kwadzo *et al*., 2013). With single or multiple-peril insurance, the farmer receives indemnities directly linked to the size of the crop loss the farm has experienced due to the peril.

Multi-peril crop insurance provides crop cover against losses caused by natural events (drought, hail, frost, disease, fire, flooding and insect damage) and lower yields. This type of crop insurance is provided and administered by private-sector crop insurance companies and other agents. This is the most popular type of crop insurance among farmers. Crop-hail

insurance is purchased less frequently and is usually purchased by farmers in hail-prone areas. Many farmers purchase crop-hail insurance to supplement multi-peril crop insurance (Insurance Fact Book, 2017).

2.6.2 Index-based insurance

Index-based insurance uses triggers to determine the actual crop loss. A trigger is an index threshold which can be either above or below a specified trigger, usually an amount of rainfall, which determines when payment can be made. Triggers can be made by either using data on rainfall amounts or crop yield data (Cole *et al*., 2012). Payments from claims are not made on the basis of individual form losses, but from deviations from the index such as rain, soil moisture and humidity. Area yield insurance is an example of the type of insurance that measures crop yield as an index in a particular geographical region. Indirect index insurance uses external indices such as satellite, vegetation and weather derivatives. Payments are made when crop yields fall below a certain predetermined trigger. Weather index-based insurance is designed for specific, unpredictable events such as drought or floods, the data of which is usually recorded in weather stations. Payments are made when the index (rainfall amount) is below or above a predetermined threshold which can lead to crop loss (Ellis, 2016).

According to Miranda (1991), index insurance does not always provide farmers with indemnities when they experience revenue or crop losses on their farms, and the indemnity payments farmers receive do not always represent the size of the loss the farmer has experienced accurately. Farmers are less willing to pay for index-based insurance as compared to multiple/single peril insurance (Ellis, 2016). The availability of crop insurance and a range of crop insurance products determines the type of insurance that farmers are willing to purchase. Therefore, the drivers of crop insurance supply are important in determining the type of products available in a country.

2.7 DRIVERS OF CROP INSURANCE SUPPLY

With the increase in crop-damaging weather incidences and climate change, crop insurance availability is becoming essential. Mahul and Stutley (2010) found that crop insurance is currently available in more than 100 countries, either as well-developed programmes or pilot programmes. The majority of high-income countries have well-developed crop insurance markets in comparison with low- and middle-income countries. Pilot programmes on multi-

peril crop insurance and weather index-based crop insurance are being implemented in different countries.

However, Tsikirayi *et al.* (2011) analysed the uptake of agricultural insurance services in the agricultural sector of Zimbabwe. The study revealed that there are limited agricultural insurance providers in the country. The location of most insurers was found to make farmers' access to insurance services difficult. This was mainly because of a lack of agricultural underwriting skills and of the data needed to develop effective and efficient agricultural insurance packages. Rattani (2016) argues that most developing countries have problems funding agricultural insurance. Many of them depend on international assistance to deal with extreme, climate-related events that cause huge losses to farmers and this is why farmers struggle when it comes to accessing agricultural insurance.

According to Ligon (2011), the range of agricultural insurance products provided in a country is usually dependent on the willingness of the government to provide subsidies, on the availability of data to support underwriting, and on actuarial analysis, which ensures that the products are viable and enables the presence of viable infrastructure for providing insurance (including trained loss adjusters, regulatory structures and product delivery mechanisms). Hence, developed economies are more willing and able to provide subsidies than developing countries. They are also more likely to have information, data and the required infrastructure needed to provide such insurance.

The provision of agricultural insurance has therefore been regarded as challenging and multi-peril insurance is seen as an expensive and complex product. For a product to be developed, there are three basic criteria which must be satisfied: i) the crop must be economically significant; ii) the product must be of interest to the producer and iii) offering the product must be feasible. Offering insurance may not be feasible if data is inadequate to evaluate the actuarial reliability of the product, or when the initiated product is too complicated (Ligon, 2011). Therefore, farmers' preferences for crop insurance need to be determined, because they influence farmers' interest in purchasing crop insurance.

2.8 FARMERS' PREFERENCES FOR CROP INSURANCE

Farmers have different preferences for crop insurance because they face unique environmental risks and agricultural commodities have different levels of yield risks.

Therefore, preferences for crop insurance are a function of the agricultural commodities produced and the risk environment faced by the farmers (Blank and McDonald, 1996). With the expanded programme of crop insurance attributes, farmers have to make choices about crop insurance programmes and products that meet their needs and constraints, so to increase their crop insurance adoption rates.

Sherrick *et al.* (2003) employed the conjoint method to elicit coy and soybeans farmers' preferences for crop insurance products in the Midwest of the USA. The study used the choice of insurance type, unit flexibility and coverage levels of crop insurance features. Farmers had a marked preference for strong flexibility, indicating that farmers prefer the freedom of selecting the extent of their acreage to have under their insurance policies. Having greater flexibility allows farmers to match insurance utilisation to the risk characteristics of geographical tracts, which can affect their farm operations. The farmers in the study also preferred revenue products over yield products. Farmers that preferred revenue insurance were younger, and had larger farms and more geographically dispersed acreages. Tailoring of product attributes to farmers' businesses and demographic characteristics can be improved by utilising these relationships.

Makki and Somwaru (2001) found that insurance product choices are highly influenced by the cost of insurance, level of risk and premium subsidies. Farmers with high-yield risks were more likely to prefer revenue insurance contracts and higher coverage levels. Olila (2014), assessed maize farmers' preferences for crop insurance in Kenya. The study found that farmers preferred higher coverage levels. Hence, an increase in coverage levels motivated the farmers' preference for crop insurance. Farmers had a negative preference for the cost feature of crop insurance: this implies that an increase in premiums led to a lower preference for crop insurance. Farmers had a higher preference for receiving compensation in the event of a yield loss. Farmers also preferred being involved in the process of designing crop insurance programmes and had a higher preference for the multiple-peril risk cover over the single-peril cover. This group also had a higher preference for insuring against crop and market risks and crop and medical insurance cover. In general, farmers preferred a bottom-up approach to crop insurance, one which involved stakeholder engagement.

Vandeveer (2001), examined the demand for crop insurance among litchi farmers in northern Vietnam. The study found that farmers preferred an all-risk insurance programme over a single risk programme. Most farmers preferred their insurance to be based on the area yield

and not on individual farm yields because area yield data was available in the form of commune and district yield records. Farmers also preferred district insurance over commune insurance and also preferred lower indemnity prices. This was due to the fact that coverage that has a higher indemnity price was associated with higher premiums.

Farmers' interest in purchasing crop insurance is influenced by various factors. These factors influence farmers' decisions to purchase crop insurance, hence affecting their demand for it.

2.9 THE DEMAND FOR CROP INSURANCE

The demand for crop insurance depends on the following factors: i) the farmer's utility function of income; ii) the farmer's current income; iii) the farmer's subjective frequency distribution of future income; iv) the change in the frequency distribution of future income generated by the contract; and v) the premium of the contract (Niewuwoudt and Bullock, 1985). For farmers to purchase crop insurance, they must first perceive that the premiums and the expected benefits offer them value (FAO, 2004). The sellers must be able to see an opportunity for a positive actuarial outcome over time and profit. The demand for crop insurance is highly influenced by the expected return on insurance by measuring participation as the ratio of actual liability over a measure of total possible liability.

Makki and Somwaru (2001) argue that the decision to purchase crop insurance is also influenced by the premium level, risk level, expected indemnity and other available risk management tools. Several studies have reported that an increase in insurance premiums has the potential to reduce farmers' participation in crop insurance (Goodwin and Smith, 2003; Knight and Cobble, 1997). McCarthy (2003) revealed that farmers in Morocco with relatively higher incomes were more interested in purchasing crop insurance than farmers with low incomes. Sherrick *et al.* (2003) reported that some of the factors that influence crop insurance demand are the costs and returns of crop insurance, financial risks, yield and other business-related risks, farm size, coverage levels, forms of diversification, farmers' relationship to adverse selection, and moral hazard.

Aidoo *et al.* (2014) investigated crop insurance as a risk management tool among Ghanaian arable crop farmers. The study identified the critical factors that influence the premiums farmers are willing to pay towards the insurance scheme: it revealed that the most of the farmers were interested in purchasing crop insurance and the factors that influenced their

decisions were the land tenure system, the age of the farmer and the farmer's education level. The study further revealed that a government subsidy was required, since farmers had a preference for low premiums, which were not feasible from the perspective of private insurance providers.

Enjolras *et al.* (2012) analysed the demand for crop insurance in Italy and France. The study revealed that the farmers' decision to purchase crop insurance is influenced by the farmers' aversion to risk, as well as the intrinsic characteristics and the performance of their own agricultural enterprises. The study revealed an increase in premium levels in Italy as compared to France, because there were public subsidies offered in France for policies in which catastrophic risks were included. Without that kind of intervention, insurance tends to be more costly and less profitable. Shashi Kiran and Umesh (2015) found that Indian maize farmers were not aware of the products and procedures of crop insurance and this contributed to the limited demand for crop insurance. The inability of farmers to assess the benefits of crop insurance is certainly one of the reasons for a limited demand for it (Gamdo and Zilberman, 2008).

Wright and Hewitt (1994) investigated the limited demand for crop insurance and reported on the factors that contribute to it. These include the fact that the organisational structure of farming is such that farmers can use other mechanisms such as product diversification, credit and other financial markets to manage risk. According to Barnett *et al.* (1990), the expected rate of return on insurance is an important factor when determining the demand for crop insurance. The high prevalence of crop-damaging weather occurrences is likely to continue to push the demand for crop insurance for the coverage of losses (FAO, 2005). Feng (2004) and Shi (2008) argue that even if 100% coverage were provided as protection for historical yields, without any subsidy, only 25% of the farmers would purchase it.

Ghazanfar *et al.* (2015) investigated the factors that influence farmers' decisions to participate and purchase crop insurance in Pakistan. Their findings revealed that the majority of farmers were interested in purchasing crop insurance but that there was still a large number of farmers who showed no interest in it. Their findings also indicated that low literacy rates and little awareness of the expected benefits of crop insurance might be the reasons why farmers were refusing to accept it. Farmers with more loss experience were more interested in purchasing crop insurance because they felt insecure about their future yield. They felt that it was far better to have crop insurance to avoid losses from future climatic hazards.

Balmalssaka *et al*. (2015) studied the maize farmers' interest in participating in the crop drought-index market for insurance in Ghana. The study revealed that education, access to credit and farmers' experience of other forms of insurance were the most significant factors that determined the farmers' interest in purchasing crop insurance. Damage incurred due to drought increased the probability of farmers purchasing crop insurance. The past disaster event return period and the number of non-farm income sources reduced the likelihood of farmers to make the decision to purchase crop insurance. To enhance farmers' purchasing of crop insurance, there is a great need to integrate crop insurance into micro-finance. Koume and Komenan (2012) reported that among Ivorian cocoa farmers, the age of the farmer, their farming experience, household size, farm income and farm size had a significant influence on a farmer's interest in purchasing crop insurance.

Danso-Abbeam *et al.* (2014) emphasised the need to educate farmers about the importance of crop insurance. Linking agricultural insurance with other products can enhance the demand for crop insurance and lead to the successful adoption of agricultural insurance. Linking agricultural insurance with other financial services such as credit is beneficial to farmers because it provides them with capital to purchase insurance premiums and hence reduce the use of scarce resources to finance risk cover. Mahul and Stutley (2010) reported that this approach has the benefit of reaching a larger number of clients because it provides a package with more than one product. This finding strongly suggests that an increase in the future demand for crop insurance may be achieved through the design of more attractive crop insurance products (Goodwin *et al*., 2003).

2.10 THEORETICAL FRAMEWORK

2.10.1 Random utility theory

This is one of the theories used in crop insurance studies. The theoretical ground of the Choice Experiment (CE) method stems back to the Lancaster characteristic theory of value, which states that individuals derive utility from the characteristics of the goods rather than the goods themselves (Lancaster, 1966). Random utility theory (RUT) is based on the hypothesis that every individual is a rational decision maker who maximises utility to his or her choices (Thurstone, 1927; McFadden, 1974; Manski, 1977).

The theory states that the utility that an individual *n* obtains from alternative *j*, labelled U_{nj}, expressed as a function of attributes (X) can be expressed as:

$$U_{nj} = \beta' X_{nj} + \varepsilon_{nj} \quad (1)$$

Where equation 1 shows that utility comprises of two parts; the measurable or systematic component β_n which is a function of the observed attributes X_{nj} and a random component which captures the variations in preferences in the population due to the unobserved stochastic error term ε_{nj}. The random utility theory supports the econometric basis of the CE (McFadden, 1974).

According to this theory, utility is considered an unobservable variable that is a random variable measured as a probability that rational consumers will make choices that yield them the highest utility given any choice set. The effects of the unobserved attributes and variations in tastes, latent individual characteristics and measurement errors create randomness. According to Liesivaara and Myyra (2014) in Choice Experiment (CE), multiple questions and alternatives with different attributes are presented to the respondents. After the choices have been made, it is then possible to analyse the trade-offs that the respondents make while ranking all the alternatives presented. If one of the attributes is related to the price of the service or good, estimating the marginal value of each attribute and the consumer's willingness to pay for a hypothesised bundle becomes possible.

The Random Utility approach can be used to link the deterministic model with a statistical model of human behaviour, since stated behaviour surveys sometimes reveal preferences structures that may appear as inconsistent with the deterministic model (Martinsson *et al*., 2001). Therefore, this theory will not be used in this study, because of the inconsistencies derived from observational deficiencies that arise from the unobservable components which include the characteristics of the individuals or the non-included attributes of the alternatives in the experiments, heterogeneity of individual preferences and/or measurement error (Hanemann and Kanninen, 1999)

2.10.2 Expected utility model

A rational farm household seeks to minimise risk, and at the same time maximise utility because of limited resources. When considering the fact that farmers are usually capital-constrained, a rational farmer will select the investment with the highest Net Present Value (Mishra and Morehart, 2001). Since agricultural production is associated with risk, the higher

the risk, the higher the demand for crop insurance should be. When studying the effects of risk in agricultural production, farmers' different attitudes towards risk and their decisions when faced with risk, it is useful to use the concept of expected utility. This study therefore employs the expected utility model.

According to Hojjati and Bockstael (1989), a farmer's utility is a function of income or profit made from production. Her attitude towards risk will be reflected in the expected utility she associates with the outcomes, faced with uncertainty. In this model, each farmer's utility can be assumed to be a function of the expected and variance of profit, so that all decisions are based on the comparison of the expected profit and variance of profit across alternatives. The theoretical foundation of the mean-variance approach is that a farmer maximises her expected utility.

Von Neumann and Morgenstern (1947) proposed a set of axioms that the theory into risk attitudes are based on; this theory was later developed further by others. The axioms aid in demonstrating that a farmer's risk attitude can be deduced if the preference ordering and the distributional properties of the risky prospect are known. Therefore, farmers' behaviour when faced with risk can be studied using the expected utility model.

Korir (2011) employed the expected utility theory when studying risk management of Kenyan agricultural households and the role of off-farm investments. In this model, the farmers are assumed to prefer an alternative that has a certain return Y over the alternative with a risky return. The assumption is that a household has a utility function and seeks to maximise the expected value of a Von Neumann-Morgenstern utility function subject to the following income constraint:

$$U = U(y, c) \qquad (2)$$

Where y= net farm income and $c = \text{consumption}$

The utility function of a risk-averse farmer is illustrated in Figure 2.1. Hence, the expected utility of a random income that can take two values with equal probability can be calculated as:

$$y = \begin{pmatrix} \bar{y}+\delta \; with \; probability \; 1/2 \\ \bar{y}-\delta \; with \; probability \; 1/2 \end{pmatrix} \qquad (3)$$

The expected utility is given by:

$$Eu(y) = 1/2[U(\bar{y} + \delta) + U(\bar{y} - \delta)] \quad (4)$$

Because of the concavity of the utility function this $Eu(y)$ is less than the utility associated with the sure income $\bar{y}$. This shows halfway between the two utility levels. The measure of the cost of risk associated with the loss of the expected utility or producer welfare is the difference between the two utilities. The cost of the risk in monetary terms can be realised by asking the farmer how much of the sure income will he be willing to give up in the same position as with the risky income. $\hat{y}$ is the certainty equivalent income and it gives the same utility. It can then be defined as:

$$u(\hat{y}) = Eu(y) \quad (5)$$

The difference between $u(\hat{y})$ and $\bar{y}$ gives the cost of the risk premium, which is the average income amount the farmer is ready to give up in order to exchange and get a sure income in exchange for the random income (De Janvry and Sadoulet, 1995).

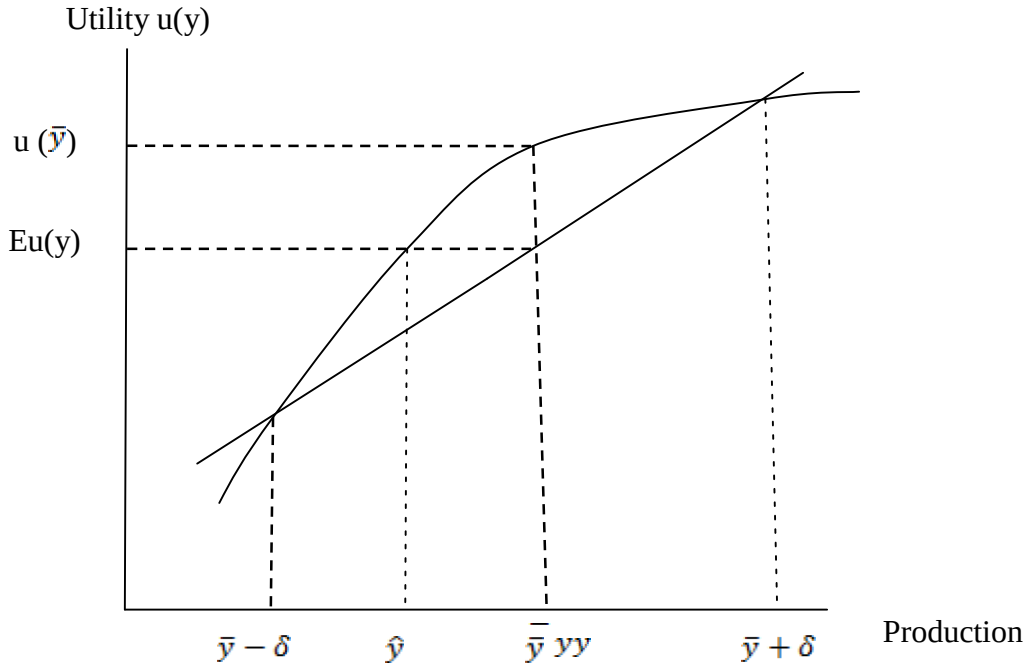


Figure 2.1: Risk aversion

Source: De Janvry and Sadoulet (1995)

The magnitude of the risk premium is dependent on the probability distribution of income and the shape of the utility function. The curvature of the utility function represents the level of risk aversion; hence, the more curved the utility function is, the larger the risk premium will be. Hardaker *et al.* (2004) showed that for a risky prospect the subjective expected utility (SEU) can be calculated from the subjective probabilities and this value indicates about an individual's attitude towards risk, considering his expectations based on individual subjective probabilities.

Since the curvature of an individual's utility function reflects that individual's risk aversion, the utility function can be defined only up to a positive linear transformation. A constant measure of the curvature transformation is needed. The simplest measure of such is the absolute risk aversion function:

$$r_a(y) = -\frac{u''(y)}{u'(y)} \qquad (6)$$

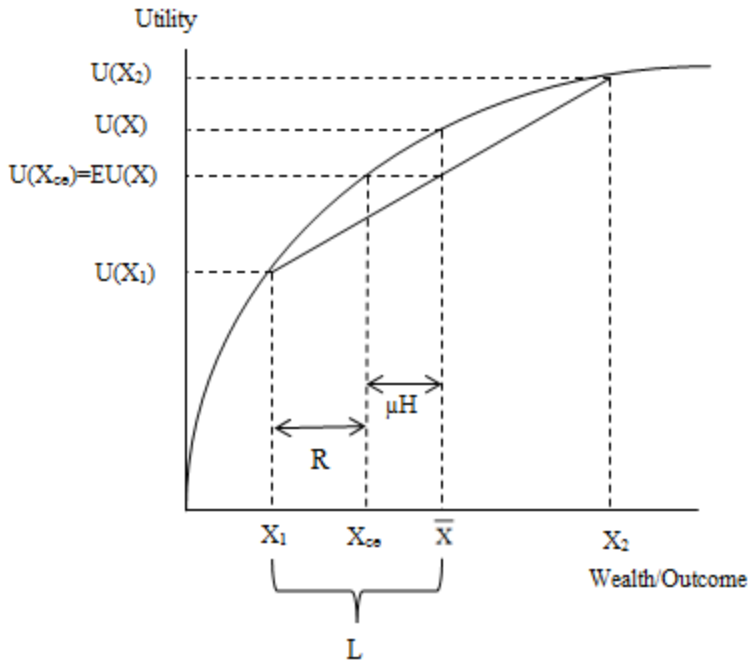
Where $u''(y)$ is the second derivative and $u'(y)$ is the first derivative of the utility function, $r_a(y)$ tends to decrease with increases in y, since the richer people get, the higher the probability of them taking risks (Hardaker *et al*., 2004).

The Expected Utility Theory has limitations in that its application can be only to a single attribute (wealth/pay-off). Amador *et al*. (1998) and Berbel and Rodríguez (1998), demonstrated the convenience of employing more than one attribute when considering the producer's utility function. This shows that farmers' decision-making processes can be influenced by other factors such as leisure maximisation, managerial problems and working capital minimisation (Gomez-Limon *et al*., 2002). Because of the assumption that the utility function is concave in wealth, insurance is valued under expected utility maximisation. Full insurance is demanded when an insurance premium is set at actuarially fair levels. Under expected utility partial insurance is optimal, especially when an insurance load is applied. Consumers tend to prefer low, deductible insurance which exceeds the predicted levels of expected utility (Pashigan *et al*., 1966).

Despite the fact that farmers are often risk-averse, different individuals have different attitudes towards risk (Hardaker *et al*., 2004). Risk preferences often differ between individual and they are usually influenced by social factors such as age, education and farming experiences. A farmers' risk preference is also influenced by their financial position, business risks and personal level of risk aversion. Socio-economic and demographic factors

such as age, education, farm size, land tenure, geographic location and yield risk may affect farmers' risk preferences (Barry *et al*., 2004), but the on the final analysis, farmers' own risk preference is usually a factor determining their decision to purchase crop insurance.

The choice to purchase or not to purchase crop insurance is based on the expected utility theory. Social factors such as age and education affect farmers' preferences and perceptions (Hardaker *et al*., 2004). Risk preferences denote the curvature of the utility function and they are very important for decision making. As shown in Figure 2.2, yield perceptions usually affect the expected yield $\bar{X}$, which varies between X_1 and X_2. Hence, the perceived yield risk also affects farmers' perceived probability of loss. Features of insurance products have an influence on $X_{ce.}$ Therefore, the rate of the insurance premium and the level of the return R from the insurance are affected if a loss occurs. Business-related factors such as farm size, nonfarm income and land tenure affect the yield variables X_1, X_2 and $\bar{X}$, further affecting the insurance decision (Branstrand and Wester, 2014).



X_1: Min outcome
X_2: Max outcome
$\bar{X}$: expected outcome
X_{ce}: certain outcome
μH: insurance premium
L: loss
R: Return

Figure 2.2: Decision to purchase crop insurance

Source: Branstrand and Wester (2014)

The expected utility theory has also incurred some criticism and its critics have proposed alternative theories of farmers' behaviour under risk. However, the expected utility theory continues to be the dominant framework of empirical analysis and it is used in this study.

2.11 EMPIRICAL MODELS

This section reviews some empirical studies analysing risk and insurance. Various techniques such as the Adoption of Insurance Approach and the Random Parameter Logit (RPL) model are presented in this section. This section gives an overview of some of the methods used to elicit farmers' interest to purchase crop insurance and how they are constructed.

2.11.1 The Adoption of Insurance Approach

This is one of the approaches used in crop insurance studies. It stems from the evidence presented in theory, showing that new farming tools are adopted when the net benefits are positive, that is, when the costs of adopting the new technology are lower than the expected returns. For effective insurance adoption, Just *et al.* (1999) proposed that the risk aversion incentive can be separated from the expected revenue incentive and the expected value of indemnity payments. Garrido and Zilberman (2008) argue that even though these factors are important, insurance outcomes (expected returns from insurance, individual loss ratios) are hardly used in empirical studies to explain farmers' insurance decisions.

Garrido and Zilberman (2008) employed a data set that comprised of complete characteristics of each farm's insurance strategy, premium subsidies, premiums paid and collected indemnities. The study revealed that the variability of returns from insurance has far more positive influence when compared to the expected benefits of the decision to pay for insurance.

Lefebvre *et al.* (2014) studied the factors that determine insurance adoption among Bulgarian farmers. In their study they followed the same approach used by Velandia *et al.* (2009), who investigated the factors affecting the simultaneous utilisation of crop insurance of US farmers, spreading sales and forward contracting for maize and corn farmers in Indiana, Illinois and Iowa states. The multivariate probit model was used, since it allows for possible correlation in the different decisions. Since the different risk management tools that influence the farmer's net return are not easily observed, these effects are then included in the error

term. Lefebvre *et al.* (2014), specified this model as a system of four equations: $Y_1$was the decision to purchase insurance, Y_2 the presence of production/marketing contracts, Y_3 irrigation usage and Y_4 the presence of diversified farm activities:

$$Y_{ij}^{*} = \beta_j X_{ij} + \varepsilon_{ij} \quad j = 1, \dots, 4 \qquad (7)$$

$$Y_{ij} = 1 \; if \; Y_{ij}^{*} > 0 \quad \text{And 0 otherwise} \qquad (8)$$

$$\varepsilon_{ij} \sim N_j[0, \mathrm{R}] \quad j = 1, \dots, 4$$

Where $Y_{ij} =$ is the decision of farmer i to adopt a risk management instrument j.

$X_{ij} =$ is a vector of observed variables that affects the risk management decision j of farmer i.

For all the equations $X_{ij} = X_i$, the same set of explanatory variables was used . This model involves the distribution of error terms as multivariate normal, each having a mean of zero and variance-covariance matrix R, which has 1 on the main diagonal values and correlation $P_{jk} = P_{kj}$ as the off-diagonal values. The MVP was calculated as the impact of explanatory variables on the likelihood of adopting insurance $(Y_1 = 1)$ which is conditional on all adopted other risk management tools ($Y_1 = Y_2 = Y_3 = 1$) (Velandia *et al*., 2009).

Mishra and Goodwin (2003), when analysing farm level, crop versus revenue insurance adoption, used the following model:

Firstly the model assumed that there is a finite set of m possible insurance plans from which a farmer can choose. By modelling the i^{th} farmer's decision as maximising the expected utility of profits by accepting/choosing the j^{th} bundle of insurance among the m discrete insurance plans:

$$max_j\{E(U(\beta_{ij}))' f_i(X_i)\%g_{ij}\} \quad j' \; 1, \dots, m \qquad (9)$$

Where; f_i= a function of $X_i = X_{i1}, \dots, X_{iq}$ which is a (1 × q) vector of attributes of the i^{th} farmer affecting the desirability of an insurance plan. The model also assumes that $g_{ij}$is a random variable which is identically and independently distributed with the Weibull density function. By letting $Y_{ij} = 1$ if the farmer chooses the j^{th} insurance plan and $Y_{ij} =$ 0 otherwisw. By following McFadden (1974) the probability of the i^{th} farmer choosing the j^{th} insurance plan may be expressed as the following multinomial logit model:

$$P_{ij}' \ P(Y_{ij}'1)' \ \frac{expf_i(X_i)}{1\%j_{k_1'}^{m\&1} \ \exp f_k(X_i)} \qquad j' \ 1,2,\ldots,m\&1 \qquad (10a)$$

$$P_{im}' \ P(Y_{im}'\,1)' \ \frac{1}{1\%j_{k_1'}^{m\&1} \ \exp f_k(X_i)} \qquad (10b)$$

Where: the P's are conditional probabilities of the insurance plans, given the explanatory variables. In this study, they represent the probability of choosing between the two insurance plans (crop insurance or revenue insurance).

P_1 and P_2 are the probabilities of choosing either of the insurance plan, and P_3 is the probability of choosing both. P_4 is the probability of choosing neither the crop insurance nor revenue insurance plan, so that, for example, m = 4. The probability of choosing crop insurance is $P_1 + P_3$, while the probability of choosing revenue insurance is $P_2 + P_3$.

In this model, the maximum-likelihood estimation (MLE) method can be used to estimate the conditional probabilities. A linear form $f_i(X_i) = X_i\$_i$ is used where$\$_j = \$_{i1},\ldots,\$_{ig}$. These coefficients cannot be interpreted directly because the $'s enter the probabilities P_{ij} nonlinearly. A direct interpretation of the coefficient can be obtained by taking the logarithm of P_{ij}/P_{i4}:

$$Ln(\frac{P_{ij}}{P_{i4}})' \ X_iN\$_{j4} \qquad j * 1,2,3 \qquad (11)$$

Equation (5) is the logarithm of the odds in favour of outcome *j* relative to outcome 4, and $\$_{jq}$ is the marginal effect of X_{iq} on the logarithm of this ratio.

2.11.2 The Random Parameter model and the Multinomial Logit model

These are some of the models often used in crop insurance studies. In the analysis of CE data, the multinomial logit (MNL) model is the most commonly used discrete choice model. Although the model has relative simplicity, it has the following drawbacks that limit its application: it is based on the assumption of constant variance which results from the independence of irrelevant alternative which states that the ratio of choice probabilities between two alternatives in a choice set is somehow not affected by the changes in that choice set. The other assumption is that there is homogeneity in tastes/preferences across all respondents. However, this assumption is unable to consider the fact that preferences are unobservable to the researcher and they tend to vary among respondents even with the same socio-demographics (Olila, 2014). It also violates the consumer axioms of stability and

transitivity of choices by imposing independence of unobserved factors in repeated choices over time (Otieno, 2011).

Following the limitations of the Multinomial logit model, the Random parameter logit (RPL) model is the preferred model. It is a highly flexible model that allows approximation of any random utility model. It also accounts for preference heterogeneity by allowing utility parameters to vary randomly and continuously among individuals. This allows computation of unbiased estimates of individual preferences. Accounting for preference heterogeneity by interacting the RPL model with the socio-demographic characteristics of farmers provides a broader perspective of other impacts of policy options and distributional consequences and provides better insight for policy outcomes (McFadden and Train, 2000). Olila (2014) used the RPL when analysing preferences for crop insurance in Kenya.

2.11.3 Propensity score

When estimating the farmers' interest to purchase crop insurance, farmers not interested are usually excluded from the study. The exclusion of uninterested farmers poses the selectivity bias if only interested farmers are included in the sample. Ruling out farmers who are not interested in crop insurance can lead to biased estimates (Long *et al*., 2013). In the absence of experimental data, the propensity score matching model (PSM) can be used to account for this sample selection bias (Dehejia and Wahba, 2002). According to Rosenbaum and Rubin (1983), the PSM is the conditional probability that a farmer adopts the new product, given the pre-adoption characteristics. To create the condition of a randomised experiment, the PSM employs the unconfoundedness assumption, also known as conditional independence assumption (CIA), which implies that once the vector of pre-adoption characteristics is controlled for, product adoption is random and uncorrelated with the outcome variables. Therefore the PSM corrects selection bias which may arise due to systematic differences between the farmers willing and the farmers not willing to pay for crop insurance (Ali, 2013).

Mendola (2006), conducted a study on agricultural technology adoption using propensity score matching in rural Bangladesh. Following the propensity score matching procedure involves removing the assumptions that technology adoption is a function of a wider range of characteristics observable at the household level and that a constant technology effect exists. Doing so balances the distribution of observed covariates between the control and treatment groups with reference to the similarities of the predicted probabilities of adopting the technology. The matching procedure creates conditions of a randomised experiment. To be

able to evaluate a causal effect in a controlled experiment, the conditional independence assumption is required, which states that the selection of a technology is random and uncorrelated with variables such as income, when the variable x is controlled for. Hence, the technological effect can be expressed as:

$$\alpha(X) = E(Y^1 - Y^0|X) = E(Y^1|T = 1, X) - E(Y^0|T = 0, X) \quad (12)$$

The average technological effect can be expressed as:

$$\alpha = E\{\alpha(X)\} \quad (13)$$

Households with similar propensity scores have a technological effect that can be expressed as:

$$\alpha(p(X)) = E\left(Y^1\middle|T = 1, p(X)\right) - E(Y^0|T = 0, p(X) \quad (14)$$

Where the whole population has an effect expressed as:

$$\alpha = E\{\alpha(p(X))\} \quad (15)$$

Given the relevant controls of X, the PSM method reduces the dimensionality of the conditioning problem by comparing households with the same probability of selecting the new technology (Rosembaum and Rubin, 1983). The nearest neighbour is one of the methods that can then be used to identify the closest twin for each household in the opposite technological status. This method estimates the technological effect as the average difference between household characteristics between each pair of matched households of adopter and non-adopters.

2.12 CONCLUSION

This chapter reviewed relevant studies on farmers' preferences for crop insurance and the factors influencing their interest to purchase crop insurance. Furthermore, it reviewed the nature of risks and their effects on agriculture, the importance of risk management strategies and crop insurance as tools that cushion farmers from potential losses, and the supply and demand of crop insurance. It then presented the theoretical framework by reviewing the random utility and the expected utility theories. The expected utility theory was employed in this study. In addition, the empirical framework was reviewed and the adoption of the insurance approach, the random parameter and the multinomial logit models were discussed.

On considering the limitations of these models, the binary logistic and probit regression models were found to be more suitable for this study. These models are explained in the following chapter.

CHAPTER 3

METHODS AND PROCEDURES

3.1 INTRODUCTION

The preceding chapter was a review of literature relevant to this study. This chapter provides a description of the study area, sampling and data collection methods. Issues related to model specification and statistical analytical techniques are also discussed.

3.2 THE STUDY AREA

The study covered two administrative regions of Swaziland; the Hhohho and Lubombo regions. The Hhohho region is located in the western part of the country and has a climate characterised by wet summers and dry winters. Annual rainfalls are the highest in this region, ranging, between 1000 and 2000 mm. The Lubombo region is located in the eastern part of the country and is the driest region, with a climate characterised by hot temperatures and less rainfall, between 500 to 900 mm per annum. Hhohho is one of the highest maize-producing regions in the country, while Lubombo is the lowest. Crop production in the Lubombo region is susceptible to drought and it is mainly practised by smallholder farmers under rain-fed conditions (Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN), 2003). Even though the Lubombo region is the driest region in the country, the amount of rainfall differs among the areas in the region, depending on altitude. Areas such as Maphungwane receive more rainfall than other parts of the region and it is one of the highest maize-producing areas.

3.3 SAMPLING METHOD

The Hhohho region is the highest maize-producing region in the country due to favourable climatic conditions (FANRPAN, 2003). On the other hand, the Lubombo region is the driest region in the country. The two areas were purposively selected, one in each region. Sigangeni area in the Hhohho region was selected mainly because it is one of the highest maize-producing area in the region and the majority of farmers in that area are maize sellers. The

Maphungwane in the Lubombo region area was also purposively selected. In order to recruit respondents, the snowballing sampling method was used (Goodman, 1961). One farmer in each area was identified, who then assisted in identifying other farmers who also produce surpluses and sell their maize. The final sample size was 150, and in each area, 75 households were interviewed.

3.4 DATA COLLECTION

The survey was carried out from 19 June and 6 July 2017. Data was collected through face-to-face interviews using a pre-tested questionnaire. Face-to-face interviews were preferred to the use of telephone or mail interviews, as internet and mobile phone services are unpredictable among farmers in the rural areas. The questionnaire elicited information regarding household and farm characteristics, socio-demographic factors and crop insurance features. The survey targeted maize farmers who are usually surplus maize producers and who consume and sell their surplus to the National Maize Corporation or individual buyers. An enumerator, trained by the researcher, assisted in the data-collection process. Household heads and other relevant family members involved in farming in the households were interviewed. Younger respondents and older family members assisted one another when necessary. To ensure that there were correct responses to all the questions, the researcher checked all the questionnaires on a daily basis.

3.5 MODEL SPECIFICATION ISSUES

Considerable effort was devoted to reorganising the data for the purpose of increasing the amount of information suitable for this study. Several issues motivated the model specification.

3.5.1 Diagnosis of outliers

An outlier can be defined as an observation that appears to deviate from other observations in the sample. It may be an indication of bad data due to incorrect data coding. However, outliers may also indicate interesting observations, so they should be diagnosed and a decision should be made about whether they should be kept or eliminated from the sample (ESB, 2013). It is important to identify potential outliers because extreme observations can

influence the results for statistical analysis (Makhura, 1994). Univariate analysis was conducted for each dependent and independent variables. Values which were suspected to have been entered incorrectly were adjusted. Certain outliers of interest were seen in the following independent variables: family size, where one household had 23 family members which resulted from a polygamous family arrangement, even though an average household size was 7. On the expected yield (EY), one household had an EY of 300 bags, while a typical household in the sample has an EY of 49 bags. The number of years the farmer has experienced farm losses (Years loss experience) was another outlier of interest: 30 years loss experience was seen, whilst a typical household in the sample had about two years loss experience. These outliers were of interest and they did not need to be adjusted. They were kept because they were real and showed different and interesting characteristics of the sample.

3.5.2 Treatment of missing values

The presence of missing values was expected in this data set, due to multidimensional variables. For example, maize farmers may not have livestock and grow other crops or engage in other sources of income besides maize production. So they would not provide information on those activities. Most statistical packages have various options of treating missing values such as substituting the means for missing values. However, considerable effort was devoted to ensure that data had no missing values for critical variables.

3.5.3 Collinearity diagnosis

Multi-collinearity exists when an independent variable is highly correlated with one or more of the independent variables in a multiple regression model. Multi-collinearity is a problem because it undermines the statistical significance of an independent variable, it leads to large variances in the estimated parameters, thus reducing the efficiency of the estimators. The larger the standard error of a coefficient, the less likely it is that the coefficient will be statistically significant in a regression, other things being equal (Allen, 1997). If the significance level of the coefficients of other variables increases when a variable is removed, this suggests that the variable is a collineated variable (Makhura, 1994). The tolerance values and the Variance Inflation Factor (VIF) measures indicate the degree to which each independent variable is explained by the other independent variable. Thus, very small

tolerance and large VIF values denote high collinearity. The common cut-off threshold is the tolerance value of 0.10 and VIF less than 10 (Hair Jr *et al*., 1995).

The multicollinearity test was conducted looking at the Variance Inflation Factor (VIF) and the tolerance values, for all independent variables. The VIF of all the independent variables were below the threshold of 10.00 and tolerance values were above 0.10. This implies that multicollinearity was not present between the independent variables used in this study.

3.6 DATA ANALYSIS

Data obtained were analysed using descriptive statistics, the probit model and the logistic regression model. The descriptive statistics employed involve the use of distribution tables, frequencies, percentages and means. The descriptive statistics were used to present the socio-economic, household, farming, risk characteristics of the respondents and crop insurance information. The Statistical Package for the Social Sciences (SPSS) was used for analysis and STATA to obtain the marginal effects.

3.7 MODEL SPECIFICATION

3.7.1 Objective 1: To identify the features that farmers prefer to take crop insurance

Identifying the conditions under which farmers have a preference for crop insurance is important in order to ascertain their needs and constraints. This informs crop insurance providers so they can increase crop insurance adoption. The adoption of crop insurance is highly dependent on its demand among farmers. By involving farmers in the design stages of crop insurance schemes, farmers can increase their adoption because their needs would be considered.

Farmers interested in purchasing crop insurance were asked about their preferences if a new crop insurance were to be introduced. To identify the conditions that farmers prefer for crop insurance, they were asked to make choices of features such as the risk cover, coverage levels, premiums, nature of coverage, compensation and subsidies, among other aspects. The results were presented using descriptive statistics, percentages, frequencies and tables.

Description of crop insurance features

Table 3.1 presents the crop insurance features and their descriptions, in which farmers made their choices based on literature.

Table 3.1: Description of crop insurance features

Variable	Description
RISK COVER	Preferred risk cover for new insurance scheme (single-peril, multi-peril and index-based insurance)
COVERAGE LEVEL	Preferred coverage levels (60%, 70% etc.)
PREMIUM	Preferred monthly premium (in rands)
FARM-INVOL	If farmer preferred to be involved in context designing of insurance programs (1=yes; no=0)
COMPENS	Compensation based on the current market price of a bag of maize (1=yes; no=0)
NATURE-COV	Nature of coverage (1=crops only, 2=crops and livestock)
GOV SUBS	Most preferred government subsidy (1= premium subsidy. 2=input subsidy, 3= revenue subsidy)
TIME-PUR CI	How long it would take a farmer to purchase crop insurance.
OUTB-PESTD	If outbreak of pests and diseases would be reason to purchase crop insurance (1=yes; no=0)
MORE THEFT	If more exposure to theft would be reason to purchase crop insurance (1=yes; no=0)

3.7.2 Objective 2: To identify the factors that influence farmers' preferences for crop insurance

To determine the relationship between socio-economic characteristics and farmers' preferences for crop insurance, logistic regression models were used to identify those factors that influence farmers' preferences for crop insurance.

Logistic regression models

In this model, the expected values of the dependent variable are dichotomous, meaning that the variable takes a value of one or zero. The effect of a unit change in the independent variable is not the same for all values of the independent variable (Makhura, 1994). These effects can be expressed as:

$\beta_k = \phi_0$; Where: (1)

$\phi_0 = \log[(P_i/1\text{-}P_i)|X_i]$ (2)

Or the log of odds of being interested in adopting crop insurance when X is fixed at X_i and

$\phi_1 = \log[(P_i/1\text{-}P_i)|X_{i+1}]$ (3)

Or the log of odds of being more interested in adopting crop insurance when X is changed to X_{i+1}. Therefore, the estimates in the logit model can be expressed as:

$\beta_k = \log\{[(P_i/1\text{-}P_{i+1})|X_i] /[(P_i/1\text{-}P_i)|X_i]\}$ (3-1)

Where the βs are the linear estimates of the log of odds ratios. By taking the antilog of (3-1) gives the odds ratio:

$\gamma = [(P_i/1\text{-}P_{i+1})|X_{i+1}] /[(P_i/1\text{-}P_i)|X_i]$ (3-2)

The denominator shown in (3-2) is the number of times in which the odds of being interested in adopting crop insurance exceeds the odds of not being interested in adopting crop insurance when the independent variable X, is fixed at X_i. The numerator is the odds being interested in adopting crop insurance when the X changes by one unit.

Schlotzhauer (1983) explained that the odds ratios indicate the number of times by which the odds of being interested in adopting crop insurance when the explanatory variable changes by a unit exceeding the odds of being more interested in crop insurance when the explanatory variable was fixed at X_i. Makhura (1994), illustrated the relationship between the probabilities and odd ratios. The author gave an example that when the probability of being commercial when the marketing efficiency was fixed at ME_i was 1.041, if the ME_i was increased by a unit to ME_{i+1} and the probability of being commercial associated with ME_{i+1} is 0.7 (P_{i+1}). Therefore, the probability of being non-commercial when the efficiency increases by a unit will be $0.3(1 - P_{i+1})$ and the odds of being commercial when efficiency increases by a unit will be 2.333. The odds ratio associated with a unit change in marketing efficiency will be 2.242 (2.333/1.041). Because the odd ratio is the exponent of beta estimate, it can be used to show the direction of the relationship between P_i and X_i. Hence, $\gamma > 0$ if there is a positive relationship and $\gamma < 0$ if the relationship is negative. The example is also relevant to the adoption of crop insurance.

To determine the change in probability of being interested in adopting crop insurance due to a unit change in an explanatory variable, Dp/Dx, the logits can be expressed as:

$\phi_i = \alpha + \beta X_i = \log(P/1\text{-}P)$ so the probability function can be expressed as $P = [\frac{e^{\phi}}{(1+e^{\phi})}]$ (4)

$Dp/d\phi = \{[\frac{e^{\phi}}{(1+e^{\phi})}] - [\frac{e^{\phi}}{(1+e^{\phi})}]\}^2 = P\text{-}P^2 = P\ (1\text{-}P)$ (5)

Where P (1-P) is maximised at P=0.5 and P(1-P) = 0.25. So, $d\phi/dX=\beta$.

3.7.3 Objective 3: To determine if maize farmers are interested in purchasing crop insurance

The farmers' interest to purchase crop insurance was determined by the percentage of farmers interested in purchasing crop insurance for their maize production. With the use of descriptive statistics, percentages, frequencies and tables, respondents were asked if they were familiar with crop insurance and if they had ever purchased it before. They were also given a brief description of what crop insurance and how it works; farmers were then asked if they were interested in purchasing crop insurance. The percentage of farmers interested in purchasing crop insurance indicates the level of demand among the farmers.

Hypotheses

Ho: The main hypothesis is that farmers are interested in purchasing crop insurance (Aidoo *et al*., 2014; Ghazanfar *et al*., 2015; Ellis, 2016).

Ho: Farmers who are familiar with crop insurance are more interested in purchasing crop insurance (Danso-Abbeam *et al*., 2014; Ellis, 2016; Xiu *et al*., 2012).

3.7.4 Objective 4: To assess the factors influencing farmers' likelihood to purchase crop insurance

The factors that influence farmers' interest to purchase crop insurance were estimated using the probit model using maximum likelihood method based on information on farmers who are interested and not interested in purchasing crop insurance. Factors used in the analysis based on literature included the socio-economic factors, farming characteristics, risk coping strategies and crop insurance awareness.

- ***The probit regression model***

To determine the relationship between the different factors and the farmers' interest to adopt and purchase crop insurance, the probit model was used. Probit models were used to identify those factors that influence farmers' interest to adopt and purchase crop insurance and to identify factors that differentiate between farmers who prefer it and those who do not prefer crop insurance; this was done for the entire sample size. This regression model has been the most frequently used model in determining the factors that influence the demand for crop insurance (Ellis, 2016). The probit model is suitable for dichotomous dependent variables, since the variable takes a value of one or zero (Mfungwe, 2012). The general probit model can be expressed as follows:

$$Y_i^* = \beta_0 + \sum_{i=1}^{n} \beta_n X_i + \mu_i \quad (6)$$

Where Y_i^* can be defined as a latent variable not observed, a dummy variable defined by Y_i is what is observed.

Y_i is the dichotomous dependent variable expressed as follows:

$Y_i = 1$, when a farmer is interested in adopting and purchasing crop insurance

$Y_i = 0$, when a farmer is not interested in adopting and purchasing crop insurance

β_0= is the intercept

β_i= the regression coefficients that explains the probability to farmers' interest to adopting and purchasing crop insurance

X_i= independent variables with an assumption that $\beta_n X_i$ is a normally distributed random variable

$\mu_i =$ the stochastic error term

The dependent variable is the interest to purchase crop insurance. The independent variables used in this study include socio-economic, farm characteristics, risk-coping strategies, loss experience and awareness of crop insurance. The probit model results include coefficients that only give the direction of the relationship between the independent and dependent variables. To interpret the relationships in terms of the interest to adopt and purchase crop insurance or not, the marginal effects were used. Therefore, the marginal effects for the estimated coefficients are expressed as follows:

$$\frac{\partial pr(y_i=1|x_i;\beta)}{\partial x_{ij}} = \frac{e^{x'\beta}}{[1+e^{x'\beta}]^2} \cdot \beta_j \quad (7)$$

In assessing the goodness of fit, the coefficient of determination (R^2) is commonly used for linear regression models. However, for logistic regression, logit models have similar interpretation. Makhura (1994) used two indicators, the ratio number of observations that were predicted and found to be correct to the total number of observations. The second indicator to be reported is the pseudo R^2 which is expressed as:

Pseudo R= Model X^2/ (N+ Model X^2). Unlike the linear model that uses the F-statistic to test the joint null hypotheses that H: $\beta_2 = \beta_3 = \ldots = \beta_k = 0$. In the logistic model, the likelihood ratio is used. The statistic follows a chi-square (χ^2) distribution when the null hypothesis is true. The likelihood test ratio, also referred to as the model X^2, can be expressed as:

Model X^2 = (-2LogL0)-(-2LogL1), where L1 is the value of the likelihood function for the full model as fitted and L0 is the maximum value of the likelihood function when all coefficients except the intercept are 0. In the probit model, the Pearson chi-square and the percentage correctly predicted were used in this study.

- ***Choice of independent variables and their description***

Variables that affected farmers' interest and preferences for crop insurance in the theoretical discussions were socio-economic, demographic factors, business information, risk attributes and risk management strategies. The factors included age, education, geographic position, yield risk, farming and loss experiences which can affect the crop insurance and risk preferences (Barry *et al*., 2004). Data were available for the use of these variables. Table 3.2 presents the description of the explanatory variables used in this study. The theoretical expectations of the variables used in the analysis for the factors that influence farmers' interest to purchase crop insurance and farmers preferences based on literature review are addressed in Table 3.3.

Table 3.2: Description of independent variables

Independent variable	Variable	Variable Description
Household characteristics		
Age of household head	AGEHH	Age of head of household (years)
Age of the second household head	AGE2HH	Age of the second household head (years)
Gender of household head	GENDER	Gender of household head (1 = male,0 = female)
Household Size	HSIZE	Number of family members (head count)
Marital Status	MARRIED	Farmer is married = 1; single = 0
Occupation	OCCUP	Major occupation of farmer (1= farming is the major occupation, 0 = other major occupation)
Education	HEDUC	Farmer attained the higher level of education = 1 ; lower level of education = 0
Farming Characteristics		
Membership	MEMBER	Membership in a farmer's union/association (1 = yes, 0 = no)
Location	LOCATION	Location of farmer (1 = Lubombo region; 0 = Hhohho region)
Receive farming education	FARMEDUC	Farmer receives farming education (1 = yes, 0 = no)
Access to credit	CRED	Ability of farmer to access to credit (1 = yes, 0 = no)
Farming experience	FARMEXP	Experience in farming maize (years)
Expected yield	EY	Expected yield after harvest (number of 100kg bags)
Crop type	CROPTYPE	Types of crops grown by farmer (1 = maize only, 0 = maize and other crops)
Amount consumed	AMOUNTCONS	Amount of maize consumed by farmer (number of 100kg bags)
Coping strategy		
Savings	SAVINGS	Farmer is able to save (1 = yes, 0 = no)
Crop insurance awareness		
Familiarity with crop insurance	FAM_CI	Knowledge of crop insurance (1 = yes, 0 = no)
Loss experience		
Loss experience	LOSSEXP	The number of years a farmer has experienced losses

Table 3.3: Hypothesised relationship with farmers' interest to purchase crop insurance

Independent variables	Independent variable	Dependent variable- Interest to purchase crop insurance	Source of hypothesised relationships
Household characteristics		**Interest decision**	
Age of head of household	AGEHH	-	(Aidoo *et al*., 2014; Shashi and Umesh, 2015; Abdullah *et al*., 2014)
Gender of head of household (males)	GENDER	+	(Ellis, 2016; Danso-Abbeam *et al*., 2014)
Household size	HSIZE	-	(Danso-Abbeam, 2014; Ali, 2013; Wan,2014)
Marital status	MARRIED	+	(Ellis, 2016; Danso-Abbeam *et al*., 2014)
Occupation	OCCUP	+	(Ellis, 2016)
Education level	EDUC	+	(Aidoo *et al*., 2014; Danso-Abbeam *et al*., 2014; Ellis, 2016)
Farming Characteristics			
Membership	MEMBER	+	Danso-Abbeam *et al*., 2014; Balcita, 2015; Liu *et al*., 2010).
Location	LOC	+/-	(Wan, 2014; Barry *et al*., 2004)
Farming education	FARMEDUC	+	(Ellis, 2016; Ali, 2013)
Access to credit	CRED	+/-	(Ghazanfar *et al*., 2015; Ellis, 2016; Ali, 2013; Olila, 2014).
Farming experience	FARMEXP	-	(Abdullah *et al*., 2014; Ellis, 2016, Danso-Abbeam *et al*., 2014)
Expected yield	EY	+	(Balcita, 2015; Barry *et al*., 2003; Shaik *et al*., 2008)
Crop type	CROPTYPE	+/-	(Ali, 2013; Ellis, 2016; Ghazanfar *et al*., 2015)
Coping Strategies			
Savings	SAVINGS	+	(Aidoo *et al*., 2014)
Crop insurance awareness			
Familiarity with crop insurance	FAM_CI	+	(Danso-Abbeam *et al*., 2014; Ellis, 2016; Xiu *et al*., 2012).
Loss experience (dummy)	LOSSEXP	+	(Ghazanfar *et al*., 2015; Ellis, 2016; Barry *et al*., 2004)

3.7.5 Objective 5: To identify ways of improving farmers' acceptability of crop insurance

To identify ways of improving farmers' acceptability of crop insurance, farmers were asked to suggest ways that could increase the adoption of crop insurance. Farmers who were not interested in purchasing crop insurance were asked to state reasons why they are not interested in doing so, in order to find out what could be done to make more farmers interested in purchasing crop insurance. Farmers who were interested in purchasing crop insurance were also asked to identify ways in which more farmers could be interested and motivated to adopt and purchase crop insurance. Results were presented in descriptive statistics which include tables with frequencies, percentages and charts.

3.8 CONCLUSION

This chapter provided a description of the study area of Maphungwane in the Lubombo region and Sigangeni in the Hhohho region. Purposive and snowballing sampling methods were used in this study. Furthermore, the data collection method of using well-structured questionnaires, through face-to-face interviews was described and issues related to model specification were also discussed. The probit model was used to identify factors that influence farmers' interest to purchase crop insurance. Binary logistics regressions were used to identify those factors that influence farmers' preferences for crop insurance.

CHAPTER 4

CHARACTERISTICS OF SURPLUS MAIZE PRODUCERS

4.1 INTRODUCTION

The foregoing chapter discussed a description of the study area, sampling and data collection methods. This chapter provides an overview of the characteristics of the sample households in order to assess the variables for the specification of the model. The first section discusses the socio-economic, household and farming characteristics and the last section discusses familiarity with crop insurance, interest to purchase crop insurance, financial endowment and the preferences for crop insurance. Some additional salient statistics are provided in Appendix A.

4.2 SOCIO-ECONOMIC CHARACTERISTICS OF SAMPLE HOUSEHOLDS

The socio-economic factors reflect household livelihoods and also influence the economic behaviour of households in the rural areas. Hence, this section discusses the socio-economic characteristics of the sample households in the study areas. It covers information on the household structure, the risk characteristics and the asset structure.

4.2.1 Household structure

The household structure is presented in terms of family size and participation of members in various activities. Table 4.1 shows the size and structure of the household.

4.2.1.1 Household size

In this study, the household size is defined as the number of household members who stayed in the household full-time during the time of study. In this study sample, a typical household had about seven family members. The number of people in the households ranged from one person to 23 people. Out of the seven members, two were adults and five were children. In a number of cases, the household consisted of only a husband and wife, while others were polygamous and extended families (in-laws, grandparents and relatives). The larger family size was, typically, a result of a polygamous or an extended family arrangement. Such extended families are common in Swaziland. Typically, a larger family size is associated with

a larger consumption expenditure, which may affect a farmer's affordability of crop insurance and lead to limited uptake of crop insurance. However, a larger family size may also be an incentive for farmers to invest more in agriculture so as to feed their families. Farmers may be motivated to purchase crop insurance so that they receive compensation in case of crop losses.

Table 4.1: Household size

Variable	N	Mean	Minimum	Maximum	Std.Dev
Total male members	150	3.53	0.00	12.00	2.03
Total female members	150	3.94	0.00	12.00	2.21
Number of children	150	4.86	0.00	15.00	2.76
Total family members	150	7.47	1.00	23.00	4.01

4.2.1.2 Gender, age and education of the respondents

Usually, the household head is responsible for coordinating, decision making regarding all household activities and also providing for the families. Therefore, the gender, age and education of the household head can influence household decision-making processes. The household head was the husband or the wife, if she was a widow. Of the 150 respondents, 126 were household heads. The other 24 were other family members responsible or involved in the farming activities in the household. In the rural areas of Swaziland, the male heads tend to migrate to the urban areas to seek employment. In the absence of the husbands, the wives are left to run and make household decisions as *de facto* (functional) heads. Figure 4.1 shows that in 41.27% of the households, this is the case. About 24.60% of the households are headed by a *de jure* (legal) female head. In the sample, about 65.87% of the households are effectively headed by women.

Since the majority of respondents are women who make household decisions, they may be more interested in purchasing crop insurance. They may want to minimise risks as much as possible, because farming is important for their livelihoods. However, since they are responsible for their families' livelihoods, they may lack the financial means to purchase crop insurance, especially, when their husbands fail to provide financial support.

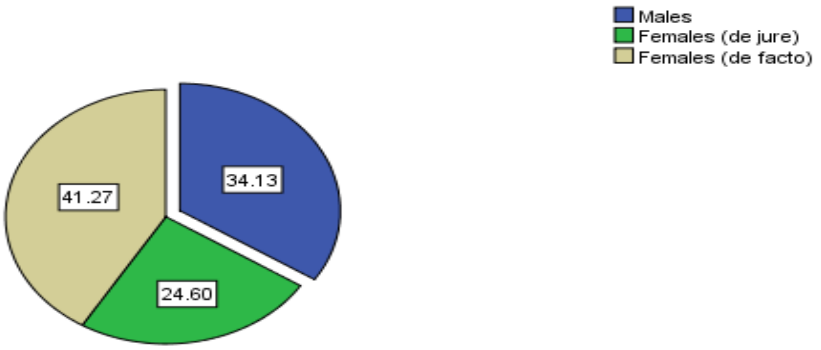


Figure 4.1: Gender of the household head

The age of the respondents is one of the important factors in understanding their views and preferences about particular problems or the acceptability of innovations such as crop insurance. A higher age may indicate a high level of experience or exposure to certain activities. A typical household head was 52 years, with the oldest being 91 years and the youngest 18 years. In Table 3.3, a negative relationship was hypothesised between age and farmers' interest to purchase crop insurance. As such, the average age of 52 indicates a population of older farmers. This may suggest that these farmers have a high level of experience and are more confident in their farming techniques. Hence, they may be less interested in purchasing crop insurance.

The 91-year-old respondent was very articulate and very involved in the farming activities in the household. This suggests that older people are still actively involved in farming to support their families. The 18-year-old respondent was also involved in farming activities, but received assistance from their grandparents. Another age pattern relates to household head and the second member of the household. In Table 4.2, a 13 years age difference is observed between the household head and second member of the household. This is normal and common in most rural areas in the country, where a head would be a husband and the second member a wife. Generally, most females get married earlier and start families. This may suggest that most farmers have responsibilities of providing for their families. As such, they may be motivated to invest more in agriculture; therefore, they are likely to be more interested in purchasing crop insurance.

Table 4.2: Age of household head and second household member

Variable	N	Mean	Maximum	Minimum	Std.Dev
Age of respondents	150	52.26	91.00	18.00	16.52
Age of H-Head	73	61.67	91.00	33.00	13.96
Age of second household member	53	48.42	73.00	26.00	12.06

The education level is a critical factor because it may affect the respondent's attitudes, their way of understanding and the acceptability of crop insurance, since the response of an individual is more likely to be determined by his or her educational status. As shown in (Table 4.3), out of the 150 respondents, the majority had reached the high-school level of education. This may suggest that the majority of respondents can understand and learn how crop insurance works. As such, they may have a positive attitude towards crop insurance because they can understand its benefit better than farmers who have no formal education.

Table 4.3: Education level of respondents

Variable	Number of respondents	%
No formal education	24	16.0
Primary school	49	32.7
High school	64	42.7
Tertiary education	13	8.7
Total	150	100

4.2.2 Household endowment

4.2.2.1 Land

Land unavailability can be a major constraint for rural households that wish to increase their farming activities (Makhura, 2001; FAO, 1994). In the study areas, households are located in the Swazi Nation Land (SNL), where they have usage rights to residential and arable land. Respondents were asked about the size in hectares of the area they use for farming. Table 4.4

shows that the average area for the study sample was 2.28ha. Land allocation in the SNL is determined by the chief, who considers the size of the available land in the area. As the demand for land increases, land becomes insufficient and households are being allocated less of it.

In general, none of the households own the land, so farmers cannot use it as collateral. However, they are free to use the land allocated to them in other ways. Farmers with less land and those who want to increase their land can rent some of the fields from other farmers who do not use it. Households who usually rent land from other farmers are those who are allocated farming land far from their homes, who prefer nearer places, and those are allocated to land that is difficult to cultivate. The fact that these farmers cannot use the land as collateral hinders agricultural development, since they cannot obtain credit to finance further operations and increase their production. Their capability to purchase crop insurance is therefore limited. Farmers who rent farming land may be less interested in purchasing crop insurance, especially if the land allocated is difficult to cultivate and the returns are not substantial.

Table 4.4: Land size and ownership

Variable	N	Mean	Min	Max	Std.Dev	% owning	%renting
LANDSIZE (ha)	150	2.28	0.25	10.00	1.70	0.00	6.67

4.2.2.2 Mobile and movable assets

Mobile assets are any motorised equipment on wheels, such as vehicles and tractors. Movable assets may include tangible agricultural implements (such as a tractor, trucks, plough, planter or cultivator) that can be moved around. Few households own such assets and most households usually hire tractors for farm activities. This is also evident in this study sample: Table 4.5 shows that only 20% of the respondents owned any one of these assets. Out of all the respondents, 80% of the households did not own such assets. These households usually hire the government tractors or other farmers' tractors. This suggests that farmers who own these assets could produce more maize. An increase in maize production may be an incentive for farmers to invest more in crop insurance to receive protection against potential losses. With an increase in production, farmers might be able to sell more maize and get more

income; therefore, they would be better able to afford to purchase crop insurance and more likely to demand more crop insurance services.

Table 4.5: Ownership of mobile and movable assets

Variable	N	% Owning
Tractor ownership	150	13.33
Other implements ownership	150	6.67
Total		20.0

4.2.3 Farming characteristics

Farming characteristics can influence farmers' decisions and attitude towards crop insurance. In this case, farming characteristics are represented by types of crops, livestock, experience households have in farming (in years), the expected yield (the number of 70 kg bags produced) and farming education.

4.2.3.1 Types of farming

In the study sample, all the respondents were maize farmers; some farmers diversified their crops to horticultural and other field crops. However, the main crop was maize. As shown in Table 4.6, the majority of households farm only maize.

Table 4.6: Types of crops

Variable	Number of respondents	%
Maize only	127	84.7
Maize and Beans	13	8.7
Maize, Beans and Sweet potatoes	1	0.7
Maize and potatoes	5	3.3
Maize, Veggies and Beans	1	0.7
Maize and Veggies	3	2.0
Total	150	100

Typically, as Table 4.7 highlights, households produce about 41 bags of maize, which is measured as the actual yield (AY). The maximum yield is obtained by farmers who have more farming land and provide all necessary inputs. Farmers tend to produce more maize and consume less; they also sell more maize than they consume. Hence, some sell all their maize, while others consume it and sell the surplus. This may suggest that farmers prefer getting an income out of their produce, which they can use to pay their children school-fees and provide for their family needs. Furthermore, this may suggest that increasing production can benefit farmers, since they prefer selling their maize to get income. An increase in income could therefore allow farmers to afford to purchase crop insurance and this could be an incentive to increase production, since they will receive compensation in case of crop losses.

Table 4.7: Maize and livestock characteristics

Variable	N	Mean	Min	Max	Std.Dev
Maize production (AY)	150	41.92	1.00	250.00	44.70
Maize sold (#100kg bags)	150	25.25	0.00	228.00	40.38
Maize consumed	150	15.88	0.00	80.00	13.37

4.2.3.2 Farming experience and the expected yield

A typical household has experienced about 26 years in farming. In Table 3.3, a negative relationship was hypothesised between farming experience and farmers' interest to purchase crop insurance. Generally, 26 years of farming experience is higher and may suggest that respondents have more farming experience. This may suggest that most farmers are more experienced with maize farming. As such, they may be confident in their farming methods and resistant new technologies such as crop insurance.

Typically, Table 4.8 shows that households expect to get 49 (70 kg) bags of maize after harvesting. Farmers would learn from past events and the losses experienced to determine their expected yield. A positive relationship was hypothesised between the EY and farmers' interest to purchase crop insurance. As such, a higher EY suggests that farmers would be more interested in purchasing crop insurance because they know they can sell more maize and get more income, and thus, afford to purchase crop insurance.

Table 4.8: Farming experience and the expected yield

Variable	N	Mean	Min	Max	St. Dev
Farming experience (years)	150	26.49	1.00	70.00	15.33
EY (bags)	150	49.41	2.00	300.00	48.65

A difference in the expected yield can be seen in the different regions (see Appendix A). A typical farmer in the Hhohho region generally expects to get about 56 bags, while a typical farmer in the Lubombo region expects to get about 42 bags. The Hhohho region receives the most rainfall, whilst Lubombo is the driest region in the country. This may imply that farmers in the Lubombo region would be more interested in purchasing crop insurance than farmers in the Hhohho region, since they experience more losses.

4.2.3.3 Farming education

Educating the household heads on how to improve farming productivity, includes choice of the correct seed varieties, pest control measures, farming technologies and other farm-related decisions. Respondents were asked if they received farming education or advice and to identify the source of the information. According to Table 4.9, out of the 150 respondents, an average of 60.7% received farming education, mainly through extension officers allocated to the area. The availability of extension services ensures that farmers are educated on risk management strategies such as crop insurance, since extension officers are usually equipped with such knowledge. This may suggest that farmers who have access to extension services are more likely to be interested in purchasing crop insurance because they are more likely to be aware of its role and benefits.

Table 4.9: Farming education and its sources

Variable	N	Number of respondents	%
Receive farming education	150	91	60.7
Source of farming education:	91	70	76.9
Extension services	91	15	16.5
Farmers ‘associations/union	91	2	2.2
Media			

4.2.4 Risk characteristics

Risk is an important aspect of the farming business. It involves uncertainties related to weather, prices, yields, global markets, government policies and other factors that impact farming and can cause variations in farm income. It is important to investigate farmers' attitudes towards risk and to explore the risk management mechanisms they employ to cope with it (USDA, 2016). The issue of risk is a nexus between farming activities and insurance.

4.2.4.1 Farmers' attitudes towards risk

Farmer's attitudes towards risk are an important factor in determining how farmers view and cope with risk. Respondents were asked if they thought their production was exposed to any kind of agricultural risk, and if they had ever experienced any production loss previously. Those who indicated that they had experienced losses were asked to say how many years they had experienced losses for. Table 4.10 indicates that the majority of the respondents thought their production was exposed to many agricultural risks and 92.0% had experienced production losses.

According to Table 4.11, the maximum number of years (30 years) loss experience was in the Lubombo region and experienced by a 91-year-old farmer. This indicated that agriculture is a risky enterprise which requires sustainable risk management strategies. Even though farmers face agricultural risks, farming is very important to them: it is a tradition and a means of survival for most of them. Hence, most farmers may be interested in purchasing crop insurance so that they are compensated in case of crop losses and are better able to provide for their families. When comparing the two regions, farmers in the Lubombo region have experienced more losses than farmers in the Hhohho region due to the different climatic conditions of the regions. This may suggest that farmers in the Lubombo region are more interested in purchasing crop insurance than farmers in the Hhohho region.

Table 4.10: Risk exposure and experience

Variable	N	Number of respondents	%
Risk exposure	150	145	96.7
Experience prod loss	150	138	92.0

Table 4.11: Crop loss

Variable	N	Mean	Min	Max	Std. Dev.
Loss experience (years)	138	2.88	1.00	30.00	3.10

4.2.4.2 Risk management strategies

Farmers have different risk management strategies which they use to cope with risk. Some of these strategies include the selling of assets, taking out loans, diversifying their production, hedging maize prices, purchasing high-quality seeds and improving their technical skills. Respondents were asked if the risk management strategies they employed were effective. According to Table 4.12, the majority of the respondents (74.7%) said their strategies were effective. They indicated that, if they did not use them, they would have failed to continue with their maize production. This implies that farmers are confident in their coping mechanisms, including those related to coping with risk. This may suggest that they prefer familiar coping strategies over new risk management strategies such as crop insurance; therefore, they may be less interested in purchasing crop insurance.

Table 4.12: Opinion if risk coping strategies were effective during the El Niño drought

Variable	N = 150	Number of respondents	%
Highly effective		84	56.0
Effective		28	18.7
Less effective		19	12.7
Not at all		15	10.0
Don't know		4	2.7

4.3 FINANCIAL ENDOWMENT

In this study, financial endowment is represented by farmer's access to credit, farm income, savings, insurance policies and non-farm income. Households tend to depend more on financial assets, as they integrate with the monetary economy (Makhura, 2001).

4.3.1 Access to credit

Access to credit can be defined as the ability of farmers to borrow money to finance agricultural production. Respondents were asked if they accessed credit to finance agriculture production during the previous twelve months. Table 4.13 shows that only 24% indicated that they had accessed credit, mainly from rotating savings and credit associations (ROSCAs), which are popular among women in the communities. About 76% of the households did not access credit, mainly because some could finance their own production, or they had no source of credit, or because they disliked incurring debt and preferred selling their assets to borrowing. Lack of access to finance was one of the key impediments to farmers: it hindered improvement in the efficiency of agricultural productions and the adaptation of better technologies by farmers.

About 59% of the Swazi people do not borrow (FinScope, 2014). Those who do, rely on family, friends or other informal sources such as ROSCAs. This is in line with the findings that those farmers who borrow rely on ROSCAs, friends and relatives. However, more farmers in the study indicated lack of access to credit that were identified in the FinScope survey. Rural communities, particularly those involved in farming, are lagging behind the national financial inclusion process. This may imply that there is a need for targeted, inclusive finance policies and programmes to support farmers. It also suggests that farmers have no access to credit to finance their maize production, and this may make farmers not to progress from subsistence to commercial farming. This may be another reason why farmers may be less interested in purchasing crop insurance.

Table 4.13: Access to credit

Variable	N	Number of respondents	%
Obtained credit	150	36	24.0
Sources of credit:	36		
ROSCAs		18	50.0
Friends and relatives		8	22.2
Formal institutions		5	13.9
NGO		4	11.1
Informal lenders and relatives		1	2.8

4.3.2 Farm income

Farm income is an important element which determines the ability to afford risk management strategies (technologies) such as crop insurance. Table 4.14 highlights that a typical household earns an average income of R8255.50 per season. The farmers with no income did not sell their maize in the 2015/16 season, despite the fact that they are usually maize sellers. They only harvested enough to feed their families and to give some to relatives. The decision not to sell was a result of lower production the previous year. A significant difference is seen between the two regions (see Appendix A). The average income received in a household in the Hhohho region was R13 020.13, while in the Lubombo region it was R3490.87. The difference was a result of the climatic conditions in the Hhohho region and the fact that most farmers in that region produce for selling purposes. The fact that farmers in the Hhohho region received more income and had favourable climatic conditions may suggest that farmers in this region are less interested in purchasing crop insurance. On the other hand, farmers in the Lubombo region received less income due to unfavourable climatic conditions, which may motivate them to seek for risk management strategies such as crop insurance, since farming is vital for their livelihoods and the mere fact that farmers are solely dependent on agriculture means that farming cannot stop.

Table 4.14: Farm income

Variable	N	Mean	Min	Max	Std. Dev.
Income (R)	150	8255.50	0.00	116130.00	15924.17

4.3.3 Non-farm income

Non-farm income refers to all sources of household income besides farming. This has a bearing on farmers' interest in purchasing crop insurance. According to Table 4.15, out of the 150 households surveyed, 60% had non-farm income and 40% were solely dependent on farming for survival. Most of the farmers had a non-farm income ranging from R1000 to R4000 per month, as compared to other similar non-farm income ranges. However, about 47 households earned non-farm income of more than R4000 per month. This implies that most farmers received less income, which they used for their household needs. With less income, farmers would experience challenges in paying crop insurance premiums. Despite the fact that some farmers may be interested in adopting crop insurance, the affordability of crop insurance may be an issue that affects their interest in purchasing crop insurance.

Table 4.15: Non-farm income and monthly income

Variable	N	Number of respondents	%
Have other source of income	150	90	60.0
Non-farm income/month:	90		
≤R1000		13	14.4
R1000-R4000		30	33.3
R4000-R8000		13	14.4
R8000-R12000		15	16.7
R12000-R16000		6	6.7
R16000-R20000		4	4.4
≥R20000		9	10.0

4.3.4 Savings and insurance policies

Of all the respondents, Table 4.16 brings out that only 32.7% are able to save and only 26.7% have insurance policies. About 27% of the Swazi people have no access or have not used any financial products or services to manage their finances (FinScope, 2014). About 22% were able to save, but they kept their money at home. According to the FinScope survey, about 73% of the Swazi people did not have insurance. Similarly, according to this study, it can also be noted that 73.3% of the respondents had no insurance in 2017. This shows that the majority of maize farmers have no insurance policies. This may suggest that farmers are unfamiliar with crop insurance, have a stereotyped view of insurance or cannot afford to purchase it. All these factors may contribute to farmers' limited interest in purchasing crop insurance.

Table 4.16: Savings and insurance policies

Variable	N=150	% Owning	% Not owning
Savings		32.7	67.3
Insurance (health, life, property etc.)		26.7	73.3
Agricultural insurance		0.0	100

Of all the respondents, none had agricultural (crop or livestock) insurance. Farmers who had any kind of insurance policy only had health, life or property insurance. Since none of the households had crop insurance, the next step was to determine their attitudes and preferences towards crop insurance and to assess whether there is a demand for crop insurance and what conditions farmers prefer for crop insurance. This calls for the agricultural insurance industry and the government of Swaziland to promote the idea of agricultural insurance to farmers.

4.4 CROP INSURANCE INFORMATION

In this section, farmers were asked if they were familiar with crop insurance and if they know any crop insurance providers in the country. Those respondents familiar with crop insurance were also asked if they knew about its benefits and what their opinion was regarding its effectiveness. Out of all the respondents, none had ever purchased crop insurance before.

4.4.1 Knowledge of crop insurance

Knowledge of crop insurance influences the interest to purchase it. According to Table 4.17, out of the 150 respondents, only 9.3% were familiar with the idea. These respondents were familiar with crop insurance were asked if they thought crop insurance was effective; out of the 14 respondents, the majority thought crop insurance was extremely effective. This indicates a lack of education and promotion of crop insurance in the country, and farmers may be less interested in purchasing it because they have no knowledge of its benefits and accessibility. Farmers need to be educated about crop insurance, then their preferences for crop insurance can be identified.

Table 4.17: Familiarity and effectiveness of crop insurance

Variable	N	Number of respondents	%
Farmers familiar	150	14	9.3
Farmers not familiar		136	90.7
Effectiveness of CI**:**	14		
Extremely effective		6	42.9
Effective		5	35.7
Less Effective		2	14.3
Not at all effective		1	7.1

4.4.2 Farmers' interest to purchase crop insurance

Since the majority of the households were not familiar with crop insurance, to determine if farmers were interested in crop insurance the concept was briefly explained to them. Respondents were asked if they would be interested in purchasing crop insurance for their maize production. The majority of households showed an interest in doing so.

Table 4.18: Farmers' interest to purchase crop insurance

Variable	N	Interested	Not Interested
Familiar farmers	14	6 (42.9 %)	8 (57.1 %)
Unfamiliar farmers	136	72 (52.9 %)	64 (47.1 %)
Total	150	78 (52.0 %)	72 (52.0 %)

According to Table 4.18, out of the 9.3% of the respondents familiar with crop insurance but who had never purchased crop insurance, only 42.9% were interested in purchasing crop insurance for their maize production and 57.1% were not interested in purchasing crop insurance. This indicates that being familiar with crop insurance does not guarantee that a farmer will be interested in purchasing it. Out of the 90.7% respondents who were unfamiliar with crop insurance, after a brief description of what crop insurance is, 52.9% of the respondents were interested in purchasing crop insurance. Lack of education on crop insurance is one of the key factors that contributes to farmers not buying crop insurance. Out of the 150 respondents, 78 were interested in adopting crop insurance. Overall, the majority of respondents were interested in purchasing crop insurance.

Farmers' interest to purchase crop insurance differs between the two regions. In the Lubombo region, Table 4.19 indicates that 72% of the respondents were interested in purchasing crop insurance, whilst only 32% in the Hhohho region were interested in purchasing crop insurance for their maize production. Farmers in the Hhohho region felt they could cope with risk themselves and weather conditions permitted them to do so as the area is less affected by events such drought in comparison with the other regions. While farmers in the Lubombo region were more interested in crop insurance, they felt that, given the climatic conditions of the area, they could benefit from it. It therefore seems clear that farmers faced with more risks and uncertainty are more interested in purchasing crop insurance, and that any plans to introduce crop insurance should target vulnerable regions first.

Table 4.19: Farmers' interest to purchase crop insurance in the two regions

Regions	N	Interested	Not Interested
Hhohho	75	24 (32.0 %)	51 (68.0 %)
Lubombo	75	54 (72.0 %)	21 (28.0 %)
Total	150	78 (52.0 %)	72 (48.0 %)

4.5 DIFFERENCES IN CHARACTERISTICS OF RESPONDENTS INTERESTED OR NOT INTERESTED IN PURCHASING CROP INSURANCE

This section discusses the differences between farmers who were interested in purchasing crop insurance and those who were not interested in doing so with respect to socio-economic, household and farming characteristics of the farmers.

4.5.1 Socio-economic characteristics

Out of the 150 respondents, Table 4.20 highlights that 56.5% of the female farmers were interested in purchasing crop insurance and only 43.5% male farmers were interested in doing so. Male farmers tend to be more confident about their farming methods and risk-coping strategies, while female farmers tended to be more risk-averse than males. Typically, more single farmers (68%) were interested in purchasing crop insurance than married farmers (32%). Married farmers generally have children; hence, they tend to have more responsibilities than single farmers. This may imply that Swazi farmers with fewer responsibilities are better able to afford purchasing crop insurance than married farmers.

Respondents who had attained higher education (high school and tertiary level) were more interested in purchasing crop insurance than farmers who had no formal education. Respondents who had attained a lower level of education (primary education) were less interested in purchasing crop insurance than the farmers who had no formal education. This is consistent with Ellis (2016), who found that educated farmers were more willing to purchase insurance compared to uneducated and less educated farmers. This was definitely the case with farmers in this study. Typically, respondents who had other major occupations besides farming were more interested in purchasing crop insurance than the farmers who had farming as the major occupation.

Table 4.20: Socio-economic characteristics of farmers

Socioeconomic characteristics		***N***	***% Interested***	***% Not interested***
Gender	Male	58	44.8	55.2
	Female	92	56.5	43.5
MS	Single	25	68.0	32.0
	Married	125	57.6	42.4
Education	No formal	24	54.2	45.8
	Primary School	49	54.7	45.3
	High School	64	45.8	54.2
	Tertiary	13	45.3	54.7
Occupation	Farming only	97	44.3	55.7
	Other businesses	53	55.7	44.3

4.5.2 Household characteristics

The independent sample t-test was used to test the mean difference for the continuous variables, by showing whether there was a statistically significant difference between farmers interested and not interested in purchasing crop insurance with respect to the different household characteristics. The age of the household head of the farmers interested or not interested in purchasing crop insurance was found to be statistically different. Farmers interested in crop insurance were younger compared to farmers not interested in doing so. This may imply that younger farmers are more willing to adopt new technologies. Therefore, educating younger farmers more about the benefits of crop insurance is likely to increase the adoption of crop insurance in the country. However, the household size and incomes of the farmers interested or not interested in purchasing crop insurance were similar, since none were found to be significant.

From Table 4.21, it was found that the farming experience of farmers interested and/or not interested in purchasing crop insurance was found to be statistically different. Farmers interested in purchasing crop insurance had less farming experience compared to farmers not interested in purchasing crop insurance. This implies that farmers with more farming experience prefer purchasing crop insurance to protect their agricultural businesses and

minimise risks in order to safeguard the livelihoods of their families. However, there were no statistically significant farm sizes between farmers interested and farmers not interested in purchasing crop insurance.

Table 4.21: Characteristics of farmers interested and not interested in purchasing CI

Continuous Variables	**Interested** ***(Mean)***	**Not interested** ***(Mean)***	**Significance** ***t-test***
Age of Household Head (average years)	47.59	57.32	-3.735***
Household Size (average household size)	7.88	7.01	1.333
Farm Size (average hectares)	2.48	2.32	0.517
Farming Experience (average years)	21.17	27.28	-2.473**
Income (average income)	R5687.42	R9819.38	-1.599

4.5.3 Farming characteristics

Table 4.22 indicates that out of the 127 of the respondents who only grew maize, 50.4% were interested in purchasing crop insurance. Out of the 49 farmers who had savings, 71.4% were also interested in purchasing crop insurance. This implies that encouraging farmers to save is likely to increase the uptake of crop insurance in Swaziland. Farmers who had more loss experience were more interested in purchasing crop insurance and farmers familiar with crop insurance were less interested in purchasing crop insurance. Those respondents not interested in purchasing crop insurance received more farming education had more access to credit and grew maize and other crops when compared to farmers interested in purchasing crop insurance.

Table 4.22: Farming characteristics of farmers

Farming Characteristics		***Interested (%)***	***Not interested (%)***
Receive farming education	Yes	49.5	50.5
	No	55.9	44.1
Crop type	Maize only	50.4	49.6
	Maize and other	46.2	53.8
Access credit	Yes	47.2	52.8
	No	53.5	46.5
Savings	Yes	71.4	28.6
	No	42.6	57.4
Loss Exp.	Yes	53.6	46.4
	No	36.4	63.6
CI awareness	Yes	60.0	40.0
	No	51.1	48.9

4.6 FARMERS' PERCEPTION ON CROP INSURANCE

Awareness of crop insurance and its properties had an effect on the farmer's decision to purchase crop insurance. A lack of information is a major constraint on crop insurance adoption. Farmers who are aware of insurance have more information on crop insurance than farmers who have no knowledge of crop insurance (Barry *et al*., 2003). Out of the 150 respondents, only 9.3% were familiar with crop insurance while 90.7% had no knowledge of crop insurance. This shows that farmers lack information on crop insurance availability and its benefits and there is a need to educate farmers about crop insurance and its benefits.

Table 4.23 shows that out of the 9.3% of farmers familiar with crop insurance, none had ever purchased it. Those farmers were asked to state reasons why they have never purchased it before: 42.9% said they lacked sufficient knowledge to make the decision to purchase crop

insurance, 49.9% said it was too expensive, 14.2% said they could cope with risks on their own, 7.1% said they did not trust insurance companies. This indicates that the farmers lack education about the effectiveness and benefits of crop insurance. Educating farmers about crop insurance has the potential to increase farmers' demand for crop insurance.

Table 4.23: Purchasing crop insurance

Farmers familiar with crop insurance	N=14	Yes (%)	No (%)
Ever purchased CI		0.0	100
Reason:			
Lacked sufficient knowledge		42.9	57.1
Too expensive		49.9	50.1
I can cope with risk on my own		14.2	85.8
I do not trust insurance companies		7.1	92.9

Out of the 150 respondents, 52% were interested in purchasing crop insurance. Farmers who had experienced a severe drought in 2015/16, were then asked about the likelihood of their purchasing crop insurance before and after the drought.

Figure 4.2 shows their likelihood of results before the drought: 15.4% responded with 'highly likely', 57.7% with 'likely', 12.8% with 'unlikely' and 14.1% with 'highly unlikely'. The majority of farmers said they would have been likely to purchase crop insurance before the drought if they were informed about it. This indicates that farmers recognise the importance of crop insurance, considering the risky nature of agriculture. It also suggests that educating farmers about crop insurance can increase adoption, since farmers will have information about its benefits in the event of devastating losses.

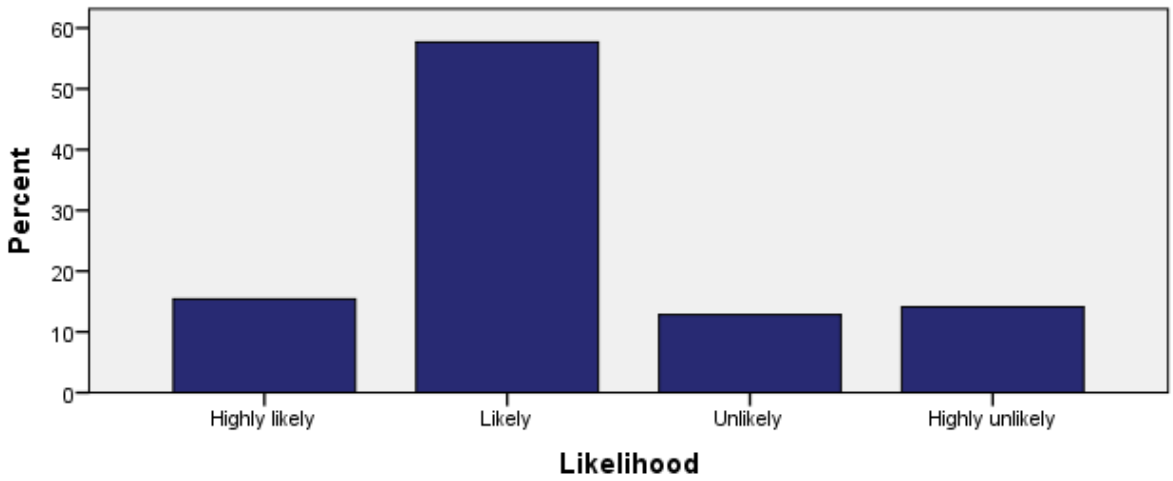


Figure 4.2: Farmers' likelihood of purchasing crop insurance before the drought

Figure 4.3 illustrates the farmers' likelihood of purchasing crop insurance after the drought results: 46.2% responded with 'highly likely' and 53.8% with 'likely'. The likelihood of purchasing crop insurance after the drought increased because, after experiencing massive losses, the farmers were more responsive to crop insurance. None of the farmers had an 'unlikely' purchasing response. This indicates that farmers prefer purchasing crop insurance to losing their produce. It shows that farming is not just a tradition to these farmers but a means of survival.

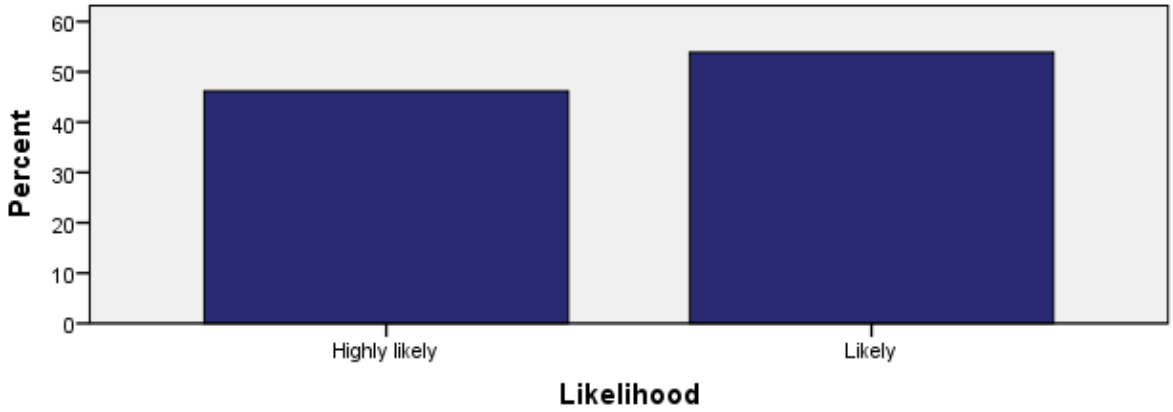


Figure 4.3: Farmers' likelihood of purchasing crop insurance after the drought

4.7 FARMERS' PREFERENCES FOR CROP INSURANCE

Farmers that were interested in purchasing crop insurance were given a range of crop insurance feature options from which they selected their preferences. Finding the crop insurance features/attributes began with a literature review of relevant policy attributes and their importance in the available choices. Farmers were asked to make choices on features such as risk cover, coverage levels, premiums, nature of coverage and subsidies, among other aspects. The following results present the frequencies, percentages and table of farmers' preferences on the crop insurance features.

4.7.1 Risk cover

Risk cover assists in assessing farmers' preference for either the multi-peril cover, single-peril or the weather index-based crop insurance. Asking farmers about the type of risk cover they prefer is important because it encourages them to engage with the idea of crop insurance. Before asking the respondents, the types of crop insurance were explained to them. The respondents were then asked to make a choice about which one they preferred. Table 4.24 brings out that the majority of maize farmers in Swaziland (82.1%) preferred the multi-peril type of crop insurance, due to the fact that it provides cover against a number of specified risks. The farmers preferred it because they know that agricultural production incurs numerous risks, so insuring their production against them is the right choice. In this way, the farmers preferred to minimise risks as much as possible.

Table 4.24: Preferred risk cover

Dependent variable	N	Freq.	%
Risk Cover:	78		
Multi-peril cover		64	82.0
Single-peril		7	9.0
Weather Index-based		7	9.0

4.7.2 Coverage levels

A coverage level refers to an area of farming land that the farmer prefers to insure; this option allows farmers the opportunity to choose the portion of land that they wish to insure. Olila (2014) reported that there are two decisions that usually determine the amount of coverage, namely, the deductible percentage, which refers to the amount of claim the insured has to pay, and the price at which yield losses are transformed into cash. Respondents were asked how much of their farming land they preferred to cover against potential losses. The study sample consists of farmers with different farm sizes; therefore, having different coverage levels helps in informing decisions on the most preferred coverage levels among the different farmers. Asking farmers for information on their preferred coverage level is relevant and required in the designing of policies, ex-ante design process of crop insurance programmes.

Even in developed countries such as the USA, coverage levels are limited to 75%, because of moral hazard issues. Respondents were given various options of coverage levels and asked to express their preferred level. Table 4.25 shows that the majority of the farmers preferred the $\leq 50\%$ coverage level, because of cost and risk reasons. This was based on the fact that farmers associate higher coverage levels with higher premiums. Hence maize farmers in the country preferred insuring at least half of their land size.

Table 4.25: Preferred coverage levels

Dependent variable	N	Freq.	%
Coverage Levels:	78		
$\leq 50\%$		39	50.0
60%		5	6.4
70%		2	2.6
80%		2	2.6
90%		0	0
100%		30	38.4

4.7.3 Premiums

The cost of crop insurance is important because it can determine the demand for crop insurance. Higher premiums can be a disincentive for farmers to purchase crop insurance. Premiums are usually estimated based on loss and historical yields; premium levels tend to be inversely proportional to the yield levels (Olila, 2014). Therefore it is important to determine the premium rates that farmers can afford and are interested in paying towards a crop insurance scheme. Farmers face challenges in generating sufficient revenue to meet their payment claims and also in having affordable premiums that can increase crop insurance acceptance and adoption. In Table 4.26, respondents were asked about their preferred premium: about 60.3% preferred the premiums $\leq R300$ and 34.6% preferred R300-R500 premiums. This shows that farmers in Swaziland preferred the lower premiums.

Table 4.26: Preferred premiums

Dependent variable	N	Freq.	%
Premiums:	78		
$\leq R300$		47	60.3
R300-R500		27	34.6
R500-R1000		4	5.1
R1000-R1500		0	0
R1500-R2000		0	0

4.7.4 Nature of coverage

The nature of risk helps in assessing the farmers' preference for the risk cover to be either crops only or crops with livestock. In other countries, some farmers may prefer health insurance to be included in the cover (Nganje *et al*., 2004). The inclusion of the nature of coverage in the design of a crop insurance programme can be an incentive for farmers to purchase crop insurance. Since most households have both crops and livestock, Table 4.27 indicates that 57.7% preferred their cover to include both crops and livestock. In the 2015/16 drought that hit the country, farmers lost both their crops and livestock. The impact of the drought was devastating because farmers lost both their income and their food. It therefore makes sense that farmers would like their insurance cover to provide protection for both crops and livestock. Some of the farmers who preferred covering their crops only were

farmers who did not have any livestock and therefore preferred insuring what they have; in addition, some thought that including both would be expensive.

Table 4.27: Nature of coverage

Dependent variable	N	Freq.	%
Nature of Coverage:	78		
Crops only		33	42.3
Crops and livestock		45	57.7

4.7.5 Subsidies

Subsidies can be an incentive for farmers to increase their production and also purchase crop insurance. The government of Swaziland has tried providing input subsidies to maize farmers. Farmers were provided with three types of government subsidies and asked to make a choice on which one they most preferred, namely, crop insurance, inputs and revenue subsidies. Table 4.28 indicates that the majority of the respondents (64.1%) preferred input subsidies; only 25.6% preferred crop insurance subsidies. This was due to the fact that farmers thought that receiving more help in terms of farming inputs could help them increase their production and to sell more and generate more income, which they could use to pay for the crop insurance premiums. Despite the fact that the government has tried providing input subsidies over the years, farmers complain about not receiving enough help or not receiving help at all due to corruption and the delaying processes which makes them receive inputs later than the planting season.

Table 4.28: Preferred subsidies

Dependent variable	N	Freq.	%
Subsidies:	78		
Crop Insurance		20	25.6
Inputs		50	64.1
Revenue		8	10.3

4.7.6 Time taken to purchase crop insurance

The sixth feature is the time taken to purchase crop insurance. Respondents were asked if the drought was expected to continue in the country, and how much time would it take them to purchase crop insurance. Determining the time is very important because it helps in assessing farmers' perception on crop insurance and their risk attitudes. As shown in Table 4.29, about 53.8% said they would immediately purchase crop insurance. The other farmers said they would wait for a year or more and see if there was, indeed, a drought. This shows that farmers in Swaziland are now more responsive towards risk management strategies such as crop insurance. Even though crop insurance providers may have issues with farmers purchasing crop insurance because of the expected drought, this feature shows farmers attitudes risk against potential losses which affect their livelihoods.

Table 4.29: Preferred time to purchase crop insurance

Dependent variable	N	Freq.	%
Time taken to purchase crop insurance:	78		
Immediately (0 years)		42	53.8
After 1 year		24	30.8
After 2 years		7	9.0
After 3 years		5	6.4

4.7.7 Farmer involvement

The seventh feature is farmer involvement in the content design of the crop insurance programmes. Farmers were asked if they wanted to be engaged in an ex-ante design process of the programmes, or not. Since farmers have been excluded from these processes and most studies are focused on the ex-post of these programmes, this results in a top-down approach to policy formulation which means that farmers' needs, constraints and preferences are not considered. Therefore, involving farmers in the design stages will ensure that farmers' needs and constraints and preferences are considered and encourage crop insurance acceptance and purchase among the farmers (Bekele, 2004). Table 4.30 highlights that about 93.6% of the respondents preferred to be involved in the design of crop insurance programmes. This shows

that Swazi farmers place value on stakeholder involvement in the designing of programmes, because they have more information of about their needs and constraints than anyone else.

Table 4.30: Stakeholder engagement

Dependent variable	N	Freq.	%
Farmer Involvement:	78		
Yes		73	93.6
No		5	6.4

4.7.8 Outbreak of pests, diseases and theft

Lastly, respondents were asked if they would prefer purchasing crop insurance if there was a possibility or risk of an outbreak of pests, diseases and theft. According to Table 4.31, about 91% of the respondents said they would prefer purchasing crop insurance. The outbreaks of pests and diseases can lead to massive losses. Hence, having protection against those losses can be very beneficial to farmers. However, 9% said they would just have to handle the risk themselves without purchasing crop insurance. About 83.3% said they would prefer purchasing crop insurance if there is a possibility of the risk of theft. This implies that protecting crops is very important to the Swazi farmers because the loss of crops leads to loss of food and incomes thus affecting their livelihoods.

Table 4.31: Outbreak of pests, diseases and theft

Dependent variables	N	Freq.	%
Outbreak of pests and diseases:	78		
Yes		71	91.0
No		7	9.0
Increased theft:	78		
Yes		65	83.3
No		13	16.7

4.8 INCREASING FARMERS ACCEPTABILITY AND INTEREST IN PURCHASING CROP INSURANCE

In order to increase farmers' adoption of crop insurance, farmers were asked to suggest ways to improve farmers' acceptability of crop insurance by answering open-ended questions. Their responses determined their opinions on crop insurance and what could be done to make it acceptable and attractive to farmers. This information is useful because it can assist the government and the crop insurance industry in understanding farmers' attitudes towards crop insurance and facilitate efforts to structure insurance policies to meet the needs of farmers. It can also motivate policy-makers to consider crop insurance support policies. It will also contribute to the body of knowledge on crop insurance and inform policy. Contributions to research in this area are particularly valuable because the crop insurance industry in Swaziland is still under-developed.

The farmers' responses towards ways of encouraging farmers' acceptance and adoption of crop insurance are presented in Table 4.32. Out of the 78 farmers, 92.3% suggested that educating farmers about crop insurance and its benefits can have positive results, especially if crop insurance providers visit communities and arrange meetings with the farmers through the help of extension officers. About 96.2% of the farmers suggested that crop insurance companies should design insurance schemes with affordable premiums, tailored for smallholder farmers and involve farmers in the design process. About 61.5% of the respondents suggested that if the government could improve farmer support services, farmers would be able to produce more maize and get more income, thus affording to purchase crop insurance.

Table 4.32: Increasing farmers' acceptability and adoption of crop insurance

Response	*N*	*Yes (%)*	*No (%)*
▪ Educate farmers more about crop insurance and its benefits by having insurance providers to visit communities	78	92.3	7.7
▪ Farmers should pay annual premiums and not monthly premium because of the seasonality of agricultural production	78	28.2	71.8
▪ Look at the possibilities of paying premiums using produce.	78	39.7	60.3
▪ Improve government services intended to assist farmers, so to help increase production	78	61.5	58.5
▪ The Government to consider providing crop insurance subsidies	78	25.6	74.4
▪ Insurance companies should design insurance schemes where the premiums will be affordable and tailored for smallholder farmers.	78	96.2	3.8

These responses show that Swazi farmers are aware of the effects of agricultural risks such as drought; this interests them in crop insurance. Knowing their preferences would increase the adoption of crop insurance and protect farmers against potential losses.

4.9 CONCLUSION

This chapter provided an overview of the characteristics of the sample households. The majority of respondents were older female farmers with a high school education. Farmers in the Lubombo region were more interested in purchasing crop insurance than farmers in the Lubombo region, due to the difference in rainfall in the two regions. It would make sense for

crop insurance programmes to target vulnerable regions first. Almost all the farmers had experienced crop losses previously, due to disasters such as droughts. However, more losses were experienced in the Lubombo region, due to the unfavourable climatic conditions, than in the Hhohho region. About 52% of the respondents were interested in purchasing crop insurance. The majority of respondents preferred the multi-peril crop insurance model, higher coverage levels, lower premiums, market price-based compensation, and the nature of the coverage to include both crops and livestock. They also wished to be involved in the design process of crop insurance programmes.

CHAPTER 5

EMPIRICAL RESULTS

5.1 INTRODUCTION

The previous chapter focused on characteristics of surplus maize producers. This chapter presents the econometric results of the study, using the probit regression and binary logistic regression results. The explanatory variables used in this study were based on literature review and the hypothesised relationships between the explanatory variables and the dependent variables, which is the interest to purchase crop insurance, presented in Chapter 3.

5.2 FACTORS INFLUENCING FARMERS' INTEREST TO PURCHASE CROP INSURANCE

The probit model was used to determine the factors that influence farmers' interest to purchase crop insurance. This model was used to estimate the probability of a binary response based on one or more independent variables. To run the probit model, the multicollinearity test was conducted to ensure that there was no multicollinearity between the independent variables. The Variance Inflation Factor (VIF) of all the independent variables was below the threshold of 10.00 and the tolerance values were above 0.10. This implies that multicollinearity was not present among the independent variables used in this study, since all the variables had a very low VIF (Hair Jr *et al*., 1995).

Since the dependent variable has a binary response (yes = 1, no = 0), the dependent variable was interest to purchase crop insurance. The model is specified as:

Pr(INTRST) = f(AGEHH, AGE2HH, GENDER, HSIZE, MARRIED, OCCUP, HEDUC, LOCATION, FARMEXP, MEMBER, FARMEDUC, CRED, EY, CROPTYPE, AMOUNTCONS, SAVINGS, FAM_CI, LOSSEXP).

That is the probability of being interested in purchasing crop insurance depends on the set of explanatory factors. Table 5.1 presents the results of the probit estimations of the factors that have a significant influence on farmers' interest to purchase crop insurance. The model correctly predicted 80.7% of the observations, with significant chi-squared of 69.46. Six out

of the eighteen variables had coefficients that were significantly different from zero. Three of the variables were positively associated with the probability of being interested in purchasing crop insurance. The occupation of the household head, the location of the farmer and the ability to have savings increased the chance of being interested in purchasing crop insurance. The other three significant factors were negatively associated with the probability of being interested in purchasing crop insurance. The gender of the household head, education level and farming experience were negatively associated with the probability of being interested in purchasing crop insurance.

Three of the significant variables had the expected signs. The results implied that having farming as the major occupation has a considerable marginal effect on increasing the probability of being interested in purchasing crop insurance. It shows that a farmer dependent on farming is 21% more likely to be interested in purchasing crop insurance than a farmer who has other sources of income. Respondents who had other major occupations derived security from receiving income from other sources. Hence the limited interest in purchasing crop insurance when compared to farmers who had farming as the major occupation. This conforms to the hypothesised relationship between occupation and farmers' interest to purchase crop insurance shown in Table 3.3.

The next important factor in the purchasing of crop insurance is the location. This variable has a higher marginal effect, which indicates that when the farmer is located in the Lubombo region (which is the driest region in the country), this might significantly increase their chance of being interested in purchasing crop insurance significantly. A farmer in the Lubombo region is 29.8% more likely to be interested in purchasing crop insurance than a farmer in the Hhohho region. The Lubombo region is associated with higher perceived risks because of the drier climatic conditions. Hence, farmers in the Lubombo region were more interested in purchasing crop insurance, because they perceived a higher level of yield risk. The local conditions, such as the climatic conditions and types of soil, influence the crop insurance decisions that farmers make (Barry *et al*., 2004). This implies that crop insurance providers in the country should invest more time and resources in promoting insurance in more climatically vulnerable locations.

The ability to save is another important variable which had a higher marginal effect, meaning that having savings might increase the chance of purchasing crop insurance. Therefore a farmer who has savings is 24.5% more likely to be interested in purchasing crop insurance.

This implies that maize farmers in Swaziland who are able to save have an incentive to maintain their saving ability, since they use their savings mainly to pay school fees and buy planting materials. This can also imply that these farmers produce more; hence, their saving ability may also indicate that they can better afford crop insurance. This is in line with the hypothesised positive relationship shown in Table 3.3. It conforms to the findings of Aidoo *et al.* (2015), who found that the amount of savings per annum had a positive effect on insurance purchase since premiums will be paid from current farmers income or accumulated income, which can be represented by savings. Therefore this may imply that future uptake of crop insurance in the country can be accelerated among maize farmers when the level of savings by farmers improves**.**

Table 5.1: Probit regression results

Factor	Coefficient	Marginal Effects
Constant	-0.090 (0.954)	
Household characteristics		
▪ Age of household head (years)	-0.003 (0.012)	-0.001 (0.003)
▪ Age of the second household head (years)	0.016 (0.011)	0.004 (0.003)
▪ Gender (1 = male; 0 = female)	-0.698** (0.294)	-0.182** (0.073)
▪ Household size (number of family members)	0.045 (0.033)	0.012 (0.009)
▪ Marital status (1 = married; 0 = unmarried)	-0.230 (0.384)	-0.060 (0.100)
▪ Occupation (1 = farmer; 0 = other)	0.805*** (0.298)	0.210*** (0.072)
▪ Higher Education level (1 = higher education; 0 = lower education)	-0.771* (0.440)	-0.201* (0.111)
Farming characteristics		
▪ Membership in farmers' association/union (1 = yes; 0 = no)	0.246 (0.468)	0.064 (0.122)
▪ Location (1 = Lubombo; 0 = Hhohho)	1.146***	0.298***

Factor	Coefficient	Marginal Effects
Constant	-0.090 (0.954)	
	(0.280)	(0.060)
▪ Receive farming education (1 = yes; 0 = no)	0.136 (0.287)	0.035 (0.074)
▪ Access to credit (1 = yes; 0 = no)	-0.024 (0.311)	-0.006 (0.081)
▪ Farming experience (years)	-0.020* (0.011)	-0.005* (0.003)
▪ Expected yield (number of 70kg bags)	-0.003 (0.004)	-0.001 (0.001)
▪ Crop type (1 = maize only; 0 = maize and other)	-0.085 (0.375)	-0.022 (0.098)
▪ Maize consumed (number of 70kg bags)	0.013 (0.011)	0.003 (0.003)
Coping strategy		
▪ Savings (1 = yes; 0 = no)	0.943*** (0.318)	0.245*** (0.076)
Crop insurance awareness		
▪ Familiarity with crop insurance (1 = yes; 0 = no)	-0.341 (0.487)	-0.089 (0.126)
Loss experience		
▪ Loss experience (years)	-0.104 (0.077)	-0.027 (0.020)
% Correctly predicted Model CHI-SQ N	80.8% 69.46*** 150	

The results indicate that the marginal effect of the education level on the probability to purchase crop insurance is the most important of the negative factors. The higher education level has a considerable marginal effect of decreasing the probability of being interested in purchasing crop insurance. That is, a farmer who has attained the higher level of education is 20.1% less likely to be interested in purchasing crop insurance than a farmer who has attained the lower level of education. This can be explained by the fact that in Swaziland, most of the educated household heads are employed, some have government jobs and others have other businesses. Therefore, their ability to get other incomes provides them with a source of

security, so that they are not dependent on farming for their livelihoods. This would explain their lack of interest in purchasing crop insurance.

This is in agreement with Kwadzo *et al.* (2013), who also observed a negative correlation between farmers' educational level and their willingness to purchase market-based insurance. He suggested that these farmers were more exposed to other risk management practices. Black and Dorfman (2000) also suggested that better-educated farmers to manage their farms more competently and they are exposed to various risk management practices and are therefore less likely to purchase crop insurance. However, these findings were in contrast with the hypothesised relationship between education and farmers' willingness to purchase crop insurance, as shown in Table 3.3.

Farming experience has a considerable marginal effect on decreasing the probability of being interested in purchasing crop insurance. That is, every additional year in farming decreases the probability of being interested in purchasing crop insurance. More experienced farmers are 0.5% less likely to be interested in purchasing crop insurance, explaining their unwillingness or slowness in adopting new technologies. This is in line with the hypothesised negative relationship shown in Table 3.3. It is in agreement with Danso-Abbeam *et al.* (2014), who found that there is a negative relationship between farming experience and farmers' interest to purchase crop insurance. Thus, suggesting that farmers with a greater number of years in maize farming are less likely to be interested in purchasing crop insurance, this is evident from older and more experienced farmers in Swaziland. They tend to be confident and content with their current risk management practices, resulting in their limited interest in purchasing crop insurance. Kouame and Koumenan (2012) estimated a positive coefficient for farmers' experience in cocoa farming but up to a certain level of threshold, after which the effect of farming experience becomes negative.

Gender also has a considerable marginal effect on decreasing the probability of being interested in purchasing crop insurance. That is, a male farmer is 18.2% less likely to be interested in purchasing crop insurance than a female farmer. Male farmers in the country tend to be less risk-averse; they tend to have more confidence in their farming methods and risk-coping strategies, hence the limited interest in purchasing crop insurance.

Other variables such as age, household size and expected yield were generally not showing significance to farmers' likelihood to be interested in purchasing crop insurance. This is probably caused by the fact that these factors had no direct relationship with their interest to

purchase crop insurance. The age of the household head, the household size and the expected yield, among other factors, were not pivotal in determining farmers' likelihood to be interested in purchasing crop insurance.

5.3 REASONS FOR NOT CONSIDERING CROP INSURANCE

Out of the 150 respondents, 48% were not interested in purchasing crop insurance. They were asked to state the reasons why they were not interested in doing so. Generally, one would expect that some farmers would be interested and some would not be interested in crop insurance, considering that some farmers are risk-averse, some are neutral and some have a risk preference. Therefore, farmers who were not interested in purchasing crop insurance had no positive preference, as they did not want anything to do with crop insurance.

This study aimed at finding preferences farmers had for crop insurance if a new crop insurance scheme were to be introduced. To achieve this, relevant information can only be obtained from farmers who have interest in purchasing crop insurance. Farmers who expressed no interest in crop insurance have no influence on the decisions and preferences that interested farmers make. Therefore uninterested farmers had no role in what the study seeks to address so they are not included in finding the features that farmers want their crop insurance to comprise of, which can increase farmers' adoption of crop insurance and provide protection to farmers against potential losses. The reasons uninterested farmers gave are presented in Table 5.2.

Table 5.2: Reasons for not considering crop insurance

Reason	***N=72***	***Yes (%)***	***No (%)***
▪ I do not trust insurance companies		87.5	12.5
▪ It is difficult to settle claims and I do not need that stress		84.7	15.3
▪ My production is not exposed to that much risks to even consider crop insurance		81.9	18.1
▪ I do not see the need for crop insurance		66.7	33.3
▪ I can cope with risk on my own		65.3	34.7
▪ I cannot afford to pay premiums		54.2	45.8

The reasons that farmers supplied indicate the negative attitude they have towards crop insurance and risk insurance generally. These farmers tend to be risk takers who do not view crop insurance as an alternative. About 87.5% of the respondents indicated that they do not trust insurance companies and 84.7% indicated that it is difficult to settle insurance claims. About 81.9% of the respondents thought their production was not exposed to enough risk to even consider crop insurance: this indicates a level of satisfaction the farmer has in terms of yields and also a risk-preferring attitude. About 66.7% responded that they did not see the need to have crop insurance. This may also indicate a risk-preferring attitude and resistance to new risk management strategies.

Out of all the uninterested farmers, 65.3% indicated that they could cope with risk on their own and were unwilling to adopt new technologies. It might also indicate that these farmers are very confident about their farming methods. About 54.2% responded that they cannot afford to pay insurance premiums. This could be a positive response, implying that if those farmers had an increase in income, their lack of interest to purchase crop insurance could change and lead to an interest in purchasing it.

Overall, the reasons provided indicated that farmers had negative attitudes towards crop insurance and did not want to be involved in any crop insurance schemes. Most of the strong reasons pertain to the image of insurance technology. The industry may need to do more to improve the negative perceptions that are common among this sample group. Only the interested farmers were asked about their preferences regarding crop insurance.

5.4 FARMERS' PREFERENCES FOR CROP INSURANCE

This section analyses various factors and their influence on preferences of households for crop insurance by using the logistic regression model. This model is used to evaluate the extent to which different independent variables affect the crop insurance preference (Greene, 1998). Respondents were presented with multiple options for each preference. However, some options had very few responses and some did not have responses at all; therefore, some of these responses had to be merged to form two options. For analytical purposes, all the preferences were grouped into two options; for this reason, the logistic regression model was preferred over the multinomial logistic regression. Farmers were asked if they were interested in purchasing crop insurance. Out of the 150 households interviewed, 78 were interested in

doing so. These farmers were then asked about their preferences for crop insurance, since they were interested and willing to pay for it.

To run the logistic model, the multicollinearity test was conducted to ensure that there is no multicollinearity between the independent variables. The Variance Inflation Factor (VIF) of all the independent variables was below the threshold of 10.00 and the tolerance values were above 0.10. This implies that multicollinearity was not present between the independent variables used in this study, since all the variables had a very low VIF (Hair Jr *et al*., 1995).

The next step was to run the logistic regression on the dependent variables, which include all the preferences of crop insurance shown in Table 5.3. Eight models are presented in the table: Model 1 = Risk Cover; Model 2 = Coverage Levels; Model 3 = Premiums; Model 4 = Nature of Coverage; Model 5 = Subsidies; Model 6 = Time taken to purchase; Model 7 = Compensation and farmers involvement; Model 8 = Outbreak of pests and diseases and exposure to theft.

Table 5.3: Farmers preferences for maize crop insurance

Variable	**Risk cover** (Model 1)		**Coverage levels** (Model 2)		**Premiums** (Model 3)		**Nature of cover** (Model 4)	
	Co eff.	Odds Ratios	Co eff.	Odds ratios	Co eff.	Odds ratios	Co eff.	Odds ratios
Age HH	0.066 (0.047)		0.074** (0.031)	1.077	0.026 (0.029)		0.018 (0.026)	
Age 2HH	0.093* (0.052)	1.097	-0.022 (0.026)		0.005 (0.025)		-0.029 (0.023)	
Household Size	-0.034 (0.117)		0.108 (0.083)		-0.133 (0.092)		0.130* (0.077)	1.139
Married	0.948 (1.152)		-2.582*** (0.986)	0.076	-0.359 (0.899)		0.327 (0.837)	
Occupation	-1.924* (1.035)	0.146	-1.211* (0.644)	0.298	-0.237 (0.611)		0.095 (0.554)	
Higher Educ.	0.628 (1.520)		-0.347 (0.978)		3.130** (1.481)	22.869	1.295 (0.932)	
Location	-1.171 (1.228)		-0.024 (0.697)		0.135 (0.665)		0.661 (0.647)	

Variable	**Risk cover** (Model 1)		**Coverage levels** (Model 2)		**Premiums** (Model 3)		**Nature of cover** (Model 4)	
	Co eff.	Odds Ratios	Co eff.	Odds ratios	Co eff.	Odds ratios	Co eff.	Odds ratios
Farming education	1.245 (0.909)		0.356 (0.636)		0.955 (0.646)		0.993* (0.574)	2.700
Access Credit	0.117 (0.993)		1.429** (0.727)	4.174	-0.666 (0.719)		1.531** (0.727)	4.621
Expected Yield	-0.013* (0.007)	0.988	-0.009 (0.006)		0.011* (0.006)	1.011	0.001 (0.006)	
Farming Experience	-0.007 (0.036)		-0.020 (0.022)		0.038* (0.022)	1.039	-0.011 (0.021)	
Savings	0.553 (0.851)		0.182 (0.627)		-0.401 (0.629)		-0.011 (0.553)	
Knowledge of CI	-1.827 (1.462)		1.105 (1.025)		-0.769 (1.067)		-0.347 (0.959)	
Years Loss Exp.	-0.106 (0.272)		0.009 (0.154)		-0.167 (0.155)		-0.084 (0.144)	
Constant	-3.766 (3.067)		-0.613 (2.079)		-4.765* (2.622)	0.009	-2.314 (1.941)	
-2 log likelihood	48.368		82.666		79.417		91.023	
Pseudo R^2	0.450		0.371		0.376		0.239	
χ^2	0.069		0.062		0.063		0.506	

*Notes; ***, **, * Significant at 1%, 5% and 10% respectively. Values in parenthesis are standard errors.*

5.4.1 Risk cover

Model 1 identifies factors that have an influence on the preferred risk cover. In this case, the respondents' preference was as follows: 64 respondents for the multi-peril crop insurance (MPCI), 7 for the single-peril and 7 for weather index-based insurance. The majority of respondents preferred the multi-peril insurance cover. This conforms to the findings of Olila (2014), who found that there is a high preference for the multi-peril risk cover. This indicates that, as maize farmers in Swaziland are faced with numerous risks, it is rational for them to

prefer the MPCI, especially since agriculture is still an important economic sector in the country.

For analytical purposes, MPCI was assigned a value of one, and both the single-peril and weather index-based insurance were assigned a value of zero. The results, as presented in Table 5.3, show that the chi-square statistics of the model was statistically significant at the 10% level. The model correctly predicted 87.2% of the observations. Three variables were statistically significantly associated with the risk cover. The variable that contributed positively was the age of the second household head (Age 2HH). The logistic analysis shows that age 2HH was significant at the 10% level. The odds of preferring the MPCI when the age of 2HH is increased by one year are 1.097 times more than the odds of preferring the single-peril and weather index-based insurance.

Two variables were negatively associated with the risk cover. These variables were Occupation and the Expected Yield (EY). The logistic analysis shows that Occupation and EY were both significant at the 10% level. Therefore, the odds of preferring an MPCI when a farmer has agriculture as the major occupation are 0.146 times less than the odds of preferring the single-peril and weather index-based insurance, as compared with the situation when the farmer has another occupation. This implies that farmers dependent on farming are less likely to be interested in purchasing the multi-peril crop insurance. This can be explained by the fact that farmers with no other sources of income are less likely to afford to pay crop insurance premiums. Farmers associated the multi-peril cover with higher premiums, since it covers a number of perils. On the other hand, farmers with other sources of income are more likely to prefer the multi-peril cover because they are more likely to afford paying crop insurance premiums. Since they have other occupations, they could also be more educated than the other farmers and could have a better understanding of the role of crop insurance.

The odds of preferring the MPCI when the EY was increased by one bag of maize was 0.988 times less than the odds of preferring single and weather index-based insurance. This implied that, even though farmers could expect more yield, they still prefer a crop insurance type associated with lower premiums. Most farmers in the country have been severely affected by droughts, and these farmers prefer insuring their crops against specific perils such as droughts.

5.4.2 Coverage level

Model 2 identifies factors that have an influence on the preferred coverage level. In this case, the respondents' preference was as follows: 38 respondents for the ≤50% level of coverage, 6 for the 60%, 2 for 70%, 2 for the 80%, 0 for the 90% and 30 for the 100% coverage levels. The majority of respondents preferred coverage levels higher than 50%. This conforms to Olila (2014), who found that farmers prefer higher coverage levels and can be explained by the fact that maize farmers in Swaziland face various risks such as weather variability, pests and diseases, among other risks. Hence, the more these farmers invest in their farming, the more they prefer insuring a higher portion of their farms.

For analytical purposes, ≤50% was assigned a value of zero, and coverage levels >50% were assigned a value of one. The results are also presented in Table 5.3. The model correctly predicted 76.9% of the observations. Four variables were statistically significantly associated with the coverage levels. Two variables contributed positively, namely, the age of the household head (Age HH) and access to credit. The logistic analysis shows that Age HH and access to credit were both significant, at the 5% level. Therefore, the odds of preferring a coverage level >50% when Age HH increased by one year was 1.078 times more than the odds of preferring a coverage level ≤50% than when age did not change. This implied that older farmers preferred higher coverage levels. This can be by the fact that older farmers usually have more farming experience. They tend to know the severity and impact of risks on their production and therefore prefer higher coverage levels in order to minimise risks as much as possible.

The odds of preferring a coverage level >50% when the farmer had access to credit were 1.429 times more than the odds of preferring a coverage level ≤50% than when a farmer did not have access to credit. This implied that farmers with access to credit preferred higher coverage levels. Farmers who had access credit were able to finance their production and thus increase production. Therefore, they were more likely to prefer higher coverage levels.

The variables Married, which is a dummy variable (1 represented married and 0 otherwise), and Occupation, negatively contributed to the dependent variable. The logistic analysis showed that the Married variable was significant at the 1% level. However, Occupation was significant at the 10% level. The odds of preferring a coverage level >50% when the farmer was married are 0.076 times less than the odds of preferring a coverage level ≤50% than when a farmer was single. This implied that married farmers are less likely to prefer higher

coverage levels. Generally, higher coverage levels were associated with higher premiums. As such, married farmers had more household responsibilities and can better afford lower premiums, hence their preference for lower coverage levels.

The odds of preferring a coverage level >50% when a farmer had agriculture as the major occupation were 0.298 times less than the odds of preferring a coverage level ≤50% than when a farmer had another occupation. This implied that respondents with farming as the major source of income were less likely to prefer higher coverage levels. Usually, farmers dependent on agriculture had no other sources of income to finance other household needs and farm income was the only source of income used to cover all household needs. Therefore, those farmers had limited funds to afford higher coverage levels.

5.4.3 Premiums

Model 3 identified factors that have an influence on the preferred premiums. In this case, the respondents' preference was as follows: 47 respondents chose premiums ≤R300, 27 chose the R300-R500 and 4 chose the R500-R1000 monthly premium, 0 respondents chose the R1000-R1500 or the R1500-R2000 premium options. The majority of respondents preferred lower premiums. The results conform to Goodwin and Smith's (2003) findings; as premiums go higher, there is a lower preference for crop insurance, especially among low-income, small-scale farmers. Therefore, for analytical purposes, the ≤R300 premium option was assigned a value of zero, and the >R300 premium were assigned a value of one. The results are presented in Table 5.3. The model correctly predicted 80.8% of the observations. Three variables were statistically significantly associated with the preferred premiums. The variables were: Higher Education, EY and Farming Experience, and they all contributed positively to the preferred premium.

The logistic analysis showed that Higher Education was significant at the 5% level. The odds of preferring a premium >R300 when a farmer had attained the higher level was 22.869 times more than the odds of preferring a premium ≤R300, than when a farmer had a lower level of formal education. These results indicated that the more educated respondents preferred higher insurance premiums. This can be explained by the fact that most educated farmers in the country usually have other sources of income and so can better afford higher premiums.

The logistic analysis also showed that EY and Farming experience were both significant, at the 10% level. The odds of preferring a premium >R300 when EY increased by one bag of

maize was 1.011 times more than the odds of preferring a premium ≤R300 when EY does not change. This implied that farmer with a higher EY preferred higher premiums. Farmers who expected to get more maize also expected to sell more, and thus to get more income. They could better afford to pay premiums when they expected to get more returns from their investment in farming. However, higher premiums could act as a disincentive to purchase crop insurance for farmers with lower EY.

The odds of preferring a premium >R300 when farming experience increased by one year was 1.039 times more than the odds of preferring a premium ≤R300 when farming experience did not change. These results indicated that maize farmers who had more farming experience preferred higher premiums. Experienced farmers tended to be confident about their farming methods and have more farming knowledge. They usually produced more maize and could afford higher premiums compared with low-income, small-scale farmers. The results also agreed with those of Goodwin and Smith (2003), who found that there is a significant negative coefficient on the cost feature (premium), which implies that as premiums go higher, there is a lower preference for crop insurance among low-income, small-scale farmers.

5.4.4 Nature of coverage

Model 4 identified factors that have an influence on the preferred Nature of Coverage. In this case, the respondents' preferences were as follows: 33 respondents for *Crops only* and 45 respondents preferred their cover to include both *Crops and livestock*. The majority of respondents in the sample preferred their cover to include both crops and livestock. Therefore, *Crops only* was assigned a value of zero, and *Crops and livestock* was assigned a value of one. The results are presented in Table 5.3. The model correctly predicted 70.5% of the observations. The chi-square statistics of the model was statistically significant at the 10% level. Three variables were statistically significantly associated with the Nature of coverage. The variables were Household size (HSIZE), whether a farmer received farming education (Farming Educ.) and *Access to credit*, all variables contributed positively. The logistic analysis shows that HS and Farming Education were significant at the 10% level and Access to credit was significant at the 5% level.

The odds of preferring *Crops and livestock* when HSIZE increased by one family member was 1.139 times more than the odds for preferring *Crops only* than when the HS did not

change. This implied that farmers with higher household sizes preferred their coverage to include both crops and livestock. Generally, most households grew crops and reared livestock for consumption and commercial purposes. Since these farmers could get income from both crops and livestock, it was not surprising that most farmers preferred covering both against potential losses.

The respective odds of preferring *Crops and livestock* coverage when the farmer had received farming education and had access to credit were 2.70 and 4.621 times more than the odds of preferring *Crops only* than when the farmer had not received farming education and had no access to credit. This showed that farmers who had received farming education and had access to credit preferred covering both crops and livestock. This implied that farmers who had received farming education had a better understanding of the role and benefits of agricultural insurance. Farmers who accessed credit had invested more in farming. As such, their preference for crop and livestock cover made sense, since most households had livestock. This suggested that more farmers in Swaziland would be interested in purchasing crop insurance if the insurance feature covered both crops and livestock.

5.4.5 Preferred subsidies

Model 5 identified factors that influenced the preferred subsidies. In this case, the respondents' preferences were as follows: 20 respondents opted for the crop insurance subsidies, 50 preferred input subsidies and 8 preferred revenue subsidies. The majority of respondents preferred input subsidies. This can be explained by the fact that farmers required farm inputs in order to start production. When farmers lack the funds to purchase farm inputs, they cannot do so. It follows that they prefer input subsidies because they are able to purchase farm inputs and produce maize for consumption and commercial purposes. Therefore, for analytical purposes, crop insurance subsidies were assigned a value of one, input and revenue subsidies were assigned a value of zero. The results are presented in Table 5.4. The chi-square statistics of the model was statistically significant at the 5% level. The model correctly predicted 80.8% of the observations.

Statistically, four variables were significantly associated with the preferred subsidies. One variable that contributed positively was the *Familiarity with crop insurance* (FAM_CI). The logistic analysis shows that FAM_CI was significant at the 10% level. The odds of preferring crop insurance subsidies when the farmer had knowledge of crop insurance was 2.453 times more than the odds of preferring input and revenue subsidies, as compared with when the

farmer had no knowledge of crop insurance. This implied that farmers aware of crop insurance preferred crop insurance subsidies over input subsidies. This indicated that educating farmers on the benefits of crop insurance had huge potential for increasing farmers' demand for crop insurance services.

The variables Household size (HSIZE), Occupation and Location contributed negatively to the preferred subsidies: all these variables were significant at the 5%. The odds of preferring crop insurance subsidies when HSIZE increased by one member was 0.772 times less than the odds for preferring input and revenue subsidies, as compared with when HSIZE does not change. This implied that farmers with higher household sizes were less likely to prefer crop insurance subsidies. This can be explained by the fact that most farmers with higher household sizes in Swaziland are concerned with producing more maize for consumption, in order to ensure the self-sufficiency of their households in maize production and to get income from selling their maize.

The odds of preferring the crop insurance subsidies when the farmer had agriculture as the major occupation was 0.118 times less than the odds of preferring input and revenue subsidies, as compared with when the farmer had another occupation. This implied that farmers dependent on farming were less likely to prefer crop insurance subsidies to input subsidies. These farmers were mainly concerned with improving their production and getting more income. Since farming was their main source of income, they were more likely to prefer input subsidies to improve their production.

The odds for preferring crop insurance subsidies when the farmer was located in the Lubombo region was 0.142 times less than the odds for preferring input and revenue subsidies, as compared with when the farmer was located in the Hhohho region. This implied that farmers in the Lubombo region were less likely to prefer crop insurance subsidies compared with farmers in the Hhohho region. This can be explained by the fact that farmers in the Lubombo region generally experienced the most crop losses due to unfavourable climatic conditions. They had less preference for crop insurance subsidies because, with input subsidies, they were able to purchase necessary inputs to grow maize and sell it to get income. Therefore, they were able to afford to pay insurance premiums. Furthermore, this implies that farmers in the Hhohho region had a higher preference for crop insurance premium subsidies compared with farmers in the Lubombo region.

5.4.6 Time taken to purchase crop insurance

Model 6 identified factors that have an influence on the time taken to purchase crop insurance. In this case, the respondents' preferences were as follows: 42 respondents would purchase it *immediately* (0 years), 24 would purchase it after a year, 7 would purchase it after two years and 5 would purchase it after three years. The majority of respondent chose an immediate purchase. This can be explained by the fact that these farmers had been severely affected by drought. They wanted to minimise risks by searching for risk management strategies that could compensate them for potential losses. Therefore, for analytical purposes, immediately (0 years) was assigned a value of one, and a year and more was assigned a value of zero. The results are presented in Table 5.4. The chi-square statistics of the model were statistically significant at the 5% level. The model correctly predicted 71.8% of the observations.

Statistically, five variables were significantly associated with the preferred time to purchase crop insurance. Two variables that contributed positively were Access to credit and Higher education. The logistic analysis shows that Access to credit was significant at the 5% level. The odds for preferring an immediate purchase of crop insurance when the farmer has access to credit was 7.285 times more than the odds for preferring a delayed adoption of crop insurance, as compared with when the farmer had no access to credit. This implied that farmers who accessed credit preferred an immediate purchase of crop insurance. Generally, farmers who accessed credit invested more in farming to improve their production. An immediate response to crop insurance can cushion them from potentially massive losses and default on loan repayments.

The odds for preferring an immediate purchase of crop insurance when education increased by one year was 6.415 times more than the odds for preferring a delayed purchase of crop insurance. This implied that more educated farmers preferred an immediate response to purchasing crop insurance when compared with farmers with a lower level of education. This indicated that educated farmers could understand the role of crop insurance better, hence their preference for crop insurance.

The variables Occupation, Farming education and EY were negatively associated with the time taken to purchase crop insurance. Occupation was significant at the 1% level. Farm Education was significant at the 5% level while Higher education and EY were significant at the 10% level. The odds for preferring an immediate purchase of crop insurance when the

farmer had agriculture as the major occupation was 0.124 times less than the odds for preferring a delayed purchase of crop insurance, as compared with when the farmer has another occupation. This implied that farmers who had farming as their major occupation were less likely to prefer an immediate purchase of crop insurance than farmers with other sources of income. This may suggest that the farmers dependent on farming were risk takers. Also, the farmers took more time to get the proceeds from farming activities, so they were not usually in a position to purchase immediately. The odds for preferring an immediate purchase of crop insurance when the farmer had received farming education was 0.270 times less than the odds for preferring a delayed purchase of crop insurance, as compared with when the farmer did not receive farming education. This implied that farmers who had received farming education were less likely to prefer an immediate purchase of crop insurance.

However, the odds for preferring immediate purchase of crop insurance when EY increased by one bag of maize was 0.991 times less than the odds for preferring a delayed purchase of crop insurance, as compared with when EY did not change. This implied that farmers with a higher EY are less likely to prefer an immediate purchase of crop insurance. These responses indicated a risk-preference attitude amongst the farmers.

5.4.7 Compensation and farmers' involvement

Farmers were asked if they preferred the compensation level to be based on the market price of a 70kg bag of maize. Sixty-seven (67) responded with *Yes* and 11 responded with *No*. The majority of respondents preferred compensation to be based on the market price. Therefore *Yes* was assigned the value of one and *No* was assigned the value of zero. They were also asked if being involved in the design process of crop insurance would make them more interested in crop insurance, 73 responded with *Yes* and 5 responded with *No*. The majority of respondents favoured being involved in the design process of crop insurance programmes. Therefore *Yes* was assigned the value of one and *No* was assigned the value of zero. For analytical purposes, the responses were combined and presented as one assigned if a farmer responded with *Yes* to both questions, and zero if the farmer responded with *No* to one or both the questions. Therefore, the combined responses were 63 farmers who responded with *Yes* to both questions and 15 responded with *No* to either or both questions. The model correctly predicted 82.1% of the observations.

Model 7 in Table 5.4 identifies factors that influenced the Compensation and Farmers' involvement in the designing of crop insurance programmes. The chi-square statistic was

significant at the 10% level. The variables EY and Location were positively associated with the dependent variable. The logistic analysis indicates that both variables were significant at the 10% level.

The odds for preferring the market-based compensation and farmer involvement when EY increased by one bag of maize was 1.021 times more than the odds for not preferring the market- based compensation and farmer involvement, as compared to when EY did not change. This implied that farmers with higher EY preferred market-based compensation and favoured being involved in the design processes of crop insurance programmes. Farmers with higher EY usually got more maize and were able to sell more. As such, they were more involved in maize markets. Involving them in the design processes of crop insurance programmes could be beneficial in designing efficient programmes.

The odds for preferring market-based compensation and farmer involvement when a farmer was located in the Lubombo region was 6.943 times more than the odds for not preferring the market-based compensation and farmer involvement when the farmer is located in the Hhohho region. This conforms to the findings of Olila (2014) that farmers have a distinct preference for compensation and prefer to be engaged in the design process of crop insurance programmes. This confirms that farmers in Swaziland would like to be involved, and if they are accorded opportunities to do so, the rate of crop insurance adoption is likely to increase.

Table 5.4: Farmers' preferences for crop insurance

Variable	Subsidies (Model 5)		Time taken (Model 6)		Compens. and Inv (Model 7)		Outbreak + theft (Model 8)	
	Co eff.	Odds Ratios	Co eff.	Odds Ratios	Co eff.	Odds Ratios	Co eff.	Odds Ratios
Age HH	-0.012 (0.035)		0.034 (0.032)		0.001 (0.042)		0.040 (0.031)	
Age 2HH	0.035 (0.030)		-0.038 (0.027)		-0.024 (0.034)		0.034 (0.029)	
Household Size	-0.259** (0.126)	0.772	0.046 (0.081)		-0.095 (0.116)		0.273** (0.128)	1.314
Married	-0.663 (1.172)		0.832 (0.951)		0.514 (1.174)		-0.064 (0.916)	
Occupation	-2.133**	0.118	-2.09***	0.124	0.222		0.076	

Variable	Subsidies (Model 5)		Time taken (Model 6)		Compens. and Inv (Model 7)		Outbreak + theft (Model 8)	
	Co eff.	Odds Ratios	Co eff.	Odds Ratios	Co eff.	Odds Ratios	Co eff.	Odds Ratios
	(0.873)		(0.693)		(0.807)		(0.636)	
Higher Education	-0.187 (1.314)		1.859* (1.087)	6.415	-0.728 (1.349)		1.300 (1.039)	
Location	-1.955** (0.916)	0.142	1.236 (0.791)		1.938* (1.006)	6.943	1.857** (0.777)	6.404
Farming education	0.945 (0.885)		-1.309** (0.643)	0.270	-0.442 (0.863)		0.167 (0.653)	
Access Credit	-0.925 (0.960)		1.986** (0.784)	7.285	-1.138 (0.900)		0.021 (0.735)	
Expected Yield	-0.009 (0.010)		-0.009* (0.006)	0.991	0.021* (0.012)	1.021	-0.010 (0.007)	
Farming Exp.	0.007 (0.028)		-0.023 (0.025)		-0.026 (0.032)		-0.042* (0.025)	0.959
Savings	-1.244 (0.780)		0.378 (0.617)		-0.330 (0.836)		0.606 (0.681)	
CI Awareness	2.453* (1.291)	11.63	1.134 (1.196)		-1.627 (1.506)		-0.653 (1.358)	
Loss Exp.	-0.355 (0.259)		0.202 (0.173)		-0.310 (0.207)		-0.096 (0.168)	
Constant	3.115 (2.748)		-1.274 (2.173)		3.530 (3.007)		-5.362** (2.686)	0.005
-2 log likelihood	57.849		79.059		52.783		72.504	
Pseudo R^2	0.482		0.410		0.418		0.277	
	0.014		0.027		0.099		0.432	

*Notes; ***, **, * Significant at 1%, 5% and 10% respectively. Values in parenthesis are standard errors*

5.4.8 Outbreaks of pests and diseases and exposure to theft

Farmers were asked if the occurrence of undesirable events would make them prefer crop insurance. If there were an outbreak of pests and diseases, would they prefer purchasing crop insurance? 71 responded with *Yes* and 7 responded with *No*. The majority of respondents preferred purchasing crop insurance when there was the risk of an outbreak of pests and diseases. Therefore *Yes* was assigned the value of one and *No* was assigned the value of zero. Farmers were also asked if exposure to theft would make them prefer purchasing crop insurance. 63 responded with *Yes* and 15 responded with *No*. The majority of maize farmers in Swaziland therefore preferred purchasing crop insurance when there was a risk of theft. *Yes* was also assigned the value of one and *No* was assigned a value of zero. For analytical purposes, the responses were combined and presented as one, assigned if a farmer responded with *Yes* for both questions, and zero, assigned if the farmer responded with *No* to one or both the questions. Therefore, the combined responses were 58 farmers who responded with *Yes* for both questions and 20 who responded with *No* to either or both questions. This implied that the majority of farmers in the country knew the effects of risks and preferred purchasing crop insurance to cushion them against potential losses.

Model 8, in Table 5.4, identified factors that influenced the decision of farmers to purchase crop insurance when they were faced with an outbreak of pests, diseases and theft. Three variables were statistically significantly associated with the decision to purchase crop insurance when faced with these risks. The logistic analysis indicated that the variables Household size (HSIZE) and Location contributed positively and were both significant at the 5% level. The model correctly predicted 76.9% of the observations.

Therefore, the odds of preferring purchasing crop insurance when there was exposure to pests, diseases and theft when HS increases by one member was 1.314 times more than the odds for not preferring purchasing crop insurance when there was exposure to pests, diseases and theft, as compared with when the HSIZE did not change. This implied that farmers with higher household sizes preferred purchasing crop insurance when faced with risks. This can be explained by the fact that farmers with larger households required more food for consumption purposes. Such farmers needed to make sure that they produced more for their families' livelihoods by minimising risks as much as possible.

The odds for preferring purchasing crop insurance when there was exposure to pests, diseases and theft when a farmer was located in the Lubombo region was 6.404 times more than the odds for not preferring to purchasing crop insurance when there was an outbreak of pests, diseases and theft, as compared with when the farmer was located in the Hhohho region. This implied that farmers in the Lubombo region were more receptive to purchasing crop insurance when there was an outbreak of pests, diseases and theft than farmers in the Hhohho region. This can be explained by the fact that farmers in the Lubombo region face more risks due to unfavourable climatic conditions, explaining their greater preference for crop insurance than farmers in the Hhohho region. This implied that Swazi farmers faced with more risks are more interested in purchasing crop insurance.

Farming Experience contributed negatively to the dependent variable and was significant at the 10% level. The odds for preferring to purchase crop insurance when there is exposure to pests, diseases and theft when farming experience increases by one year was 0.959 times less than the odds for not preferring to adopt crop insurance when there was exposure to pests, diseases and theft, as compared with when the farming experience does not change. This implied that farmers with more farming experience were less likely to prefer purchasing crop insurance when there was exposure to pests, diseases and theft. More experienced farmers are clearly confident about their risk management strategies. This shows that more experienced farmers are at risk of experiencing massive losses when disasters strike in Swaziland, because of the lack of interest in purchasing crop insurance.

5.5 CONCLUSION

This chapter presented the empirical results of the study. It presented the probit regression model to determine the factors that influence farmers' likelihood to purchase crop insurance. The binary logistic regression models were used to determine the factors that influenced farmers' preferences for crop insurance. The probit results indicated that the factors; gender, marital status, education, occupation, location, farming experience and savings significantly influenced the farmers' interest to purchase crop insurance. The study also determined the significant factors that influenced the type of preferences farmers had for crop insurance features which included risk cover, coverage levels, premiums, nature of coverage, subsidies and compensation.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

The penultimate chapter discussed the empirical results of the study. This chapter is presented in four sections. It begins with a summary of the study and then presents the conclusions of the study. It also outlines the policy implications for accelerating the adoption of crop insurance. Lastly, it gives recommendations for further research.

6.2 SUMMARY

Agriculture is an important sector in most African countries such as Swaziland in terms of its contributions to Gross Domestic Products (GDPs). Maize is the staple crop of Swaziland and it is grown mainly under rain-fed conditions. These conditions make it susceptible to numerous risks, including climate-related ones. Considering the numerous risks that affect agriculture, the use of inefficient coping mechanisms by farmers and the negative effects on their livelihoods, farmers need a viable, sustainable risk management tool that provides them with protection against potential losses. Crop insurance is that risk management tool: it furnishes farmers with protection hedge against potential losses caused by agricultural risks and against contingent losses.

The focus has previously been on the supply and penetration of crop insurance, with less attention directed to the demand of crop insurance and the preferences farmers have for crop insurance. Because farmers are usually excluded from the design processes of crop insurance programmes, their needs and constraints are unknown and unconsidered. This study therefore aimed to investigate whether maize farmers were interested in purchasing crop insurance and to determine farmers' preferences for it. The results can assist in informing policies and programmes that enable farmers to cope with disaster and help to accelerate the adoption of crop insurance. This is critical, since the crop insurance industry in Swaziland is still underdeveloped and maize farmers currently have no access to it. The study aimed to investigate how maize farmers can be induced to adopt crop insurance so that they can cope

in disaster situations. Maize farmers were selected as the study sample, since maize is such an important crop in the country.

The main objective of the study was therefore to determine farmers' preferences for crop insurance in Swaziland. A study of the relevant literature revealed that features such as risk cover, coverage level, premiums and the nature of coverage and compensation are important in the designing of crop insurance programmes. For this reason, respondents were asked to express their preferences on these features of crop insurance. These features determined the type of products farmers needed and the products they would be willing to purchase; therefore, involving farmers in the designing of these programmes could have a positive effect on the adoption of crop insurance. Crop insurance adoption can accelerate farmer development, because farmers can increase their production if they know they have financial protection against potential losses.

The study reviewed two theories, the random utility theory and the expected utility theory. The random utility theory proposed by Lancaster is based on the hypothesis that every individual is a rational decision-maker who maximises utility to his or her choices. In this theory, utility is considered an unobservable variable that is a random variable measured as a probability that rational consumers will make choices that yield them the highest utility, given any choice set. The theory into risk attitudes, based on axioms proposed by Neumann and Morgenstern (1947), aids in demonstrating that a farmer's risk attitude can be deduced if the preference ordering and distributional properties of the risky prospect are known. Farmers' behaviour when faced with risk can be studied using the expected utility model. This study therefore used the expected utility theory.

Data was collected by means of face-to-face interviews, using a carefully-structured questionnaire. Preliminary data analysis was carried out in order to understand the socio-economic, household, farming and risk characteristics of the respondents, including crop insurance information. The probit and logistic regression models were used to analyse the data. The probit model addressed the third objective of the study, which was to identify those factors that influenced farmers' interest in purchasing crop insurance, or to identify factors that might motivate a farmer to purchase crop insurance. The logistic regression was employed to determine factors influencing farmers' preferences for crop insurance. These models were estimated and significant variables were identified. The last objective was to identify ways of improving farmers' acceptability of crop insurance. Respondents were asked

open-ended questions about the ways in which farmers' interest in crop insurance could be aroused. They suggested ways which could be used to inform policy and benefit both the farmers and the crop insurance providers.

6.3 FINDINGS AND CONCLUSION

The results of the study indicated that there was demand for crop insurance among maize farmers, since 52% of the respondents were interested in purchasing it. Respondents preferred the multi-peril crop insurance cover, higher coverage levels, lower premiums and market price-based compensation, and for the coverage to include both crops and livestock. They were also in favour of being involved in the designing of crop insurance programmes. The majority of maize farmers were not aware of crop insurance in relation to its nature, its availability and its accessibility, so they had to be given a brief description of what crop insurance is and how it works. This implied that there was lack of farmer education regarding the purpose of crop insurance and its benefits. If farmers were educated about crop insurance, this might increase its adoption. Since the needs and constraints of the farmers have been identified and presented in this study, it is now possible to tailor crop insurance schemes to suit smallholder farmers and ensure their acceptance and adoption of the concept.

The probit results indicated that gender, marital status, education, occupation, location, farming experience and capacity to save had a significant influence on the farmers' interest in purchasing crop insurance. Being female and married, having attained higher education and had more farming experience had a diminishing effect on the likelihood of a farmer being interested in purchasing crop insurance. However, having farming as one's main occupation, farming in the Lubombo region and having savings increased the probability of a farmer being interested in purchasing crop insurance.

The study also determined the significant factors that influenced the type of preferences farmers had for crop insurance features. Regarding risk cover, age had a decreasing effect on the probability of a farmer being interested in purchasing multi-peril crop insurance cover, while occupation and the expected yield had an increasing effect. On the coverage level, age and access to credit had an increasing effect, while marital status and occupation had a decreasing effect on the probability of a farmer being interested in higher coverage levels. In relation to the premium levels, education, the expected yield and farming experience all had an increasing effect on the probability of a farmer being interested in higher premiums. On

the nature of coverage, the household size, having received farming education and access to credit all had an increasing effect on the probability of a farmer being interested in a coverage that combined both crops and livestock. Regarding compensation and farmer involvement, the variables location and the expected yield both had an increasing effect on the probability of a farmer being interested in a market-based compensation and being involved in the design of crop insurance programmes.

The study identified the following ways to increase farmers' acceptance of crop insurance. These involved providing more education for farmers about crop insurance and its benefits by arranging for insurance providers to visit communities and farmers' meetings. Crop insurance providers should allow farmers to pay annual premiums instead of monthly premiums because of the seasonality of agricultural production, and they should consider the possibilities of allowing farmers to pay premiums using produce. The government should improve farm support services to encourage an increase in production which would lead to more income and better affordability of crop insurance. The government should also consider providing crop insurance subsidies for farmers, while insurance companies should design insurance schemes tailored to the needs of poor, smallholder farmers.

6.4 POLICY RECOMMENDATIONS

The majority of the farmers did not access credit for farming purposes and only 24% of the respondents had access to credit. Most of them indicated that credit was not available to them, which disproved the assumption that credit was available and the farmers chose not to use it. The lack of access to finance is one of the key impediments to farmers and hinders improvement in the efficiency of agricultural production and the adoption of better systems by farmers. Because of this, the rural communities are lagging behind the national financial inclusion process, particularly those involved in farming. This suggests that there is a need for targeted, inclusive finance policies and programmes to support farmers. Such policies should ensure that farmers have access to credit and facilitate that credit, and that institutions move away from collateral-based systems to an alternative, presumably a government guaranteed system.

With an identified demand for crop insurance, policy-makers should be motivated to consider crop insurance support policies such as crop insurance premium subsidies. Government could

also combine its incentives with farmer support services, since this would result in an increase in production and a transition from subsistence to commercial farming. The policy required to encourage crop insurance adoption must be tailored to the needs and constraints of farmers. Even though most of the respondents recognised the fact that their production was exposed to many agricultural risks and 92.0% had experienced production losses, only 9.3% were familiar with crop insurance. This indicated the need for promotion of crop insurance and education to the farmers on a national level. This exercise should be carried by the insurance industry, which could embark on a public campaign to illustrate the benefits of crop insurance.

Awareness of the demand for crop insurance will facilitate insurance service providers to structure the insurance products according to the needs of farmers. In considering the reasons that influenced the decisions of the farmers who were not interested in purchasing crop insurance, the crop insurance industry could use this information to ensure that more farmers are properly educated about the role of crop insurance in managing agricultural risks. This would also assist the government and the crop insurance industry to appreciate farmers' attitude towards crop insurance. When they have prior knowledge of farmers' profiles, it is possible to align those specific risks with suitable interventions to cater for the needs of farmers from the different climatic regions of the country. Farmers in the Hhohho region were less interested in purchasing crop insurance when compared with farmers in the Lubombo region, indicating that the farmers faced with more risks and uncertainty are more interested in purchasing crop insurance. It seems clear that the crop insurance should be introduced in vulnerable regions first.

6.5 RECOMMENDATIONS FOR FURTHER RESEARCH

The main objective of the study was to determine farmers' preferences for crop insurance among maize farmers. Two regions of Swaziland were selected in the country. Further research could investigate the demand for and preferences relating to insurance for different crops. The willingness to pay (WTP) for crop insurance can be estimated among different groups of farmers in the country by assessing the risks associated with various crops. Thus, farmers' WTP could be based on the crop and the different agro-ecological regions.

This study provided insights for future research among farmers in other regions of the country. The findings from this study can be compared to other related studies to draw inferences. A survey of a larger and more diversified population in all the regions can provide a better understanding of the demand and preferences for crop insurance in Swaziland. Furthermore, comparative studies can be conducted which would be useful in assessing the variations in the economic, institutional, social and environmental factors that influence the demand for crop insurance. This comparison can be conducted with farmers who grow the same crops across the different regions, or with different farmers in a particular region. Because offering crop insurance involves a number of stakeholders, including farmers, government institutions and financial institutions, it is recommended that research also be undertaken with other stakeholders, and not just farmers, in order to determine their willingness to participate in crop insurance programmes.

REFERENCES

Abdullah, A., Auwal, A., Darham, S. and A. Radam (2014). 'Farmers' willingness to pay for crop insurance in North West Selangor integrated agricultural development area (IADA) Malaysia'.

Abdulmalik R., Oyinbo, O. and R. Sami (2013). 'Determinants of crop farmers' participation in agricultural insurance in the federal capital territory, Abuja, Nigeria'. *Greener Journal of Agricultural Sciences,* 3(1):021-026.

Abebaw, D., Holm-Müller, K. and J. Mburu (2006). 'Understanding the perceived importance of risk for coffee growers: Empirical evidence from Ethiopia'. *Quarterly Journal of International Agriculture,* 45(3):253-268.

Abebe, T. H. and A. Bogale (2014). **'**Willingness to pay for rainfall based insurance by smallholder farmers in Central rift valley of Ethiopia: The Case of Dugda and Mieso Woredas. *Asia Pacific Journal of Energy and Environment* 1(2): 121-155.

Adger, W., Agrawala, M., Mirza, C., Conde, K., O'Brien, J., Pulhin, R., Pulwarty, B. and K. Takahashi (2007). Assessment of adaptation practices, options, constraints and capacity; in M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J.V.D Linden and C.E. Hanson, eds. Climate Change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of The Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK.

Adinolfi F., Capitanio F. and Enjolras G. (2012). 'The demand for crop insurance: Combined approaches for France and Italy. *Agricultural Economics Review,* 13(1): 5-22.

Aidoo, R., Mensah, J., Wie, P. and D. Awunyo-vitor (2014). 'Prospect of Crop Insurance as a risk management tool among arable crop farmers in Ghana'. *Asian Economic and Financial Review,* 4(3): 341-354.

Allen, M. (1997). Understanding Regression Analysis. The problem of multicollinearity. In: Understanding Regression Analysis. Springer, Boston, MA. pp 176-180.

Ali, A. (2013). 'Farmers' willingness to pay for index-based crop insurance in Pakistan: A case study on food and cash crops of rain-fed areas'. *Agricultural Economics Research Review,* 26 (2): 241-248.

Amador, F., Sumpsi, J. and C. Romero (1998). A non-interactive methodology to assess farmers' utility functions: an application to large farms in Andalusia, Spain, European Review of Agricultural Economics 25 (1) 92- 109.

Anderson, J. and Brown, R. (2005). Risk and insurance.

Asfaw, S., Shiferaw, B. and F. Simtowe (2010). 'Does technology adoption promote commercialization? Evidence from chickpea technologies in Ethiopia'. In CSAE 2010 Conference on Economic Development in Africa, University of Oxford, UK, pp. 21–23.

Aung, N. (2011). 'Agricultural efficiency of rice farmers in Myanmar; a case study of selected areas'. IDE Discussion Paper. No. 306. 2011.09

Balcita, G. (2015). 'Determinants of farmers' demand for rice crop insurance in the Ilocos region, Philippines'. A master's thesis. Department of International Development Graduate School of International Development Nagoya University.

Balmalssaka, Y., Wumbei, B., Buckner, J. and Nartey, R. (2015). 'Willingness to participate in the market for crop drought index insurance among farmers in Ghana. *African Journal of Agricultural Research.*

Baloyi, J. (2010). 'An analysis of constraints facing smallholder farmers in the Agribusiness value chain: A case study of farmers in the Limpopo Province'.

Bangsal, N. and Mamhot, P. (2012). 'Review of the Philippine crop insurance: key challenges and prospects'. CPBRD Policy Brief

Barnett, B., Skees, J. and J. Hourigan (1990). 'Examining Participation in Federal Crop Insurance'. Staff Paper 275, Department of Agricultural Economics, University of Kentucky, Lexington, August.

Barry P., Ellinger P., Schnitkey G. and B. Sherrick (2004). 'Factors influencing farmers' crop insurance decisions.' *American journal agriculture economics,* 86 (1):103-114.

Bekele, W. (2004). 'Analysis of farmers' preferences for development intervention programs. A case study of subsistence farmers from Eastern Ethiopian Highlands. *African Development and Poverty Reduction: The Macro-Micro Linkage Forum Paper.*

Berbel, J. and A. Rodríguez (1998). 'An MCDM approach to production analysis: An application to irrigated farms in Southern Spain'. *European Journal of Operational Research,* 107 (1): 108-118.

Besley, T. (1995). Savings, credit and insurance. In J. Behrman and T.N. Srinivasan (Eds.), Handbook of Development Economics Volume 3, Amsterdam: North-Holland.

Black, D. L. and J.H. Dorfman (2000). 'Identifying farmer characteristics related to crop insurance purchase decisions'. Department of Agricultural and Applied Economics, University of Georgia. *American Agricultural Economics Association.*

Blank. S. and J. McDonald (1996). 'Preferences for crop insurance when farmers are diversified'. *Agribusiness,* 12 (6): 583-592.

Bienabe, E., Coronel C., Le Coq, J. and L. Liagre (2004). 'Linking smallholder farmers to markets: Lessons learned from literature review and analytical review of selected projects'. Study Report, Final draft, March 2004. CIRAD & IRAM. World Bank.

Binswanger, H. and M. Rosenzweig (1993). 'Wealth, weather risk and the composition and profitability of agricultural investments. *Economic Journal,* 103: 56-78.

Binswanger-Mkhize, H. (2012). **'**Is there too much hype about index-based agricultural insurance? *The Journal of Development Studies,* 48(2): 187-200.

Branstrand, F. and F. Wester (2014). 'Factors affecting crop insurance decision: A survey among Swedish farmers. Swedish University of Agricultural Sciences. Department of Economics.

Brown, W. and C. Churchill (1999). Providing Insurance to Low income Households Part I: A primer on Insurance Principles and Products. USAID- Microenterprise Best Practices (MBP) Product, pp. 91.

Burger, O.E. (1962). All-risk Crop Insurance. *Agrekon* 1(3): 31-39.

Business Dictionary (2018). What is risk? Available at; http://www.businessdictionary.com/ [accessed 07 May 2018].

Cervantes-Godoy, D., Kimura, S. and J. Anton (2013). 'Smallholder risk management in developing countries. OECD Food, Agriculture and Fisheries Papers, No. 61, OECD Publishing.

Cimmyt Publications. (2003). The International maize and wheat improvement centre. Maize production in Southern Africa. Available at; http:www.cimmyt.org [accessed 04 April 2017].

Cole, S., Bastian, G., Vyas, S., Carina, W. and D. Stein (2012). 'The effectiveness of index-based micro-insurance in helping smallholders manage weather-related risks'. Systematic review.

Council of the European Union. (2011). Proposal for a regulation of the European Parliament and of the Council on support for rural development by the European Agricultural Fund for Rural Development.

Danso-Abbeam, G., Addai, K. and D. Ehiakpor (2014). 'Willingness to pay for farm insurance by smallholder cocoa farmers in Ghana'. *Journal of Social Science for Policy Implications*, 2(1):163-183.

Dehejia, R. and S. Wahba (2002). 'Propensity score matching methods for non-experimental causal studies. *Review of Economics and Statistics*, 84 (1):151–161.

de Janvry, A. and E. Sadoulet (1995). Quantitative Development Policy Analysis. Baltimore: Johns Hopkins University Press. Available at; http://caoye.lzu.edu.cn/upload/news/N20141106111536.pdf [accessed 05 June 2017].

Dercon, S. (2002). 'Income risk, coping strategies and safety nets. *The World Bank Research Observer*, 17 (2): 141-166.

Diao, X. and P. Hazell (2004). 'Exploring market opportunities for African smallholders'. Technical report, International Food Policy Research Institute (IFPRI).

Doyer, T. (2013). 'Yellow umbrella for the wine industry. Available at; http://www.swartlandwineroute.co.za/message-santam.htm [Accessed: 05 June 2017].

Ellis, F. (1998). 'Household strategies and rural livelihood diversification. *Journal of Development Studies*, 35(1): 1-38.

Ellis, E. (2016). 'Farmers willingness to pay for crop insurance: Evidence from Eastern Ghana'. Department of Agricultural Economics McGill University, Montréal;

Quebec, Canada. Available at; http://digitool.library.mcgill.ca/webclient/StreamGate?folder_id=0&dvs=1493234802508~362.

Engineering Statistics Book (ESB). (2013). Available at; http://www.itl.nist.gov/div898/handbook/eda/section3/eda35h.htm [accessed 16 Aug 2017].

Enjolras, G. and P. Sentis (2011). 'Crop insurance policies and purchases in France. *Agricultural Economics,* 42 (4): 475–86.

Enjolras, G., Capitanio, F. and F. Adinolfi (2012). 'The demand for crop insurance: combined approaches for France and Italy'. *Agricultural Economics Review,* 13 (1).

Falola, A., Ayinde, O. E. and B.O. Agboola (2013). 'Willingness to take agricultural insurance by cocoa farmers in Nigeria'. *International Journal of Food and Agricultural Economics,* 1(1).

FANRPAN. (2003). 'Maize marketing policy strategy for Swaziland. Available at; http://www.fanrpan.org/documents/d00022/ [accessed 04 June 2017].

Feng, W. (2004). 'Market failure and institution supply of agriculture insurance in China'. Journal of Finance, (Chinese) 2004-4. Available at; www.en.cnki.com.cn/Article_en/CJFDTOTAL-JRYJ200404016.htm [accessed 31 May 2017].

FinScope. (2014). Consumer Survey Swaziland. Available at; http://www.finmark.org.za [accessed 07 May 2018].

Food and Agricultural Organization (FAO). (2000). 'Sustainable agricultural development and poverty alleviation in the new millennium: reflections and lessons from the Asian crisis'. Twenty-fifth FAO regional conference for Asia and the Pacific. Available at; http://ftp.fao.org/unfao/bodies/Aprc/aprc25/x7239e.doc [accessed 04 June 2017].

Food and Agriculture Organization (FAO). (2004). 'Socio-economic analysis and policy implications of the roles of agriculture in developing countries'. Summary Report, Roles of Agriculture Project, FAO, Rome, Italy.

Food and Agriculture Organization (FAO). (2005). FAO/WFP Crop and food supply assessment mission to Swaziland. Special Report. Available at; http://www.fao.org/docrep/008/J5512e/J5512e00.htm [accessed 04 June 2017].

Food and Agriculture Organization (FAO). (2008). 'Managing risk in farming'. Available at; http://www.fao.org/uploads/media/3-ManagingRiskInternLores.pdf [accessed 06 June 2017].

Food and Agriculture Organization (FAO). (2015). 'Surge in climate change-related disasters poses growing threat to food security'. Available at; http://www.fao.org/news/story/en/item/345727/icode/ [accessed 31 May 2017].

Food and Agriculture Organization (FAO). (2016). Agriculture and Food Insecurity Risk Management in Africa.

Food and Agriculture Organization (FAO). (1994). Rural households and sustainability: Integrating environmental and gender concerns into home economics curricula. Available at; http://www.fao.org/docrep/V5406e/v5406e00.htm [accessed 06 June 2018].

Food Early Solution for Africa (FESA). (2014). FESA micro-insurance. Crop insurance reaching every farmer in Africa. January 2014 Final report.

Gadhim, E., Nyikal, R.A. and W. A. Kosura (2005). 'Attitudes towards risk among peasants: An econometric approach. *American Journal of Agricultural Economics,* 59: 710-16.

Gardner, B. L. and R.A. Kramer (1986). 'Experience with Crop Insurance Programs in the United States'. Crop Insurance for Agricultural Development: Issues and Experience, Johns Hopkins University Press, Baltimore.

Garrido, A. and D. Zilberman (2008). 'Revisiting the demand of agricultural insurance: the case of Spain'. *Agricultural Finance Review,* 68 (1): 43-66.

Ghazanfar, S., Wen, Q., Abdullah, M., Ahmad, J. and I. Khan (2015). 'Farmers' willingness to pay for crop insurance in Pakistan'. *Journal of Business, Economics and Finance,* ISSN: 2146 – 7943.

Godfray, H.C., Beddington, J.R., Crute, I.R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M. and C. Toulmin (2010). 'Food Security: The Challenge of Feeding 9 Billion People'. Science, 327(5967): 812-818. Available at; www.sciencemag.org [accessed 01 June 2017].

Gomez-Limon, J., Riesgo, L. and M. Arriaza (2002). 'Agricultural risk aversion revisited: A multicriteria decision-making approach. Available at; http://ageconsearch.tind.io//bitstream/24827/1/cp02go94.pdf [accessed 01 June 2017].

Goodman, L.A. (1961). 'Snowball sampling'. *Annals of Mathematical Statistics*. **32** (1): 148–170. Available at; https://projecteuclid.org/download/pdf_1/euclid.aoms/1177705148 [accessed 04 December 2017].

Goodwin, B. K. and V.H. Smith (2003). 'An ex-post evaluation of the conservation reserve, federal crop insurance, and other Government Programs: Program Participation and Soil Erosion'. *Journal of Agricultural and Resource Economics,* 28(2):201-216.

Goodwin, B. K., Serra. T. and A.M. Featherstone (2003). 'Modeling changes in the U.S. demand for crop insurance during the 1990s'. *Agricultural Finance Review*, Fall 2003.

Govereh, J., Jayne, T.S. and J. Nyoro (1999). 'Smallholder commercialisation, interlinked markets and food crop production: cross-country evidence in Eastern and South Africa'. MSU International Development Working Paper. East Lansing: Michigan State University.

Greene, W. (1998). *Econometric Methods*, 3rd ed. Available at; http://stat.smmu.edu.cn/DOWNLOAD/ebook/econometric.pdf [accessed 04 December 2017].

Hair, J.F., Black, W. C., Anderson, R. E. and R.L. Tatham (1995). Multivariate Data Analysis with Readings. Fourth edition.

Hanemann, M. and B. Kanninen (1999).The statistical analysis of discrete-response CV data. In Bateman, I. and K. Willies (eds.). Valuing Environmental Preferences, Oxford University Press.

Hardaker, J, B., Huirne, R. B., Anderson, J.R. and G. Lien (2004). Coping with risk in agriculture (Second edition), CAB International, New York.

Hojjati, B. and N. Bockstael (1989). 'Modeling the demand for crop insurance'. In H. Mapp, ed. Multiple Peril Crop Insurance: A Collection of Empirical Studies. Southern Cooperative Series Bulletin No. 334, pp. 153–76.

Holton, G. A. (2004). 'Defining risk'. *Financial Analysts Journal*, 60 (6): 19–25.

Hubbard, D. (2009). 'The Failure of risk management: Why it's broken and how to fix it. John Wiley & Sons. p. 46.

Insurance fact book. (2017). 'Understanding crop insurance'. Available at; http://www.iii.org/article/understanding-crop-insurance [accessed 06 December 2017].

Jones, P.G. and P. K. Thornton (2009). 'Croppers to livestock keepers: livelihood transitions to 2050 in Africa due to climate change'. *Environmental science & policy,* 12 (2009): 427–437.

Just, R.E., Calvin, L. and J. Quiggin (1999). 'Adverse selection in crop insurance: actuarial and asymmetric information incentives'. *American Journal of Agricultural Economics,* 81(4): 834-849.

Kahan, D. (2013). Managing Risk through farming. Food and Agriculture Organization of the United Nations, Rome.

Knight, F.H. and K.H. Coble (1997). 'A survey of literature on U.S. multiple peril crop insurance since 1980'. *Review of Agricultural Economics,* 19(1):128-156.

Korir, L.K. (2011). 'Risk management among agricultural households and the role of off-farm investments in Uasin Gishu County, Kenya. M.Sc, Egerton University, Kenya.

Kouame, E. and N. Komenan (2012). 'Risk preference and demand for insurance under-price uncertainty; An experimental approach for cocoa farmers in Cote d'Ivoire'. Micro-insurance Innovation Facility, Research paper No. 13.

Kramer, R.A. (1983). 'Federal crop insurance'. Agricultural History 97(1):181–200.

Kuku, O., Ajibola, A. and L. Saweda (2011). 'A review of literature on agricultural productivity, social capital and food security in Nigeria. NSSP Working Paper No. 21. Abuja: IFPRI

Kwadzo, T. M. G., Kuwornu, J.K.M. and I.S.B. Amadu (2013). **'**Food crop farmers' willingness to participate in market-based crop insurance scheme: Evidence from Ghana. *Research in Applied Economics*, 5(1):1-21. ISSN 1948-5433

Lancaster, K. (1966). 'A new approach to consumer theory'. *Journal of Political Economy*, 74(2): 132-157.

Land Bank (2013). History of the land bank; Financing Agriculture for 100 Years.

Lefebvre, M., Nikolov, D., Gomez-y-Paloma, S. and M. Chopeva (2014). 'Determinants of insurance adoption among Bulgarian farmers'. *Agricultural Finance Review*, 74 (3): 326-347.

Liesivaara, P. and S. Myyra (2014). 'Willingness to pay for agricultural crop insurance in the northern EU'. *Agricultural Finance Review*, 74 (4): 539-554. Available at; http://www.emeraldinsight.com/doi/pdfplus/10.1108/AFR-06-2014-0018 [accessed 2017-06-03].

Ligon, E. (2011). 'Supply and effects of specialty crop insurance'. National Bureau of Economic Research, Nber Working Paper Series. Working Paper 16709.

Long, Q. T., Minh, T.B., Manh, C.N and T.V. Thanh (2013). 'Farm households' willingness to pay for crop (micro) insurance in rural Vietnam: An Investigation Using Contingent Valuation Method'. East Asian Development Network (EADN) Working Paper No.64.

Machetta, F. (2011). 'On the move livelihood strategies in Northern Ghana'. CERDI, Etudes et Documents, 13. France. Available at; http:// halshs.archives-ouvertes.fr/ halshs- 00591137 [accessed 04 June 2017].

Magagula, S.D.M., Dlamini, E.V. and E.M. Mkhwanazi (2007). Modern Agriculture for Swaziland (2nd ed). Oxford University, South Africa.

Mahul, O. and C.J. Stutley (2010). 'Government support to agricultural insurance: Challenges and options for developing countries'. The World Bank, Washington, D.C.

Makhura, M.T. (1994). Theoretical and econometric models of commercialization behavior of farmers in the developing areas of South Africa'. M.Sc. Thesis. The Pennsylvania State University. University Park.

Makki, S.S. and A. Somwaru (2001). 'Farmers' participation in crop insurance markets: Creating the right incentives'. *Amer. J. Agr. Econ*, 83(August 2001a):662–67.

Maleika, M. and A.T. Kuriakose (2008). 'Microinsurance: extending pro-poor risk management through the social fund platform'.

Manski, C. (1977). 'The structure of random utility models'. *Theory and Decisions*, 8(1):229-254.

Martinsson, P. Alpizar, F. and F. Carlsson (2001). 'Using choice experiments for non-market valuation'. Working Papers in Economics no. 52, June 2001. Department of Economics Göteborg University. Available at; https://gupea.ub.gu.se/bitstream/2077/2859/1/gunwpe0052.pdf [accessed 03 June 2017].

McCarthy, N. (2003). 'Demand for rainfall-index based insurance: A case study from Morocco'. International Food Policy Research Institute, EPTD Discussion Paper No. 106. Washington, D.C. 20006 U.S.A.

McFadden, D. (1974). 'Conditional logit analysis of qualitative choice behaviour'. Available at; https://eml.berkeley.edu/reprints/mcfadden/zarembka.pdf [accessed 03 June 2017].

McFadden, D. and K. Train (2000). 'Mixed MNL models for discrete response'. *Journal of Applied Econometrics*, 15(1):447-470.

Mendola, M. (2006). 'Agricultural technology adoption and poverty reduction: A propensity-score matching analysis for rural Bangladesh'. University of Milano-Bicocca and Centro Studi L. d'Agliano, Milano, Italy. *Food Policy,* 32 (2007): 372–393.

Mfungwe, L. (2012). 'Assessing the impact and adoption of agroforestry food security programmes on the rural livelihoods: Evidence from Southern Malawi'. Master Thesis. University of Malawi.

Ministry of Agriculture (MOA). (2013). Annual reports. The Government of Swaziland.

Miranda, M.J. (1991). 'Area-yield crop insurance reconsidered'. *American Journal of Agricultural Economics,* 73:233–242.

Mishra, A. and B. Goodwin (2003). 'Adoption of crop versus revenue insurance: a farm-level analysis'. *Agricultural Finance Review,* 63(2): 143-155.

Mishra, P. K. (1996). 'Agricultural risks, insurance, and income: A study of the impact and design of India's comprehensive crop insurance scheme'. Avebury Press Brookfield, Aldershot, United Kingdom.

Mishra, A.K. and M. Morehart (2001). 'Off-farm investment of farm households: A logit analysis'. Agricultural Finance Review. Available at; https://pubag.nal.usda.gov/pubag/downloadPDF.xhtml?id=38739&content=PDF [accessed 04 December 2017].

Morduch, J. (1995). 'Income smoothing and consumption smoothing'. *Journal of Economic Perspectives*, 9(3):103-114.

Mullera, C., Cramera, W., William, L., Harea, B. and H. Lotze-Campena (2011). 'Climate change risks for African agriculture'. PNAS 108 (11): 4313–4315.

Nahvi, A., Kohansal, M., Ghorbani, M. and N. Shahnoushi (2014). 'Factors affecting rice farmers to participate in agricultural insurance'. *Journal of Applied Science and Agriculture,* 9(4): 1525-1529.

National Maize Corporation. (NMC). (2016). Annual Report. Matsapha, Swaziland.

Nayyar, D. and L. Dreier (2012). 'Putting the new vision for agriculture into action: A transformation is happening'. World Economic Forum. Available at; http://www3.weforum.org/docs/WEF_FB_NewVisionAgriculture_HappeningTransformation_Report_2012.pdf [accessed 01 June 2017].

Nelson, G.C., Rosegrant, J., Koo, R., Robertson, T., Sulser, T., Zhu, C., Ringler, S., Msangi, A., Palazzo, M., Batka, M., Magalhaes, R., Valmonte Santos, M., Ewing and D. Lee (2009). Climate change: Impact on agriculture and costs of adaptation. Food Policy Report #19. IFPRI, Washington, DC.

Nganje, W., Hearne, R., Orth, M. and C. Gustafson (2004). 'Using choice experiments to elicit farmers' preferences' for crop and health insurance'. Contributed Paper Presented at the AAEA Annual Meeting Denver, Colorado, August 2004.

Nieuwoudt, W.L., Johnson, S.R., Womack, A.W. and J.B. Bullock (1985). The Demand for Crop Insurance. Agricultural Economics Report No. 1985-16, Department of Agricultural Economics, University of Missouri.

Nimoh, F., K. Baah and E.K. Tham-Agyekum. (2011). 'Investigating the interest of farmers and insurance companies in farm insurance: The case of cocoa farmers in Sekyere West Municipal of Ghana'. *Journal of Agricultural Science,* 3(4): 126-135.

Nnadi, F. N., Chikaire, J., Echetama, A.J., Ihenacho, A.R., Umunnakwe, C.P. and O.C. Utazi (2013). 'Agricultural insurance: A strategic tool for climate change adaptation in the agricultural sector'. Adams, A. 1995. Banking and Finance Series Investment, Kluwer Law International, London. *Net Journal of Agricultural Science,* 1(1): 1-9.

Organisation for Economic Co-operation and Development (OECD). (2011). Managing Risk in Agriculture: Policy Assessment and Design. Paris: OECD.

Organisation for Economic Cooperation and Development (OECD). (2015). 'Agriculture and Climate Change'. Trade and Agriculture Directorate. Available at; http://www.oecd.org/agriculture [accessed 21 March 2018].

Olila, D. (2014). An assessment of maize farmers' preferences for crop insurance features in Trans-Nzoia County, Kenya.

Otieno. (2011). 'Economic analysis of beef cattle farmers' technical efficiency and willingness to comply with Disease Free Zones in Kenya'. Thesis Submitted for the degree of Doctor of Philosophy School of Agriculture, Food and Rural Development, Newcastle University, Newcastle Upon Tyne, NE1 7RU, United Kingdom.

Pashigan, B. P., Schkade, L. L. and G. H. Menefee (1966).The selection of an optimal deductible for a given insurance policy. *Journal of Business*, 39: 35-44.

Paxson, C. (1992). 'Using weather variability to estimate the response of savings to transitory income in Thailand'. *American Economic Review,* 82(1):15-33.

Pennings, J., Isengildina-Massa, O., Irwin, S., Garcia, P. and D. Good (2008). 'Producers complex risk management choices'. *Agribusiness*, 24 (1), 31–54.

Piot-Lepetit, I. and R. M'Barek (2011). 'Methods to analyse agricultural commodity price volatility'. Methods to Analyse Agricultural Commodity Price Volatility (pp. 1-11): Springer.

Ramasubramanian, J. (2012). 'Willingness to pay for index-based crop microinsurance in India'. University of Sussex, United Kingdom. Available at; https://www.dartmouth.edu/~neudc2012/docs/paper_19.pdf [accessed 21 March 2018].

Ramiro, I. (2009). Agricultural insurance. In Primer Series on Insurance. World Bank. [Online] Available at; http://siteresources.worldbank.org/FINANCIALSECTOR/Resources/Primer12_Agricultural_Insurance.pdf [accessed 27 March 2018].

Rao, K., Gine, X., Larson, D., Bantilan, C. and K. Charyulu (2006). 'Strategic assessment and development pathways for agriculture in the semi-arid tropics'. Policy Brief No.7. How can rainfall insurance help dryland farmers? Available at; https://www.researchgate.net/publication/277176817_How_can_rainfall_insurance_help_dryland_farmers [accessed 31 May 2017].

Rattani.V. (2016). 'Overview of agricultural insurance in Africa and Asia'. Available at; http://www.cseindia.org/userfiles/africa-asia-conclave_vjeta.pdf [accessed 31 May 2017].

Reardon, T. and J. Berdegue (2002). 'The rapid rise of supermarkets in Latin America: Challenges and opportunities for development'. *Development Policy Review,* 20(4): 371- 388.

Richards, J. (2000). 'A two-stage model of the demand for speciality crop insurance'. *Journal of Agricultural and Resource Economics,* 25(1): 177-194.

Riwthong, S., Schreinemachers, P., Grovermann, C. and T. Berger (2016). 'Agricultural commercialization. Risk perceptions, risk management and the role of pesticides in Thailand'. Kasetsart Journal of Social Sciences (2016) 1-9.

Rosenbaum, P.R. and D.B. Rubin (1983). 'The central role of the propensity score in observational studies for causal effects'. *Biometrika*, 70 (1): 41-55.

Schlotzhauer, D.C. (1993). Some issues in using the logistic procedure for binary logistic regression. The Technical Journey for SAS Sofware Users. Observations, 2(4).

Shaik S., Coble K., Knight T., Baquet A. and G. Patrick (2008). 'Crop revenue and yield insurance demand: a subjective probability approach'. *Journal of agricultural and applied economics,* 40 (3): 757-766.

Shashi Kiran, A.S. and K.B. Umesh (2012). 'Crop insurance- Strategy to minimize risk in agriculture'. 2012 Conference, Foz do Iguacu, Brazil 126734, International Association of Agricultural Economics.

Shashi Kiran, A.S. and K.B. Umesh (2015). 'Willingness to pay for crop insurance premium- A study on maize farmers in India'. International Conference of Agricultural Economics.

Sherrick, B. J., Barry, P.J., Schnitkey, G. D., Ellinger, P. N. and B. Wansink (2003). 'Farmers' preferences for crop insurance attributes'. *Review of Agricultural Economics,* 25 (2): 415–429.

Sherrick, B. J., Barry, P. J., Ellinger, P. N. and G. Schnitkey (2004). 'Factors influencing farmers' crop insurance decisions'. *American Journal of Agricultural Economics,* 86(1): 103-114.

Shi, H. (2008). 'Empirical study on influence of financial subsidy on farmers' agricultural insurance decision: Evidence from Zhejiang province in China'.Technology Economics (Chinese), 2008-09.

Sihlongonyane, M. B., Masuku, M.B. and A. Belete (2014). Economic Efficiency of Maize Production in Swaziland: The Case of Hhohho, Manzini and Shiselweni Regions.

Slater, R., Holmes, R. and N. Mathers (2014). Food and nutrition (in-) security and social protection. OECD Development Co-operation Working Papers, No. 15. Paris, OECD.

Smith, V.H., and Glauber, J.W. (2012). 'Agricultural insurance in developed countries: Where have we been and where are we going? *Applied Economic Perspectives and Policy,* 34 (3): 363-390.

Swaziland Royal Insurance Corporation (SRIC). (2016). Agricultural Insurance Products. Mbabane, Swaziland.

The Guardian. (2014). 'Agriculture insurance: freeing farmers from extreme weather risk'. Available at; https://www.theguardian.com/global-development-professionals-network/2014/oct/29/agricultural-insurance-smallholder-farmers-risk-financial-inclusion [accessed 30 May 2017].

Thurstone, L. (1927). 'A law of comparative judgement'. *Psychological Review,* 34(2):273–286.

Tsikirayi, R., Makoni E. and J. Matiza (2013). 'Analysis of the uptake of agricultural insurance services by the agricultural sector in Zimbabwe'. University of Zimbabwe. *Journal of International Business and Cultural Studies,* 7: 207-221.

United Nations (UN). (2015). Sustainable Development. Available at; https://sustainabledevelopment.un.org [accessed 07 May 2018].

United States Department of Agriculture (USDA). (2016). 'Risk in agriculture'. Available at; https://www.ers.usda.gov/topics/farm-practices-management/risk-management/risk-in-agriculture.aspx [accessed 2017-04-09].

Vandeveer, M. L. (2001). 'Demand for area crop insurance among litchi producers in Northern Vietnam'. Agricultural Economics 26 (2001) 173. Economic Research Service, US Department of Agriculture, 1800 M Street NW Room S5013, Washington, DC 20036, USA.

Velandia, M., Rejesus, R.M., Knight, T.O. and B.J. Sherrick (2009). 'Factors affecting farmers' utilization of agricultural risk management tools: the case of crop insurance, forward contracting, and spreading sales'. *Journal of Agricultural and Applied Economics,* 41(1): 107-123.

von Braun J., Bouis, H. and E. Kennedy (1994). 'Conceptual framework. In: von Braun J and Kennedy E (eds), Agricultural commercialization, economic development, and nutrition'. Johns Hopkins University Press, Baltimore, Maryland, USA. pp. 9–33.

von Neumann, J. and O. Morgenstern (1947). Theory of games and economic behaviour, 2nd rev. ed. Princeton, NJ: Princeton University Press.

Wan, W. (2014). **'**Farmers' willingness to pay for breeding sow insurance: Evidence from China's Hubei Province'. Theses and Dissertations. Agricultural Economics Paper 22. University of Kentucky. Available at; http://uknowledge.uky.edu/agecon_etds/22 [accessed 06 May 2017].

World Bank. (2005). Managing agricultural production risk; Innovations in developing countries; Agriculture and Rural development Department- World Bank.

World Bank. (2011). 'Agricultural risks and risk management'. Agriculture and Rural Development Discussion Paper. Available at; https://www.agriskmanagementforum.org/sites/agriskmanagementforum.org/files/Chapter_1_WII_Paper_Nov_2011.pdf [accessed 06 May 2017].

Wright, B. D. and J.A. Hewitt (1994). 'All risk crop insurance: lessons from theory and experience'. Economics of Agricultural Crop Insurance: Theory and Evidence; 73-109, Kluwer Academic Publishers, Boston.

Xiu, F., Xiu, F. and S. Siegfried Bauer (2012). 'Farmers' willingness to pay for cow insurance in Shaanxi Province, China'. Available at; http://ac.els-cdn.com/S0195925503001380/1-s2.0-S0195925503001380-main.pdf?_tid=3261d7e4-2a88-11e7-b4f7-00000aacb35f&acdnat=1493215190_05341aaa448606e49ce8b3d005d9cb6c [accessed 12 May 2017].

Yassin, F. (2011). 'Agricultural risks and risk management of different farming systems in Syria. Available at; http://www.fedoa.unina.it/8847/1/Firas_YASSIN.pdf [accessed 06 May 2017].

APPENDICES

APPENDIX A

Independent variables in the different regions and the total sample

Independent variable	HHOHHO			LUBOMBO			TOTAL		
	N	Mean	St.Dev	N	Mean	St.Dev	N	Mean	St.Dev
Household characteristics									
AGEHH	48	61.83	13.23	25	61.36	15.54	73	61.67	13.96
AGE-2HH	18	42.78	10.97	35	51.31	11.70	53	48.42	12.06
HOUSEHOLD SIZE	75	7.27	4.07	75	7.67	3.96	150	7.47	4.01
Factors of production									
FARM SIZE (Ha)	75	2.02	1.33	75	2.54	1.99	150	2.28	1.70
INCOME (R)	75	13020 .13	20710. 92	75	3490. 87	5968.7 5	150	8255. 50	15924. 17
FARMING EXPER	75	24.88	14.50	75	28.09	16.05	150	26.49	15.33
EXPECTED YIELD	75	56.00	44.65	75	42.83	51.81	150	49.41	48.65
RISK									
LOSS EXP (years)	75	2.33	2.26	75	3.04	3.71	150	2.69	3.08

APPENDIX B

Variable	Co eff.	Std.Error	P-values
Age	-0.008	0.011	0.450
Age2HH	0.015	0.010	0.133
Household Size	0.039	0.032	0.224
Married	-0.075	0.366	0.837
Was Married	-0.569	0.472	0.228
Occupation	0.654	0.277	0.018**
Higher Education	-0.733	0.431	0.089*
Lower Education	-0.646	0.398	0.105
Location	1.124	0.261	0.000***
Farming Education	0.196	0.279	0.483
Credit	-0.095	0.300	0.752
Expected Yield	-0.002	0.004	0.656
Farming Experience	-0.017	0.010	0.081*
Knowledge of CI	0.104	0.416	0.802
Savings	0.925	0.300	0.002***
Years loss exp.	-0.091	0.070	0.197
Constant	-0.245	0.857	0.775
Log likelihood LR Chi^2 (16) Prob>chi^2 Pseudo R^2	-73.219 61.27 0.000*** 0.295		

Probit results of propensity scores for the treated variables

Farmers' preferences for crop insurance were estimated by employing the propensity scores and the results have been presented. The decision to adopt crop insurance was the "treatment". Farmers who were interested in crop insurance and participated in the preferences are the 'treated group' and those farmers who were not interested in crop insurance and were not participants in the preferences are the 'untreated group'. Propensity scores were generated and stored as a variable on which the matching was to be done.

Nearest-neighbour matching results of farmers preferences

Variable	ATT	Std. Error	t	p-values
Risk Cover	-0.077	0.304	-0.253	0.001***
Coverage Levels	-0.179	0.299	-0.600	0.001***
Premiums	-0.038	0.284	-0.135	0.002***
Nature of Coverage	-0.231	0.273	-0.845	0.003***
Subsidies	-0.154	0.154	-0.597	0.000***
Time taken to purchase crop insurance	0.026	0.277	0.093	0.020**
Outbreak of pests and diseases & Theft	-0.103	0.303	-0.339	0.003***
Involvement and Compensation	-0.192	0.317	-0.606	0.008***

Questionnaire

An Analysis of Farmers' Preferences for Crop Insurance: A Case of maize farmers in Swaziland

Position in household……. | | 01 |

Membership in farmers' union/association: 1= Yes 0= No | | 02 |

Part 1 Basic household information

1.1: Basic family information

Family members		Gender	Age	Marital status	Education level	Occupation	Years in farming	Other language
03		**04**	**05**	**06**	**07**	**08**	**09**	**10**
1=Husband								
2=Wife								
3= Aunt								
4= Uncle								
5=Daughter								
6=Son								
7=Grandmother								
8=Grandfather								
9=Granddaughter								
10=Grandson								
Family size								
03. Family members based on household efficiency: Husband (1); Wife (2) Aunt (3) Uncle (4) Daughter (5) Son (6) Grandmother (7) Grandfather (8) Granddaughter (9) Grandson (10)		04.Gender: Male (0) Female (1)		06. Marital status: Single (0) Married (1) Divorced (2) Widow (3)	07.Highest education attained; Illiterate (0). Primary (1). High school (2). Tertiary (3)	08.Occupation of household member: Farmer(0) Teacher (1) Police (2) Nurse (3) Shop assistant (4),Other (5)		10. Other language spoken/known besides SiSwati: None (0) English (1) Zulu (2) Portuguese (3

Part 2. A: Factors of production

2.1 Land

2.1.1 How much area of land do you use for farming (ha)? …… | | 11 |

2.1.2 What land tenure system is the farming on? 1= Swazi Nation Land 0=Title Deed land | | 12 |

2.1.3 Do you own the land you use for farming? 0=No 1=Yes 2=own and rent part of it | | 13 |

2.1.4 If no, do you pay rent for the land? 0=No 1=Yes 2=Don't know | | 14 |

2.1.5 If yes, how much do you pay annually as rent? R..... | | 15 |

2.1.6 Are you willing to increase land allocated for maize production? 1=Yes 0=No | | 16 |

2.1.7 Can you get more land for farming? 0=No 1=Yes 2= The one I have is enough | | 17 |

2.1.8 If no, why? (1= difficult to get land, 2= do not afford to rent more land 3= lack of inputs/ funds to increase production 4= conflicts)

..... | | 18 |
.....
..

2.2 Labour

2.2.1 Do you hire labour? 1=Yes 0= No | | 19 |

If you do please fill the following table:

Type of labour	No. of labourers	Total amount paid/day (R)	Total number of days employed	Total amount paid per year (R)
20	**21**	**22**	**23**	**24**
1= Permanent				
2= Seasonal				
3= Casual				
4= Household				
20.Type of labour: None (0);Permanent (1) ;Seasonal (2); Casual (3)Household (4); Permanent and Seasonal (5); Permanent and Casual (6);Permanent and household(7);Seasonal and casual (8); Seasonal and household (9); Casual and household; All the above (10)				

2.2.2 Do you get any education or advice on maize farming? 1=Yes 0= No | | 25 |

2.2.3 If yes, where? | | 26 |

1= Visits from extension officers 2= Farmers' unions/associations

3= Visiting other farmers 4= Demonstration plots 5= Media

2.2.4 Do you keep farming records? 1=Yes 0= No | | 27 |

2.3 Capital

2.3.1 Did you access credit to finance agricultural purposes? 1= Yes 0= No | | 28 |

Lending sources	Has anyone in the household taken loan/cash in kind from the source in the past 12 months?	Who made the decision to borrow from the source?	Who makes the decision of what to do with the borrowed money?
29	**30**	**31**	**32**
1= Informal lender			
2= Formal lender (bank/financial institution)			
3= Non-governmental organization			
4= Group based micro-finance or lending including ROSCAs / SACCOs			
5= Friends or relatives			
Lending source; None (0) Informal lender (1) Formal lender (2) NGO(3) Microfinance (4) Friends or relatives (5) Informal lender and relatives (6)	30. Taken loans ✓ Yes, cash (1) ✓ Yes, in-kind (2) ✓ Yes, cash and in-kind (3) ✓ No (4) ✓ Don't know (5)	31/32. Decision making and control over credit ✓ Self (1) ✓ Partner/Spouse (2) ✓ Self and partner/spouse jointly (3) ✓ Other household member (4) ✓ Self and other household member(s) (5) ✓ Partner/Spouse and other household member(s) (6) ✓ Someone (or group of people) outside the household (7) ✓ Self and other outside people (8) ✓ Partner/Spouse and other outside people (9) ✓ Self, partner/spouse and	

		other outside people (10)

2.3.2 Fill the questions below on savings and insurance;

Do you have savings?		Do you have insurance policy?		If, yes which type of insurance policy	
33		**34**		**35**	
0= NO		0= NO		1= Livestock insurance	
1= YES		1= YES		2= Health insurance	
2= DON'T KNOW		2= DON'T KNOW		3= Life insurance	
				4= Property insurance	
				5= Other…….	
33. Having savings ✓ No (0) ✓ Yes (1) ✓ Don't know (2)		34. Taken an insurance policy ✓ No (0) ✓ Yes (1) ✓ Don't know (2)		35. Type of insurance policy ✓ Livestock insurance (1) ✓ Health insurance (2) ✓ Life insurance (3) ✓ Property insurance (4) ✓ Other…….. (5)	

2.3.3 Do you or does anyone in your household have other sources of income besides farming?

Household member		Other source of income	Income per year
36		**37**	**38**
1= Household head			
2= Spouse/wife			
3= Aunt			
4= Uncle			
5= Daughter			
6= Son			
7= Other family member			
36. Family members ✓ None (0) ✓ Husband (1) ✓ Wife (2) ✓ Aunt (3) ✓ Uncle (4) ✓ Daughter (5) ✓ Son (6) ✓ 2 family members (7) ✓ 3 family members (8) ✓ 4 family members (9) ✓ Other family member….(10)		37. Other sources of income besides farming ✓ No (0) ✓ Yes (1) ✓ Don't know (2)	38. Income per month per for members with others sources of income ✓ $\leq R1000$ (1) ✓ $R1000 - R4000$ (2) ✓ $R4000 - R8000$ (3) ✓ $R8000 - R12000$ (4) ✓ $R12000 - R16000$ (5) ✓ $R16000 - R20000$ (6) ✓ $\geq R20000$ (7)

2.4 Inventory

Item		Price of implement (R)	Did you pay cash/credit/exchange	If on credit, how did you pay (eg monthly instalments)	Who provided money/ sponsored the purchase
39		**40**	**41**	**42**	**43**
1=Tractor					
2= Plougher					
3= Planter					
4=					
5=					
6=					
7= Other					
39. Type of implement: None (0) Tractor (1) Plougher (2); planter (3); Other equipment (4); Tractor and Plougher (5); Tractor and Planter (6); Plougher and planter (7);All the above (8)			41. Type of payment for implement; Cash (1) Credit (2) Exchange (3)	42. Time of payment: Monthly (1) Yearly(2) After harvest (3) Other (4)	43. Who is/paid for implement: Husband (1); Wife (2); Aunt (3); Uncle (4); Daughter (5); Son (6)

Part 3: Crop production

3.1 Please indicate the following regarding maize cropping information and other available crops:

Crop	Area planted (ha)	Years of farming	Yearly expected yield (EY)	Actual yield (AY)	Amount consumed at home (kg)	Amount sold (kg)	Price per unit	Income per crop	Known risks that may affect (EY)
44	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**
1= Maize									
2=Vegetables									
3=Sweet									

potato									
4=Other									
44. Crops grown; Maize (1); Vegetables (2); Sweet potato (3) Maize and beans (4) Maize, beans and sweet potatoes (5) Maize and potatoes (6) Maize, veg and beans (7) Maize and vegetables (8)			47. Expected yield in 100kg= 1 bag	48. Actual yield after harvesting 100kg =1 bag	49. Amount sold 100kg =1 bag	50. Number of 100kg bags sold	51. Price received for 1 bag= 100 kg		53.None (0) Drought /less rainfall (1) Less rainfall and lack of inputs (2) Drought and pests(cattle) (3) Less rainfall ad wind (4) Drought and too much late rainfall (5) Too much rainfall leads to spoilage (6)

B. Experience of production losses

3.2 Have you experienced any production loss before? 0= No 1=Yes 2= Don't know | | 54 |

3.3 If yes, what type of loss did you experience: 1= Drought 2= Flood 3= Pests | | 55 |

4= Plant diseases 5= Hail

3.4 What was the extent of the loss? 0=None 1= ≤25% 2= 25-50% 3= 50-75% | | 56 |
4=75-100%

3.5 How many years have you experienced the losses?..... | | 57 |

Part 4

A: Sources of agricultural risks and risk management strategies

4.1 Do you think your production is exposed to some risk? 0= No 1=Yes 2= Don't know | | 58 |

4.2.1 If yes, please select the risks likely to affect your production and their impact;

Risk factors		1=Very high	2=High	3=Medium	4=Low	5=None
59	1=YES 0=NO	**60**	**61**	**62**	**63**	**64**
1=Loss of production by weather (drought)						
2= Quality of seed						
3= Planting technical problems						
4= Pests and diseases						
5= Fire						
6= Market risks						
7= Price risks						
8= Post-harvest losses						
9= Theft 10= drought+ quality of seed+ pests and diseases+ price risks						

4.2.2What precaution method have you used to cope with the risks? Fill out the following table.

Table 4.2.2: The risk management strategies and their effects

Method (identify all that apply)		1=Very high	2=High	3=Medium	4=Low	5=None
65	1=YES 2=NO	**66**	**67**	**68**	**69**	**70**
1= Purchase crop insurance						
2= Diversification of agricultural products						
3= Improve technical skills						
4= Purchase high quality seeds						
5= Take a loan						
6= Participate in cooperative/union						
7= Hedging maize prices						

8= Selling of assets						

4.3 Were the risk management strategies effective during the recent drought?
1= Highly effective 2= Effective 3= Little effective 4= Not at all 5= Don't know

	71

Part 5

A: Knowledge on crop insurance

5.1 Are you familiar with sugar cane crop insurance in Swaziland? 1=Yes 0=No

	72

If answer to 5.1 is YES; complete the following questions;

5.2 Briefly explain what you know about sugar cane crop insurance. 0=None 1= farmer gets compensated against insured losses 2= cover those farmers who have fenced their field

	73

.....
.....

5.3 How did you know about crop insurance?

	74

1=Family and friends 2=Insurance companies 3=Media 4=Government

5= Cooperatives/unions 6= Financial institutions 7= Extension officer

5.4 Do you know any crop insurance providers in the country? 1=Yes 0= No

	75

5.5 Which of the following types of crop insurance are you familiar with?

	76

1= One that provides cover for more than one peril i.e. drought/hail/floods/fire

2= One that provides cover for only one named threat/hazard

3=One that provides indemnity payments based on values obtained from an index that serves as a proxy for losses

5.6 Have you ever purchased crop insurance before?

	77

1=Never 2=purchased it before, but not now 3=Always purchase it

5.7 If answered (3) on 5.7, have you ever used/did it ever help you get access to credit/loan?

	78

1=Yes 0= No

5.8 If you answered (2) on question 5.7, specify reason for not purchasing crop insurance

	79

now……

……

……

5.9 If you have never purchased crop insurance, please fill out the reason/s why (identify all that apply) | | 80 |

1=Do not have sufficient knowledge to make decision to buy crop insurance 2= It's too expensive 3= Do not trust insurance companies 4= Complicated to settle claims 5= Coverage amount is too small 6= Unfair claims 7=Too many rules 8= Coverage settlement claim is limited 9= I can cope with risk by myself 10=Nobody buys crop insurance in my community 11=Insurance period is to short 12= 3 and 9 13= 2 and 3

6.0 Do you know the benefits of crop insurance? 0= No 1= Yes 2=Don't know | | 81 |

6.1 Do you think crop insurance is effective? | | 82 |

1= Extremely effective 2= Very effective 3= Effective 4=A little bit 5=Not at all 6=Don't know

6.2 If you had R1000 to purchase to spend on insurance how can you allocate it to the following types of insurance?

Insurance product		Allocated amount (R)	
83		**84**	
1= Crop insurance	01		07
2= Livestock insurance	02		08
3= Health insurance	03		09
4= Property insurance	04		10
5= Retirement fund	05		11
Total amount		The sum of amount allocated must sum to R1000	

6.3 Would you be willing/interested in purchasing crop insurance for your maize | | 85 |

| | 86 |

production? 1= Yes 0=No

6.4 If NO, explain why? 0=None 1= farmer can cope with risk 2= can't afford to pay monthly premiums 3= does not trust insurance companies

…….....
.....
.....

*If answer to (6.3) is YES proceed to part C. If NO, do not proceed to part C.

B: If farmer is not familiar with crop insurance

Brief description of crop insurance and its benefits

Crop insurance is a type of insurance purchased by agricultural producers, including farmers, ranchers and others to protect their farms against losses either through natural disasters such as, drought, floods, hail and the loss of revenue due to the decline in market prices for agricultural commodities. It is an imperative risk management tool that farmers need to ensure the sustainability of agricultural enterprises. The insurer agrees to pay a payment claim or benefit to the insured upon the occurrence of a specified loss and the insured pays a pre-specified premium. Crops covered include maize and sugar cane.

6.5 Would you be interested in purchasing crop insurance for your maize production?

1= Yes 0=No

	87

6.6 If NO, explain why? 0=None 1= farmer can cope with risk 2= can't afford to pay monthly premium 3= does not trust insurance companies 4= less risks to even consider insurance 5= difficult to settle claims 6= don't see the need for it 7= need more info about it

	88

…….....
.....
.....

*If answer to (6.5) is YES proceed to part C. If NO, do not proceed to part C.

C: Farmers preferences for crop insurance

If farmer who is familiar with sugar cane crop insurance is willing to purchase maize crop insurance and if, after a brief description of crop insurance, farmer would purchase maize crop insurance, complete the following questions;

6.7 Before the drought how likely do you think you would have been interested in purchasing crop insurance? 89

1= Highly likely 2= Likely 3= Unlikely 4= Very unlikely

6.8 After the drought how likely do you think you can purchase crop insurance? 90

1= Highly likely 2= Likely 3= Unlikely 4= Very unlikely

6.9 Which type of maize crop insurance would you most prefer to purchase? | | 91 |

1= One that provides cover for more than one peril i.e. drought/hail/floods/fire

2= One that provides cover for only one named threat/hazard

3=One that provides indemnity payments based on values obtained from an index that serves as a proxy for losses

7.0 Suppose there is a crop insurance scheme that provides the following coverage levels | | 92 |

which one would you prefer?

1= 50% 2= 60% 3=70% 4= 80% 5= 90% 6= 100%

7.1 If the crop insurance scheme requires the following monthly premiums which one will you prefer? | | 93 |

1= <R300 2= R300-R500 3= R500-R1000 4= R1000-R1500 5= R1500-R2000

7.2 Would you prefer being involved more in the designing of the context of crop insurance schemes and will that make you more likely to purchase crop insurance? 1=Yes 0= No | | 94 |

7.3 If the insurance scheme provided compensation would you prefer it to be based on the market price of a 100kg bag? | | 95 |

0= No 1=Yes 2= Don't know

7.4 If 7.1 is NO, explain which one you prefer? 0=None 1= insurance should also provide cover for intercropped crops 2=must be more to enable planting in the next season 3=since there is no surplus, that won't be enough for food | | 96 |

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7.5 Suppose the crop insurance scheme provides the following risk covers, which one | | 97 |

would

you prefer? 1= Multi-peril cover 2= Single peril 3= Yield insurance

7.6 Which nature of coverage would more prefer to be included in the crop insurance | | 98 |

scheme? 1= Crops only 2= Crops plus livestock 3= Crops with other social issues

D: Potential actions/events and their influence on farmers' preferences

7.7 Suppose the Government provided more subsidies for agricultural purposes which would | | 99 |

you more prefer?

1= Crop insurance premium subsidies 2= Input subsidies 3= revenue subsidies

7.8 Suppose the Government/ crop insurance providers would offer a reduction in crop | | 100 |

insurance premiums would you purchase crop insurance? 1=Yes 0=No

7.9 If you received more education about crop insurance would you prefer crop insurance | | 101 |

more? 0= No 1=Yes 2= Don't know

8.0 Suppose the drought was expected to continue, after how many years can you decide to | | 102 |

take crop insurance?

1= 0 years (immediately) 2= after 1 year 3= after 2 years 4= after 3 years

8.1 If there was an outbreak of pests and diseases would you prefer purchasing crop insurance? 1= Yes 0=No | | 103 |

8.2 Suppose your farm was more exposed to theft would you prefer to purchase crop

insurance? 1= Yes 0= No | | 104 |

8.3 If the following events are likely to occur which one would you most prefer to cover your crops against? | | 105 |

1= Drought 2= Fire 3= Hail 4= Flood

8.4 How much would you be willing to pay as crop insurance premium against crop cover against the level of crop loss?

Level of crop loss (that a farmer is willing to pay for crop insurance)	Premium/monthly (R)
106	
1. 0-20%	
2. 20-40%	
3. 40-60%	
4. 60-80%	
5. 80%-100%	

8.5 How much would you be willing to pay as monthly premium against an expected yield of maize?

Expected Yield (EY) 1 bag=100kg	Premium/monthly (R)
107	
1= 10-20 bags	
2= 20-30 bags	
3= 30-40 bags	
4= 40-50 bags	
5= 50-60 bags	
6= >60 bags	

8.6 What do you think can be done to improve farmers' acceptability of crop insurance? | | 108 |

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