The effect of access to finance on commercialisation of smallholder maize farmers in Eswatini

By

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Submitted in partial fulfilment of the Master of Science Degree in Agricultural Economics

in the

Department of Agricultural Economics, Extension & Rural Development

Faculty of Natural and Agricultural Science

University of Pretoria

South Africa

2020

DECLARATION OF ORIGINALITY

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

Signature……………………………………………

Isaac Phiri

Date……………………………………………………

Approved by: Dr M.N. Makhura

Signature……………………………………………

Date…………………………………………………..

DEDICATION

I dedicate this study to all farmers and agricultural economists across the African continent. I also want to dedicate this study to my friends and family for their prayers and support.

ACKNOWLEDGEMENTS

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ABSTRACT

Agricultural commercialisation is defined as the increase in the amount of produce sold relative to the amount produced. Therefore, agricultural commercialisation leads to more efficient production, economic growth, food security, and urbanisation in the agricultural sector. Agricultural commercialisation plays an important role in the sustainability of any country's economy. However, financial investment and support is necessary for commercialisation to be achieved. Finance is one of the major key economic factors that can boost agricultural commercialisation. Understanding the effect of finance on the commercialisation of the agricultural sector is important for all relevant stakeholders; and specifically among smallholder farmers who produce under difficult conditions.

The study determined the effect of finance on the commercialisation of rural smallholder farmers in Eswatini. The main focus was on agricultural finance and the commercialisation of smallholder farmers. The main hypothesis of the study was that access to finance positively influenced the commercialisation decision of smallholder farmers. The data used in this study was collected from 150 households in the Hhohho and Lubombo regions of Eswatini. Due to the simultaneous causality of the financial variables, the study faced a potential endogeneity bias problem. There were other smallholder farmers who chose not to access any form of finance, but still managed to commercialise. This attribute revealed the endogeneity bias problem; thus it was important to address it using the endogenous switching regression method.

First, the analysis of variance (ANOVA) results suggested that only farmers who accessed credit and household savings were significantly associated with a commercialisation decision. Further analysis using the endogeneity switching model revealed that credit was not significant; off-farm income, household savings, and insurance were significant in the commercialisation decision. When financial instruments were combined, the effect of finance on commercialisation became weaker and not statistically significant enough to influence the commercialisation activities of smallholder farmers.

The key findings of the study showed that financial instruments were partially correlated and interdependent, and affected the commercialisation of smallholder farmers. This implied that finance alone could not bring about agricultural commercialisation, and it might not be enough to make agriculture sustainable and resilient. Any financial investment in agriculture needs to be accompanied by other factors – such as adequate farm size, conducive climate, adequate farm training, available and affordable labour, and smaller households – to significantly influence the commercialisation of smallholder farmers. The study also identified the problem of endogeneity and how it could produce false results if not considered.

The study recommends that different combinations of financial instruments should be implemented when stimulating commercialisation of smallholder farmers. The financial instruments should be implemented together with other non-financial interventions.

Keywords: Finance, Financial instruments, Commercialisation, Smallholder farmers, Endogenous switching regression.

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ANOVA-	Analysis of Variance
FANRPAN -	Food, Agriculture and Natural Resources Policy Analysis Network
GDP -	Gross domestic product
NAMBOARD -	National Agricultural Marketing Board
NMC -	National Maize Corporation
OECD -	Organization for Economic Cooperation and Development
SACCOS -	Savings and Credit Cooperatives Society

CHAPTER 1

INTRODUCTION

1.1 Background

Agriculture is the major source of household consumption and employment, particularly on the African continent (Baiphethi & Jacobs, 2009). Despite its importance, investment in agriculture has been low, as most African countries and policy makers have tended to neglect the agricultural sector (Nchuchuwe & Adejuwon, 2012). Smallholder farmers in Africa face many challenges, which include: low productivity and commercialisation, lack of access to markets and financial services, and poor infrastructure (Balasubramanian, et al., 2007; Nchuchuwe & Adejuwon, 2012). With the effort to develop the agricultural sector and farmers in general, African governments are mobilising resources to transform the agricultural sector through commercialisation (Deijil, et al., 2017). One of the African countries undergoing agricultural transformation and promoting commercialisation is Eswatini (Khalaf, 2019).

Located in sub-Saharan Africa, Eswatini's agricultural sector is the second-largest contributor to the economic development of the country (Foreign Agriculture Service, 2016). Smallholder farmers dominate the agricultural sector in Eswatini, and most of these farmers are maize producers. Maize is the staple food in Eswatini, and most of the land is used for maize production (FANRPAN, 2003). Despite the majority of farmers being maize producers, local maize production is currently inefficient, and fails to satisfy local demand. Maize production has been on the decline since 1968, and so Eswatini imports maize to meet local demand (World Bank, 2017). In 2013, Eswatini imported 22,760 metric tonnes of maize to satisfy the local deficit (Central Bank of Swaziland, 2014). The government of Eswatini has been making numerous efforts to increase maize production through commercialisation; however, local demand is still not being met (National Maize Corporation, 2015/16).

Agricultural commercialisation has the potential to improve the welfare of the population and develop the economy. Low maize commercialisation affects the economy on both the micro and the macro levels (Abu & Haruna, 2017). Agricultural commercialisation is one of the strategies being advocated to improve the living standard of the rural population and reduce poverty levels (Nadkarni & Vedini, 1996; Pingali, et al., 2005). The constraints that are faced in the agricultural sector of Eswatini are because commercialisation has not been achieved by

most of the smallholder farmers: most of them produce maize mainly for household consumption to enable them meet their basic needs, and sell very little (Sihlongonyane, et al., 2014). With the increase in population and limited land for agricultural activities, commercialisation can be achieved through the use of modern farming equipment and market-oriented methods, which will also require financial investment (Strasberg, et al., 1999). This makes finance a major component in the commercialisation process.

1.2 Research problem

Financial accessibility and investment in agriculture are some of the major challenges faced by smallholder farmers in Eswatini. The Maputo Declaration adopted in 2003 stated that 10% of the national budget was to be allocated to the agricultural sector (AU, 2003), and the Malabo Declaration of 2014 stated that governments should identify and increase financial accessibility for the sake of agricultural investment (Union, 2014). In 2014 Eswatini's government implemented an initiative programme to accelerate the agricultural commercialisation process; however, that process has been slow (FAO, 2014). Since the implementation of these policies, no positive results have been observed in terms of agricultural investment or the accessibility of agricultural finance (Dlamini, et al., 2019). There was therefore a need to identify other initiatives to increase commercialisation.

Finance has been described as having the potential positively to impact the agricultural sector and increase commercialisation (Hussain & Thapa, 2012). This is because finance can be the source of capital to acquire inputs and services. In Nigeria, for example, increased access to credit improved smallholder farmers' productivity (Oboh & Ekpebu, 2011). Therefore the accessibility of financial services among smallholder farmers can contribute to agricultural commercialisation and economic development. However, access to finance among smallholder farmers remains a challenge in Eswatini, especially in rural areas (Sebatta, et al., 2014).

It is vital to understand how different forms of finance affect smallholder farmers' commercialisation decisions. Scant attention has been paid to the interaction between finance and agricultural commercialisation. This has resulted in the reluctance by both public and private financial companies to invest in the agricultural sector (Martin & Clapp, 2015). If the effect of finance on commercialisation can be determined to show how different forms of finance affect commercialisation, the government and private organisations can focus on providing specific forms of finance to smallholder farmers.

Despite the importance of finance in agricultural commercialisation, there has been no study linking different forms of finance and commercialisation. Most studies focus on agricultural commercialisation or finance separately. Other studies treat finance as just one of the factors, rather than the primary driver, of commercialisation (Makhura, 1994; Makhura, et al., 1998). The finding of this study bridges the knowledge gap on finance and commercialisation by determining the effect of finance on the commercialisation of smallholder famers. The main question was: does access to finance affect the commercialisation decisions of smallholder farmers?

1.3 Objectives of the study

The overall objective of this study was to examine the effect of finance on agricultural commercialisation among smallholder maize farmers in Eswatini.

1.3.1 Specific objectives were:

a) to determine the accessibility of financial services among smallholder maize farmers in Eswatini;

b) to analyse the interdependence between finance and agricultural commercialisation;

c) to determine the causal effect of different forms of finance (or financial instruments) on agricultural commercialisation;

d) to determine the effect of other socio-economic factors on commercialisation.

1.3.2 The research questions were:

a) How accessible were financial services among rural smallholder farmers?

b) What was the interdependence between finance and commercialisation?

c) Did accessibility to finance affect agricultural commercialisation?

1.4 Research hypotheses

The hypotheses of the study were:

Hypothesis 1: Finance is inaccessible among smallholder farmers in Eswatini

In Eswatini, access to financial services is one of the major challenges that smallholder farmers face. Smallholder farmers depend on informal institutions for financial assistance (Kgowedi, et al., 2002). Government and other relevant stakeholders have been making numerous efforts, but financial accessibility still remains a challenge (Mavimbela, et al., 2010).

Hypothesis 2: Finance and agricultural commercialisation are interdependent

Agricultural commercialisation requires the use of inputs. A high expenditure on input purchases needs support from the financial sector (Dong, et al., 2010). On the other hand, the formal financial sector requires smallholder farmers to commercialise if the sector is to curtail the high rate of loan diversion (Oboh & Ekpebu, 2011).

Hypothesis 3: Finance has a positive effect on agricultural commercialisation

Evaluating the effect of finance on agriculture shows a positive effect on both productivity and agricultural commercialisation. Smallholder farmers are therefore advised to access financial services to enhance agricultural commercialisation (Obilor, 2013).

1.5 Significance of the study

The study focused on agricultural finance and the commercialisation of smallholder farmers. Globally, agriculture is the most important industry because it deals with food production. Smallholder farmers play a critical role in the agricultural production of any economy, despite producing under difficult conditions. In sub-Saharan Africa, agriculture is a major source of employment, and smallholder farmers are the major producers of staple food. However, because of the challenges that smallholder farmers face, the level of commercialisation has been insufficient. For commercialisation to be achieved, affordable and accessible financial services are necessary. In Eswatini, agricultural finance among smallholder rural farmers is inaccessible and risky. This is because of high transaction costs, poor infrastructure, market and production risks, and the lack of collateral among smallholder farmers. The population in Eswatini is dominated by smallholder farmers whose livelihood depends on the agricultural sector. With most of Eswatini's population being in rural areas, there is limited access to finance that could enhance commercialisation. The government and other stakeholders have been implementing policies to increase smallholder farmers' commercialisation. However, less attention has been paid to examining the effect of finance on agricultural commercialisation. This study helped to determine that effect, and provided the necessary recommendations on how commercialisation could best be improved.

The study is expected to be useful to several stakeholders, including:

Farmers: to provide understanding about how smallholder farmers can achieve commercialisation.

Marketing institutions: to recommend relevant programmes and systems to enable smallholder farmers to achieve commercialisation.

Financial institutions: to help them to tailor finance that will enhance commercialisation among smallholder farmers.

Government: to devise appropriate finance and commercialisation policies.

Research and knowledge sector: to provide new insight into the links between finance and commercialisation.

1.6 Key concepts

1.6.1 Agricultural commercialisation

Agricultural commercialisation is defined as "changing farmers' perspective on farming as a subsistence activity towards a profitable business" (Yaseen, et al., 2018). Ellis et al. (2003) and Makhura et al. (1996) also defined commercialisation as increasing production by increasing the produce that is sold. Therefore commercialisation can result in efficient production, economic growth, food security, and urbanisation in the agricultural sector (Tirkaso, 2013). To measure commercialisation, this study used the value of output sold relative to the amount produced (Pingali & Rosegrant, 1995). Because commercialisation results in an increased market orientation on the part of smallholder farmers, it is difficult to measure the input used and the production decisions. Therefore, the value of the output sold is used as a measure for commercialisation.

1.6.2 Finance

Finance encompasses different financial products that include credit, household savings, insurance, off-farm income, or any other financial services provided to any agriculture-related undertaking. Yadav (2017) defined agricultural finance as any investment that supports farm operations. Finance focuses on support services across the entire value-chain. Agricultural finance is crucial to farmers because it helps to improve production efficiency, resulting in agricultural commercialisation (Dalberg, 2012). Finance as a whole is a broad topic, and so this study will only focus on agricultural credit, agricultural insurance, off-farm income, and agricultural household saving.

a) Agricultural credit

Agricultural credit involves all forms of finance that deal with credit requirements, the conditions of lending, and the allocation of credit. Agricultural credit also includes the purchase of farm inputs and farm machinery on credit, and other non-institutional modes of credit (Chandio, et al., 2017).

b) Agricultural insurance

Agricultural insurance is the name given to an insurance product that covers agricultural production and assets. Agriculture is a risky business because of the biological nature of its products and assets, such as crops, livestock, fisheries, forests, and other plants (Hohl, 2018). Agricultural insurance is different from other insurance products because agriculture is faced with market, biological, climatic, and production risks (Mbonane, 2018).

c) Agricultural household savings

Agricultural household savings are a common feature among rural households in developing countries who have limited access to financial markets; it is thus commonly known as 'rural household savings'. Such savings occur when a household voluntarily sets aside income for future investment. Although agricultural household savings are considered a voluntary activity, it has been argued that they depend on the income earned and the saving capability of the farmer (Adams, 1978).

d) Off-farm income

Off-farm income is the revenue earned from participating in off-farm activities, mostly by smallholder farmers. Smallholder farmers tend to supplement their farm revenue through non-farm activities to maintain a portfolio of income sources (Babatunde & Qaim, 2010). Off-farm income can contribute to household farm revenue, but at the same time it can negatively reduce farm revenue due to limited household labour.

1.7 Organisation of subsequent chapters

Chapter 1 covers the introduction, the problem statement, the objectives, and the hypotheses of the study. **Chapter 2** offers an overview of finance and the context of commercialisation in Eswatini. The chapter also analyses the challenges faced by smallholder farmers in Eswatini, and financial performance and its contribution to the agricultural sector. **Chapter 3** reviews the literature on commercialisation and finance, issues that affect commercialisation, and the relevance of commercialisation to smallholder farmers. The theoretical and empirical frameworks, methodology, and methods are presented in **Chapter 4**. The descriptive characteristics of farmers are presented in **Chapter 5**. Last, **Chapters 6 and 7** discuss the empirical results, the summary, the conclusion, and the recommendations.

CHAPTER 2

CONTEXT AND EVIDENCE OF FINANCE AND COMMERCIALISATION

This chapter describes the context and evidence of the study by reviewing the literature on finance and the commercialisation setting. An analysis of finance and the commercialisation setting on a global, region, and local level was also conducted. The chapter also focuses on the challenges and constraints surrounding smallholder farmers in Eswatini. Last, the chapter reviews the literature on smallholder farmers' financial and commercialisation activities.

2.1 Finance and commercialisation in agriculture

Globally, the commercialisation of the agricultural sector has received increasing attention because of its importance to populations. However less attention has been paid to smallholder farmers, who happen to dominate the agricultural sector (Martin & Clapp, 2015). Without government intervention, there has been a reluctance to invest in smallholder farmers on the part of the private sector, especially in none Organisation for Economic Cooperation and Development (OECD) countries. Therefore financial investment in smallholder agriculture has been a challenge, despite agriculture being a major employer. With the aim of reducing the high poverty levels among smallholder farmers in developing countries, different reports, such as those from the World Bank (2006) and the first Food Agriculture Sector Development Policy, were published to help governments align their commercialisation policies accordingly (McMichael, 2009).

Recently, agricultural finance has been one area that has gained as much global attention as agricultural commercialisation (Abu & Haruna, 2017). This was evident when the G20 leaders committed to increase the accessibility of finance among smallholder farmers during the 2009 Pittsburgh Summit (Messerlin, 2009). Like agricultural commercialisation, agricultural finance has been identified as a key component in developing smallholder farmers. As a result, developed countries have developed policies to provide finance to smallholder farmers; however, developing countries are still struggling (Pauw, 2015). Developing countries have realised the importance of agricultural finance in recent years, as they have developed policies that support increasing access to finance among smallholder farmers (Sebatta, et al., 2014; Abu & Haruna, 2017; Dlamini & Mohammed, 2018).

Sub-Saharan African countries have also identified agricultural commercialisation as a key component in reducing high poverty levels in their rural populations, of whom most are smallholder farmers (Atieno, 2001). In Ghana, for example, the government recognised commercialisation as the main driver of poverty reduction among smallholder farmers (Minae, et al., 2008). To achieve this goal, both agricultural commercialisation and finance are required (Abu & Haruna, 2017). Access to financial services in rural areas therefore needs to be developed. Currently, most smallholder farmers in sub-Saharan Africa depend on the informal sector for financial services. Ideally, government is supposed to spearhead financial and commercialisation activities; unfortunately, only a small percentage of the budget is allocated to the agricultural sector. This has contributed to the poor performance of agriculture in sub-Saharan Africa. Studies in countries such as Ethiopia, Eswatini, and Zambia have shown evidence of low investment in the agricultural sector (Woldeyohanes, et al., 2017; Sebatta, et al., 2014; Dlamini & Mohammed, 2018).

2.2 Finance and commercialisation in Eswatini

The agricultural sector in Eswatini is the second largest contributor to the gross domestic product, with maize being the main cash crop (National Maize Corporation, 2013). Maize commercialisation affects economic growth and food security in Eswatini (Van Zyl & Louw, 2017). Therefore maize plays a vital role in the economic welfare of Eswatini. Maize is produced in all four regions of Eswatini, although the level of commercialisation varies depending on the region (Dlamini & Masuku, 2012; Dlamini, et al., 2019). Maize commercialisation is performing poorly among the rural population in every region (Mavimbela, et al., 2010). The poor performance of the agricultural sector is caused by the different challenges affecting it.

Agricultural commercialisation is affected by many factors, one of which is Eswatini's land tenure system (Dlamini, et al., 2012). The system is divided into Title Deed Land and Swazi National Land. Of the total area of 1736,456 ha, 56% of the land is Swazi National Land, and the remaining 44% is Title Deed Land (Mavimbela, et al., 2010). Despite Swazi National Land being larger than Title Deed Land, farmers using Swazi National Land have no full ownership, while farmers on Title Deed Land have full ownership of the land. This means that farmers farming on Title Deed Land can easily access financial services by using the land as collateral, while the Swazi National Land belongs to the King, and land is distributed to farmers through chiefs (Office of Evaluation (FAO), 2011). Most smallholder farmers farm

on Swazi National Land, and this has drastically affected their commercialisation activities (FAO, 2014).

Maize commercialisation in Eswatini fluctuates every year, and does not meet domestic demand. Consumption has been constantly increasing due to the population increase, while commercialisation has been inconsistent and insufficient to meet the consumption demand (FANRPAN, 2003). As a result, the National Maize Corporation was mandated to import the commodity every year to meet the demand (National Maize Corporation, 2013). In 2007/08, commercialised maize dropped to around 67 000 metric tonnes from 77 500 metric tonnes in 2006/07. This prompted the National Maize Corporation to increase the amount of imported maize to 42 041 metric tonnes to meet the local consumption of 118 500 metric tonnes. To help improve commercialisation, the government introduced a policy to subsidise farmers' inputs (such as fertilizer and seed). However, since the inception of the policy, there has not been any positive impact on commercialisation (Chirwa & Dorward, 2013).

Commercialisation has not been consistent and sufficient, as observed by fluctuations in different farming seasons. In 2013/14, for example, the amount of commercialised maize increased due to increased rainfall and subsidised inputs provided by the government (National Maize Corporation, 2015/16). In the following farming season (2014/15), the amount of commercialised maize dropped drastically because the donor-funded schemes that the government depended on had dried up (Safodien, 2013). The government of Eswatini could no longer afford to subsidise inputs or hire tractors for farmers; as a result, farmers had to go back to the traditional methods of maize production. Also, because of the unfavourable climatic conditions, about 122 000 people in 2018 were food insecure, with the most affected regions being the eastern and southern parts of the country (FAO, 2018). Smallholder farmers face so many other challenges, which include limited access to finance and markets and poor infrastructure (Von Loeper, et al., 2016). These challenges hinder smallholder farmers from commercialising.

2.2.1 Commercialisation challenges in Eswatini

Smallholder farmers produce maize and other crops mainly for their own consumption, with very little sold on the market. Smallholder farmers also encounter post-harvest challenges, such as transporting their produce, storage of products, and value addition (Almond & Hainsworth, 28 February-1 March 2005). Access to markets has been one of the major challenges among most of the smallholder farmers (Von Loeper, et al., 2016). Market accessibility is very important to smallholder farmers to enable them commercialise. Most smallholder farmers in Eswatini are directly or indirectly linked to markets, although these markets are dominated by commercial farmers. Smallholder farmers are therefore side lined, and get lower prices for their produce (Poole, 2017). There has been a constant debate on choosing which markets are suitable for smallholder farmers only.

To improve market accessibility among smallholder farmers, the National Marketing Board (NAMBOARD) was formed, although pricing through the NAMBOARD was very low (FANRPAN, 2003). NAMBOARD worked hand-in-hand with the National Marketing Corporation (NMC) with the aim of helping smallholder farmers to access markets and eventually to commercialise. The NMC was introduced with a mandate to develop smallholder farmers through commercialisation and market access. Nevertheless, due to low commercialisation levels, the NMC has failed to achieve its objective (Dlamini, et al., 2017). A study was conducted to examine the welfare impact of NAMBOARD and NMC, and the results showed that over the previous five-year period, the average annual value of the loss of maize was R116,975,312.30 (Dlamini, et al., 2017). This implies that the NMC contributed to low maize commercialisation, high consumer prices, and economic losses.

2.2.2 Financial accessibility in Eswatini

Different factors affect the accessibility of financial services. These include asymmetric information between the lender and the borrower, high transaction costs (especially in rural areas), poor record-keeping among smallholder farmers, lack of facilities and infrastructure, and collateral requirements (Analytics, 2003). Most smallholder farmers fail to meet these minimum requirements. This is because formal financial institutions have strict regulations and collateral requirements, while smallholder farmers lack ownership of fixed assets that can be used as collateral. Collateral requirements therefore restrict most smallholder farmers from accessing formal financial services – specifically credit (Kgowedi, et al., 2002).

Poor record-keeping is another challenge that smallholder farmers face when demanding formal financial services. Formal financial institutions regard lending services to smallholder farmers as risky. Livingston et al (2011) highlighted that, despite the local financial institutions having high levels of liquidity, they are usually reluctant to offer financial services or loans to smallholder farmers. Banks, for example, maintain a low lending rate due to the lack of eligible demand (Ramlee & Berma, 2013), and due to the lack of competition among banks, they maintain high interest rates and only focus on extending credit to the employed and high-income earners (Analytics, 2003).

Few commercial banks in Eswatini have invested in agriculture. However, one that has invested massively in the agricultural sector is Standard Bank Eswatini. To improve financial inclusion in agriculture, Standard Bank Eswatini increased its lending period from an initial seven years to a lending period with which the farmer was comfortable. Standard Bank Eswatini also partnered with John Deere to supply farm equipment to smallholder farmers (Standard Bank Swaziland, 2015). Smallholder farmers were initially excluded from obtaining credit, and the terms were not favourable to obtain finance from banks and other formal financial institutions (Rugube, et al., 2019). A study on smallholder vegetable farmers in Eswatini showed that 56% of them depended on household savings, and only 3% of them accessed bank loans (Rugube, et al., 2019). This shows how seriously smallholder farmers were financially excluded in Eswatini.

Smallholder farmers' access to finance is very important to the economic development of the agriculture sector and of the country as a whole (Masuku, 2009). When a country has a well-developed financial sector that can support the agricultural sector, it can result in economic growth (Hlophe, 2018). Unfortunately, formal financial services are not well-established in Eswatini; as a result, smallholder farmers prefer informal sources over formal institutions. Transaction costs also contribute to the limited accessibility of finance among smallholder farmers (Kirsten, et al., 2009). High transaction costs restrict smallholder farmers' participation in financial markets. This has led to the establishment of the Savings and Credit Cooperatives Society (SACCOS). The aim of the cooperatives was to provide financial services in the informal market because of limited formal financial services (Mavimbela, et al., 2010).

Formal institutions preferred commercial farmers to smallholder farmers due to the high transaction costs incurred when dealing with smallholder farmers (Williamson, 1998). In the year 2003, only 28.5% of Swatis used formal savings facilities. The major banks that offered savings facilities were Nedbank, FNB, and Standard Chartered Bank (Analytics, 2003). Unlike other financial facilities, savings were the most accessible facility. However, the rate of savings among smallholder farmers was still very low, and this led to poor investment in the agricultural sector, and resulted in over-dependence on credit among smallholder farmers (Obalola, et al., 2018). This shows that smallholders are excluded not only from accessing credit, but also from savings facilities.

Unlike other financial services, insurance is a method of managing and reducing risks. Insurance transfers risks from famers to insurances companies in exchange for a premium (Rejda, 2011). Insurance is not only meant to provide cover, but can also promote farmers' access to credit, investment in technological inputs, and commercialisation. Therefore insurance enables farmers to invest in riskier activities. Due to high premiums and limited access to insurance, farmers choose other risk management techniques such as diversification. Access to insurance among smallholder farmers is also a challenge. Due to high premiums, most smallholder farmers cannot afford to obtain insurance, and so they are not covered for any loss. Over the years, smallholder farmers have realised the importance of agricultural insurance, and most are willing to adopt it if it is accessible and affordable (Mbonane, 2018).

2.3 Significance of finance in commercialisation

The literature shows that agricultural commercilisation and development needs to be supported by a well-developed financial system. Rugube et al (2019) identified finance as the key factor in the development of the agricultural sector. This is because agricultural commercialisation needs modern farm machinery, improved seed varieties, good marketing, transportation, and processing – all of which require finance (Veras, 2017). Awunyo-Vitor (2018) found that access to finance enables farmers to invest in agriculture on a commercial level. This makes finance a vital component in the commercialisation of smallholder farmers. Therefore, for agricultural commercialisation to be successful there is a need for an accessible and proper finance system. Since finance is a combination of different financial instruments, it is important to analyse the evidence of each financial instrument and its effect on commercialisation separately.

2.3.1 Effect of credit on commercialisation

Agriculture credit is the main source of finance in the agricultural sector, although access to credit among smallholder farmers is still a challenge. There are different forms of agricultural credit, which include cash, in-kind, or both cash and in-kind. Agricultural credit can be accessed through formal and informal institutions. Formal financial institutions, such as micro-finance institutions, commercial banks, and insurance service providers provide legislated and regulated services, while informal institutions provide unregulated credit finance (Kgowedi, et al., 2002). Informal credit finance is provided by money lenders, associations, friends or relatives, the black market, or any unregulated institutions. Informal financial institutions tend to cover a broader population than do formal financial institutions. A study by Dlamini and Mohammed (2018) in Eswatini showed that the key determinants of farmers' choice between formal credit finance and informal credit finance were the need for record-keeping and collateral. Farmers with poor record-keeping of their amount of capital, the size of their business, and their production capacity were significantly excluded by formal institutions. A survey conducted by the World Bank (2006) in sub-Saharan Africa showed that fewer than 14.9% of smallholder farmers accessed formal credit finance, while over 30.9% of commercial farmers accessed such finance. It has been proved that poor households that are financially excluded in the formal sector depend on the informal sector to meet their financial requirements (Zeller & Sharma, 1998).

Studies have showed that credit plays an important role in the commercialisation of smallholder farmers. Olaitan (2006) recognised credit as an essential tool that can boost smallholder farmers' commercialisation activities. However, the effect of credit on commercialisation tends to vary from country to country. A study by Gunes et al. (2017) in Turkey showed that credit had a significant positive effect on commercialisation. This led to high competitiveness among banks to supply credit finance to farmers. This might not be the case in Eswatini because of different economic and environmental factors: Turkey is developed, as is its infrastructure, compared with Eswatini. A study by Hussain and Thapa (2012) in Pakistan found that smallholder crop farmers who accessed credit became more commercialised than farmers who had not accessed credit. Pakistan was ranked number 131, and Eswatini 132, on the 2019 index of economic freedom (The Heritage Foundation, 2019). According to Stansel (2012), the economic freedom index is a valuable tool that is used to measure government restrictions and public finance; if Pakistan showed a positive effect, it is likely that Eswatini could have similar results. However, Pakistan and Eswatini are not

economically comparable due to the differing transaction costs faced by these two countries. High transaction costs among most African countries affect the impact of credit on the commercialisation of smallholder farmers (Floro & Yotopoulos, 2019).

Agricultural credit in Africa tends to have a low effect on commercialisation and this has raised serious concerns. A study by Ali et al. (2014) in Rwanda showed that agricultural credit increased productivity by 17%, resulting in a slight increase in the commercialisation of farmers. In Ethiopia, credit affected productivity positively, which eventually increased the market orientation of farmers (Tirkaso, 2013). A study by Oboh and Ekpebu (2011) in Nigeria proved that accessibility to credit led to an improvement in productivity and enabled smallholder farmers upgrading to becoming commercial farmers. This means that commercialisation can still be achieved through the use of credit in Eswatini and other developing countries.

The positive effect of credit on crop production is because credit enhances farmers' capability of acquiring modern farming equipment and being able to afford the latest farm inputs (Mavimbela, et al., 2010). However, Makhura et al. (1998) argued that smallholder farmers in Africa need grants, not credit, because they aim to generate income for their basic needs, and this is the reason for the very small degree of commercialisation. In developing countries, smallholder farmers divert credit meant for agriculture to personal use. Often smallholder farmers defy commercialisation despite having access to credit that can improve their livelihood (Vercillo & Hird-Younder, 2019). This is an endogenous behaviour of farmers that most researchers have struggled to analyse over the years.

2.3.2 Effect of insurance on commercialisation

According to Slovic et al. (1977), individuals obtain insurance to protect themselves against severe risks that may occur due to natural hazards, accidents, or disease outbreaks. There are many types of insurance policy; this study only focused on insurance policies that affected smallholder farmers' commercialisation and access to finance. Smallholder farmers are vulnerable to different risks, such as production risks and market and price risks that affect the rate of commercialisation. This is because the climate is unpredictable, markets are unreliable, and prices keep fluctuating (Govereh, et al., 1999). If these risks could be transferred to the insurer, the rate of commercialisation by smallholder farmers could change significantly (Njegomir & Pejanovic, 2011). Therefore insurance contributes to the commercialisation of the agriculture sector. Insurance transfers risks to the insurance providers, enabling farmers to invest in the agriculture without worrying about potential

losses (Sihem, 2017). Most studies show that insurance increases agriculture commercialisation; at the same time, other studies have argued that insurance had no significant effect on commercialisation (Mbonane, 2018).

In Africa, smallholder farmers view insurance as a one-way traffic that only benefits the insurance companies; this has led to a low adoption of insurance (Nmadu & Peter, 2010). This is because agricultural insurance tends to serve a very limited purpose, and most of the schemes are not viable. For smallholder farmers to commercialise, insurance should cover at least most of the risks at an affordable premium. These risks include market risks, price risks, and production risks, but unfortunately insurance companies only focus on production risks (Raju & Ramesh, 2007). In practice, insurance cannot cover all the risks affecting the agricultural sector. Farmers therefore mainly obtain insurance to cover extreme weather events due to unpredictable weather and climate change (Roberts, 2005). This has affected both the supply of and demand for agricultural insurance, especially among smallholder farmers. If affordable and reliable insurance could be supplied, smallholder farmers' commercialisation could be positively be affected.

Access to insurance encourages farmers to improve production and commercialisation. However, it also depends on the financial capacity of farmers to pay premiums. In other words, access to other financial services influences access to insurance. Sihem (2017) examined the relationship between agricultural insurance and other financial services. The results of the study showed that agricultural insurance acts as an intermediary between finance and commercialisation (Mbonane, 2018). We can therefore conclude that agricultural insurance accessibility is influenced by the accessibility of other financial services (Awunyo-Vitor, 2018).

Smallholder farmers are affected not only by agricultural risks, but also by health, motor vehicle, and other risks. According to Liu (2004), medical expenses can affect the agricultural production and commercialisation of smallholder farmers. This is because the income earned from on-farm or off-farm activities can end up being used to pay medical bills, and not reinvested in agricultural production. An analysis of agricultural accidents by Becker and Wood (1994) showed that motor vehicle accidents resulted in the highest number of fatalities; no off-farm or work-related motor vehicle accidents were considered. This proves that motor vehicle accidents are serious risks that cannot be ignored in agriculture.

2.3.3 Effect of household savings on commercialisation

Rural household savings are another form of finance that affects commercialisation. In rural areas, informal markets are the major source of savings finance (Zeller & Sharma, 1998). Most farmers prefer savings for future investment in the agricultural sector. Smallholder farmers prefer household savings rather than credit, due to the lower interest rates. A study conducted in Malawi by Diao et al. (2016) aimed to facilitate formal savings for agricultural inputs. Farmers who had saved for the next farming season commercialised more than those who had not saved, because they had enough inputs for production. This shows that household savings have a positive effect on commercialisation. Malawi and Eswatini have similar economic and climatic conditions; hence, similar results can be obtained in Eswatini. Smallholder farmers over the years have developed an informal way of accessing financial services, due to the inaccessibility of formal financial services. Village savings and loan associations have been implemented in Malawi and in most West African countries. A village savings and loan association normally comprises 10-15 people who contribute their savings to a group account and provided financial services to other members (Ellis, et al., 2003; Ngegba, 2016). Financing through a village savings and loan association has positively affected farm productivity, resulting in agricultural commercialisation in Malawi and other countries where it has been implemented (Ngegba, 2016). Household savings have shown evidence of improved food security for households and of poverty reduction in rural communities (Abu & Haruna, 2017).

2.3.4 Effect of off-farm income on commercialisation

Off-farm income contributes to the financial capital needed for agricultural investment. When other financial markets fall short or are inaccessible, off-farm income is the best alternative because of its availability (Woldeyohanes, et al., 2017). Off-farm activities can be both agricultural and non-agricultural activities. While the accessibility of other financial services is affected by high transaction costs, off-farm income compensates for imperfect financial markets (Oseni & Winters , 2009). Similar results have been observed in many different sectors, not only within the agricultural sector.

Smallholder farmers tend to engage in different off-farm activities to generate income for both agricultural and non-agricultural activities (Van Den Berg & Kumbi, 2006). Agricultural off-farm activities tend to have a greater impact on commercialisation than non-agricultural off-farm activities, because smallholder farmers tend to learn various skills in addition to generating income (Matenga & Hichaambwa, 2017). Over the years researchers have struggled to determine how off-farm activities affect the commercialisation of smallholder farmers. This seems mainly due to the endogeneity bias aspect of the study, and also the trade-off between the amount of times spent on off-farm activities and the income being generated. Woldehanna et al. (2000) argued that off-farm income can only improve the commercialisation activities of smallholder farmers if the income earned is invested directly in farming activities. At the same time, the off-farm income generated should be good enough to increase household savings. Also, it is hard to determine the proportion of income generated from off-farm activities that is invested in agriculture.

Off-farm income also acts as insurance in case of crop failure or other unforeseen circumstances. However, off-farm income can negatively affect agricultural commercialisation when the household decides to depend entirely on it (Woldehanna, et al., 2000). A study by Woldeyohanes et al. (2017) showed that off-farm income had no significant influence on household commercialisation activities, and additional off-farm income negatively affected commercialisation. Therefore the effect of off-farm income on commercialisation depends on both endogenous and exogenous factors.

2.4 Other factors affecting finance and commercialisation

There are other exogenous factors that drive commercialisation, including the availability of technologies, markets, and government policies (Chirwa, 2012). These commercialisation factors alter prices, transaction costs, and marketing systems. Agricultural commercialisation occurs when farmers increase their income obtained from the sale of produce, and the income obtained is later used for production and input (Poulton, 2017). However, reinvestment in production is rarely made, especially among smallholder farmers who focus on production for household consumption only. It is important, therefore, to educate smallholder farmers about commercialisation and its importance.

2.4.1 Effect of education on finance and commercialisation

Smallholder farmers' education plays a vital role in commercialisation. Most policy-makers have realised that education and technological know-how are the primary determinants of commercialisation (DAFF, 2012). Smallholder farmers therefore need to be educated, and to recognise the importance of education (Adhikari & Bjorndal, 2012). Without education about any imposed policies, farmers will not adopt the programme. If farmers are not educated on the importance of commercialisation, commercialisation efforts will not be achieved.

Education affects the efficient use of finance in marketing and production processes. Despite smallholder farmers having experience in farming, they tend to be ignorant about reinvesting and about modern farming methods. According to Nmadu and Peter (2010), about 65% of smallholder farmers in Niger were ignorant about commercialisation techniques and managing finance, especially insurance. Education has a significant effect on the accessibility of finance and the agricultural commercialisation process. Education also plays a key role in the adoption of modern technology for commercialisation purposes.

2.4.2 Effect of technological development on finance and commercialisation

Technological development in agriculture is important for commercialisation to be achieved in the agricultural sector. Commercialisation can be accelerated by the adoption of modern technological equipment, and through training farmers about the importance of using technology. Research conducted in Zambia found that smallholder farmers working for commercial farmers tend to adopt commercialisation activities faster than other non-commercial farm workers. This is because commercial farm workers are exposed to the available technology and training by working with commercial farmers (Matenga & Hichaambwa, 2017). The aim of training farmers to adopt technology is to increase their technical efficiency and production, and to enable them to become market-oriented (Adhikari & Bjorndal, 2012). When effective training has been conducted, the adoption of technology is efficient.

In most African countries, including Eswatini, farmers are not trained in the efficient application of inputs and the use of technology. Farmers are also not consulted before policies are implemented. Vercillo and Hird-Younder (2019) argued that smallholder farmers need to have a sense of ownership of the policies being implemented; otherwise they tend to reject modern farming methods. Thus, before implementing technological policies, farmers are supposed to be involved in the process. If farmers are side lined when formulating project objectives, they tend to shy away from projects that can help them commercialise.

2.4.3 Effect of infrastructure development on finance and commercialisation

Introducing farmers to improved infrastructure and modern markets in the agricultural sector is meant to help smallholder farmers to become increasingly commercialised (Kremen, et al., 2012). However, modern infrastructure is quite poor or completely unavailable to smallholder famers. The reasons for this include their distance from modern cities, lack of access to markets, lack of access to information, and a poor transport system. A study conducted by Poulton (2017) showed that farmers closer to urban areas tend to commercialise more than farmers further away. With poor linkages to markets, farmers are constrained and cannot access the valuable inputs required for production (Siyaya & Masuku, 2013). Without proper infrastructure facilities, commercialisation cannot be easily achieved. This makes infrastructure development one of the determinants of commercialisation, especially with access to markets.

In most rural areas in Eswatini and other sub-Saharan African countries, the infrastructure is in a dilapidated state. The rural areas are completely cut-off from formal facilities and services. This has contributed to the low commercialisation activities in Eswatini and other developing countries. Infrastructure development can be improved through government involvement and policies.

2.4.4 Effect of government support and policies on finance and commercialisation

The agricultural sector, especially among smallholder farmers, has attracted few private financial investors. This has led to government involvement in the provision of financial services among smallholder farmers to enable them to achieve commercialisation (Martin & Clapp, 2015). The government's role has been to link farmers and financial service providers. Private sector investors, however, have been reluctant to invest in agriculture without government's assurance and support (Martin & Clapp, 2015). This has led to governmental interference and involvement in the agricultural sector. For finance to have a significant impact on commercialisation, governmental involvement is required to facilitate technological transfers, training, price control, market provision, and agricultural insurance (Makhura, et al., 1996).

Government policies are important in supporting investment in rural infrastructure, extension services, property rights, and many other factors that hinder commercialisation (Pingali, et al., 2005). Commercialisation is a gradual process that can be achieved by changes in input use, production mechanisms, and post-harvest activities (Pingali & Rosegrant, 1995). This clearly shows that commercialisation depends on government's interventions and policies (Gebreselassie & Ludi, 2007). Unfortunately, most governments focus on policies that cannot be integrated into the wider markets. This is why transaction costs are quite high among smallholder farmers, and commercialisation is very low (Gebreselassie & Ludi, 2007).

Land is one of the most valuable assets in agriculture, and farmers need land to produce food. Land distribution requires government involvement to ensure that state-owned land is commercialised, and that farmers are provided with the legal documents they need to access finance or use land as collateral (Mavimbela, et al., 2010). Without collateral, smallholder farmers are restricted from accessing finance, and commercialisation is thus quite impossible (FAO, 2014). This has resulted in a slow pace of commercialisation among smallholder farmers. A study by Abu and Haruna (2017) found that government policies in Ghana significantly affected agricultural commercialisation. This is because that government's decision to commercialise land not only improved financial accessibility, but also led to commercialisation among smallholder farmers. Thus efforts to commercialise smallholder farmers cannot exclude government involvement, and government involvement is required to ensure that transaction costs are reduced and financial accessibility is increased.

2.5 Summary

The chapter highlighted some of the major challenges that affect finance and the commercialisation of smallholder farmers in Eswatini. Agricultural commercialisation has been a major focus in both developed and developing countries, and has led to increased financial investment in the agricultural sector. In Eswatini, agricultural finance and commercialisation has been low due to various challenges affecting the performance of the agricultural sector. Some of these are: the land tenure system, poor infrastructure, market inaccessibility, and the financial exclusion of smallholder farmers. These and many other challenges have significantly affected the performance of the agricultural sector, and so commercialisation among smallholder farmers is still very low. To understand the effect of finance on commercialisation, a range of research on finance and commercialisation was reviewed. The evidence showed that the effect of finance on commercialisation varied, depending on the financial instruments and the regional setting of the farmer. Agricultural credit increased the commercialisation activities of smallholder farmers in both developed and developing countries. Insurance and off-farm income had a varying effect on the commercialisation of smallholder farmers. This depended on the source of finance, which could be either formal or informal. Finance and commercialisation were also significantly influenced by other factors, such as education, government policies, and technological and infrastructure development.

CHAPTER 3

FINANCE AND COMMERCIALISATION OF SMALLHOLDER FARMERS

This chapter is divided into three sections. The first section defines agricultural commercialisation in detail and the measures of commercialisation. The second section introduces theories and various frameworks on agricultural commercialisation. Last, the chapter looks at model formulations and research methods.

3.1 What is agricultural commercialisation?

Agricultural commercialisation has been identified as the major stimulator in the economic growth of a rural population (Von Braun, 1995). Also, agricultural commercialisation helps with generating income and with the nutritional status of the household and the population at large. The aim of agricultural commercialisation is to generate revenue through the supply of farm produce to meet market demand (Senyolo, et al., 2009). Farmers are thus required to use available resources to meet market demand, whether local or international (Maponya, et al., 2015). Commercialised farmers need to anticipate consumer demand and provide for the needs of consumers. Farmers are supposed to understand the market environment, their potential customers, the quality demanded, and how much the customers are willing to pay for a particular product (Grunert, 2005). These questions are very important in agricultural commercialisation decision-making. However, agricultural commercialisation is not the end activity; rather, it comprises input application, production, and marketing.

Agricultural commercialisation is associated with increased productivity and income obtained after marketing the produce (Bernard & Spielman, 2009). When farmers commercialise, they think about the profits to be obtained after selling their produce (Makhura, et al., 1998). During the agricultural commercialisation process, markets link farmers to non-farmers, other industries, and the population in the urban sector. Markets not only link farmers to buyers, but also act as a way to indicate fluctuations in prices (Acharya, 2006). Access to an efficient market helps with the growth of the agricultural sector and the commercialisation of smallholder farmers. However, when there are imperfect markets and high transaction costs, markets cannot enable smallholder farmers to achieve commercialisation (Jayne, et al., 2006). Price is another important component of the agricultural commercialisation process. Due to the high cost of agricultural production, farmers need to sell their produce at a reasonable price to cover their production costs (Gardner, 2006); but when prices are too high,

consumers cannot afford the agricultural produce, and so commercialisation fails. Equally, agricultural commercialisation fails if the price is too low and farmers cannot afford to cover their costs (Dimpfl, et al., 2017). Some of the major costs incurred by farmers are transportation, agricultural inputs, and labour. Often the government intervenes in price determination to ensure that farmers get reasonable prices. This is because the government depends on farmers to provide food for the population.

3.1.1 Measures of agricultural commercialisation

According to Leavy and Poulton (2007), agricultural commercialisation can be determined using either the input or the output component. Using the input segment, agricultural commercialisation is the number of inputs acquired from the market. As farmers commercialise, they tend to reduce the use of their own inputs, such as manure, and rely on the market to supply improved inputs and services, such as fertilizer and herbicides. However, it is very difficult to obtain reliable data using the input segment approach, due to poor record-keeping among farmers (Islam, 2009). Because of this, determining commercialisation using the output and market orientation of smallholder farmers is strongly recommended. Thus agricultural commercialisation is defined as the increase in market orientation by the increase in the output being sold by smallholder farmers (Hussain & Thapa, 2012). Agricultural commercialisation does not mean increased productivity or improved welfare; it is the increase in output being sold through linkages of input, production, and support services.

To measure agricultural commercialisation, a static method can be used that focuses on the output segment. Agricultural commercialisation is measured by calculating the proportion of agricultural output sold on the market with respect to the output being produced. This method is known as the household commercialisation index, as shown in Equation 1. The ratio of sales-to-output measures the value of sales by a household as a percentage of the total gross value from its agricultural production (Strasberg, et al., 1999).

$$\text{Household commercialisation index} \qquad\qquad\qquad\qquad 1$$
$$= (\text{gross value of amount sold} / \text{gross value of all amount produced})$$

Agricultural commercialisation is therefore measured as the percentage of produce sold with respect to production. The greater the percentage, the more commercialised the farmer was in that specific farming season.

3.2 Theoretical framework

To analyse the commercialisation of smallholder farmers, the household decision framework was adopted. As smallholder farmers become commercialised, they become market-oriented, generate more revenue, and become food-secure. This is similar to the household utility maximisation model, and is the reason why the household decision framework was adopted for this study.

The decision to commercialise at the household level is influenced by both endogenous and exogenous factors. The household decision framework helps to determine the factors that influence commercialisation decisions. The household decision framework adopted for this study has been previously used by Von Braun et al. (1991), Makhura (1994), and Makhura et al. (1999). Studies by Key et al (2000) and Makhura et al (2001) also adopted the household commercialisation framework. Using Key et al.'s (2000) household utility maximisation model, commercialisation at household level is influenced by household consumption, the level of production at household level, and the inputs used for production. Depending on the household characteristics, households have the option of consuming all the produce, selling all the produce, or a combination of both (Makhura, et al., 2001). Given the household characteristics(H_u), households can either consume (c_k) or generate more revenue to purchase agricultural inputs(R_k).

$$Max\ U = u(c_{k,}\ R_k; H_u) \qquad\qquad 2$$

In Eswatini, like many other developing countries, the commercialisation of smallholder farmers is a challenge due to various constraints that hinder market participation (Omiti, et al., 2009). These constraints tend to affect the amount/type of input being used, the amount of produce consumed at household level, and how much produce is commercialised. The challenges faced by smallholder farmers have resulted in low levels of commercialisation activities. To achieve commercialisation, farmers incur transaction costs that include increased production costs, searching for buyers, bargaining for reasonable prices, and transportation of maize to buyers (Makhura, 1994). With 'transaction cost' being a new institutional economics concept, it can be analysed using a neoclassical economic framework (Williamson , 2000). However, this study focuses more on the household level of commercialisation, and not on the institutional economic framework.

Finance has been identified as one of the major household constraints that affect household utility maximisation. Household utility maximisation is subject to: full income constraint, resource balance, and production technology constraints. The household jointly makes consumption, production, and market participation decisions subject to finance and other constraints (Makhura, et al., 2001). Finance affects the input and the technology used, which eventually affects the maximisation of the household decision.

The Lagrangian optimisation equation for household commercialisation is defined in Equation 3.

$$\boldsymbol{Max\ U = u(c_{k,}\ R_k; H_u) + \mu_k[\sum_{k=1}^{N} p_k(q_k - s_k) - R_k - p_k c_k + E] +}$$
$$\boldsymbol{\lambda[p_k(q_k - s_k) - p_k c_k - p_i x_{ik} + R_k + e_k]} + \varphi\ [\text{G}\ (\boldsymbol{q_k x_{ik}; H_q})] \qquad 3$$

where:

1. $[\sum_{k=1}^{N} p_k(q_k - s_k) - R_k - p_k c_k + E]$; is the income constraint
2. $[p_k(q_k - s_k) - p_k c_k - p_i x_{ik} + R_k + e_k]$ are the resource balance equilibria, and
3. $[\text{G}\ (q_k x_{ik}; H_q)]$ is the technology constraint.

where μ_k, φ and $\boldsymbol{\lambda}$ are Lagrange multipliers for income, technology, and resources balance constraints. The constraints in Equation 3 restrict smallholder farmers' commercialisation activities. The three major constraints identified were the income constraints, resource balance, and technological constraints (Makhura, et al., 2001). The income constraint is the amount of income that is available to smallholder farmers to invest in commercialisation activities, which include input purchases, wages for workers, repair and purchasing of farm machinery, and many other farm activities. Resource balance is the use of limited available resources to achieve optimal results (El-Fadel, et al., 2000). These resources could include water, land, vegetation, household labour, and farm machinery. Resource balance is considered a constraint because resources are equally important and necessary for other non-agricultural activities. The last identified constraint that affects commercialisation was technological constraints. Smallholder farmers do not have the latest farming equipment, and this makes it hard for them to commercialise, considering that they are still using traditional farming methods (Matenga & Hichaambwa, 2017).

The household constraints (income, resource balance, and technology constraints) are all exogenous factors that need financing. Except for on-farm income, any other finance is exogenous. Finance contributes to household utility maximisation, and forms a major component of the commercialisation of smallholder farmers (Makhura, et al., 2001). External finance can be generated through off-farm activities, credit, government grants, household savings, and insurance. Finance affects production and technological constraints, which together reduce household utility maximisation. If the first-order condition assumptions are achieved, this household utility problem can be analysed using the Lagrangian method. When the first-order conditions are satisfied, the demand and supply equations can be determined, and the shadow prices can be determined (Makhura, et al., 2001).

$$\frac{\partial u}{\partial c_k} = \mu p_k + \lambda p_k \qquad\qquad 4$$

This simply means that commercialisation is affected by prices and exogenous factors such as finance. Therefore finance affects commercialisation through income, resource balance, and technological constraints. All commercialisation is affected by external factors other than finance.

3.3 Empirical framework

Commercialisation decisions are influenced not only by the household characteristics that are subject to constraints, but also by other unobservable factors (Alene & Manyong, 2007). This means that the error term is endogenous, due to several other factors that affect the commercialisation decisions of smallholder famers (Jaleta, et al., 2015). Different models have been developed to deal with endogeneity, which, if ignored, can affect technological adoption, commercialisation decisions, and sample selection. In this study, the endogenous switching regression model was adopted because it demonstrates the marginal level of commercialisation among smallholder farmers who have accessed finance, and those who have never accessed finance (Alene & Manyong, 2007).

Using other econometric methods such as the logit regression model, the results suffer from selection bias, and the error term tends to be endogenous (Abu & Haruna, 2017). Endogeneity occurs when the error term is correlated with the independent variables. The major cause of endogeneity is the omission of key variables in the regression, which leads to biasness and inconsistency in the estimators (Wooldridge, 2013). The decision to access finance could be endogenous, and estimating the commercialisation without accounting for endogeneity produces biased results (Jaleta, et al., 2015).

The problem of endogeneity can also arise because the decision to access finance is voluntary; more commercially oriented farmers are therefore more likely to access finance to increase their commercialisation than are less commercially oriented farmers (Alene & Manyong, 2007). Endogeneity can also arise due to unobservable or missing variables. To prevent endogeneity bias, unobservable and missing variables must be considered because they have an impact on both finance and commercialisation (Kuntashula & Mungatana, 2013). Endogenous switching regression analysis accounts for variables that can cause biasness in the estimated variables and sample selection (Alene & Manyong, 2007). For example, farmers can access finance to pay their children's school fees or medical bills, which has absolutely nothing to do with agriculture or commercialisation. Failure to account for such unobservable variables will result in an overestimation or underestimation of the impact of finance on commercialisation.

3.3.1 Endogeneity bias problem

The endogenous switching regression model was developed to solve problems with many comparable variables (Lokshin & Sajaia, 2004). This model was first used to analyse the participation of workers in union activities. The workers' decision to participate in union activities was found to be endogenous – hence the use of the endogenous switching regression model, which allowed for the estimation of external factors affecting the decision to participate, and included union and non-union workers. This allowed for the inclusion of all factors that affected union or non-union workers, or both.

Devaney and Franker (1986) used a probit model to determine the impact of food expenditure on dietary requirements. However, it was discovered that participants behaved differently from non-participants with respect to their food intake. The model was prone to endogeneity bias; thus another method was required that would solve the endogeneity bias problem. Devaney and Moffitt (1991) developed a utility-based model to solve the endogeneity bias problem when determining nutrient demand by assuming that all variables were equal across

the two participation regimes. Their investigation found that the two participating regimes were different. Also, the error term in the participation equation was found to be correlated with a normally-distributed variable slope parameter in the nutrient demand equation. Devaney and Moffitt (1991) then employed a specification for endogeneity bias correction, and also used alternative specification methods.

Butler and Raymond (1996) used similar empirical specifications to those of Devaney and Moffitt, (1991). The study focused on the nutrient intake that was conditional on the participation regime, which was a linear function of several other variables. The participation decision was described by a probit model, represented as a propensity to participate. Like Devaney and Moffitt (1991), Butler and Raymond (1996) assumed that the parameters for most variables were the same across the participation regimes, although both commented more explicitly on the restrictiveness of the assumptions. Unlike other preceding studies, Butler and Raymond (1996) found evidence of endogeneity bias in one of their two data sets. Furthermore, after correcting for endogeneity bias, they failed to find the strong positive effects of food stamps noted in the preceding studies. Determining the effect of access to finance on commercialisation also suffers from the endogeneity bias problem. Carter (1988) showed that smallholder farmers are autonomous, and can systematically choose whether or not to obtain financial services. Similarly, since smallholder farmers are autonomous, they have the choice whether or not to commercialise. It is because of this autonomous behaviour of farmers that this study adopted the endogenous switching regression model.

3.4 Study area

The study focused on two regions of Eswatini – the Lubombo region and the Hhohho region – because they had the highest number of commercialisation activities being implemented by the National Maize Corporation (FANRPAN, 2003), and because the Hhohho region has favourable climatic conditions, making it the highest maize-producing region, while Lubombo is the driest, and hence the lowest maize-producing region. The selected regions have different climatic conditions, which give wider variations and unbiased results.

The Lubombo region is located on the eastern side of Eswatini, and is characterised by a narrow plateau whose altitude rises to 770 m.; the average rainfall is 600 mm, and the daily temperature varies from 10 to 27 degrees Celsius. Lubombo produces less than 10% of the annual average maize production in Eswatini due to its extreme climatic conditions (FANRPAN, 2003), whereas the Hhohho region contributes over 60% of the annual maize production (Sihlongonyane, et al., 2014). The Hhohho region is located in the northern part of Eswatini, with a climate characterised by wet summers and dry winters. The annual rainfall ranges between 1000 and 2000 mm, depending on the year (FAO, 2015). The two selected regions were also suitable because they have the highest rural populations, of 197 201 and 248 791 respectively (Ministry of Agriculture, 2017).

3.5 Data description

The data used for this study was collected from smallholder farmers in Eswatini in 2017. The study targeted smallholder maize farmers, and focused on their financial perceptions and commercialisation activities. The data was collected in the two regions that were selected – Lubombo and Hhohho – using a purposive sampling method (Mbonane, 2018). To narrow down the sampling size, two areas were selected in each region. The Sigangeni and Maphungwane areas were chosen in the Hhohho and Lubombo regions respectively, because those areas had the highest maize commercialisation activities in each of the two regions. A snowballing sampling technique was used to identify farmers with commercialisation activities (Mbonane, 2018). The reason why face-to-face was used to collect data was because most farmers in Eswatini do not have access to internet services.

3.6 Model specification issues

The data used in this study was reorganised and cleaned by removing detected inconsistencies and errors in order to improve the quality of the data. The data cleaning did not affect the sample size.

3.6.1 Outliers and influential observations

Outliers and influential observations are data points that differ significantly from other data points in the variable (Aggarwal, 2015). Outliers can result for different reasons, such as experimental error, variability in measurement, incorrect data coding, or bad sampling techniques. Using univariate analysis, outliers – such as production size, family size, farm sizes, finance, and commercialisation – were identified. Three farmers who were producing more than 1000kg of maize were identified. A thorough check found that these outlier farmers were consistent and were not errors or mistakenly recorded, and so no corrections were made. Two mistakes were identified where farmers sold more than they produced. After consultation with the interviewer, these errors were corrected.

3.6.2 Collinearity of independent variables

Collinearity significantly affects the significance and efficiency of results (Wooldridge, 2013). Correlation among the independent variables was detected by checking the significance of the results after adding/removing the variables. If the significance level of the coefficients changes significantly after the addition/subtraction of a variable, this suggests the presence of collinearity (Makhura, 1994). The variables amount produced and amount sold were not used in the regression due to collinearity with the dependent variable. The endogenous switching model requires the error term to be normally distributed, and so the variance inflation factor (VIF) was used to check for the collinearity of other variables. Due to the endogeneity of the study, a correlation analysis was conducted among all the variables, as shown in the Appendix, Table A1. This was important because access to finance is influenced by different factors. Although some values were correlated, the correlation coefficients were not significant at the 5% significance level.

3.6.3 Missing values

Missing data can be a serious concern in econometrics analysis. According to Wooldridge (2013), if data is missing from any variable, the variable cannot be used for econometric analysis. The data set had no missing values, and it was thus safe to use all the variables required for econometric analysis.

3.6.4 Combination of variables

The two-way three-way analysis required a combination of the financial variables for analysis. The variables were combined and analysed separately. Because of the complexity of the combination process, the chances of making errors were quite high. The combined variables were therefore verified and counter-checked more than four times.

3.6.5 Dropping of variables

The data set used for this study focused on the commercialisation and finance of smallholder farmers in Eswatini (Mbonane, 2018). Variables that were not important for this study were dropped, and only variables that were required were used for analysis. Insignificant variables were also dropped, because they influenced the significance of the model. Independent variables that affected the significance of the independent variables due to correlation were also identified and dropped.

3.7 Model specification

The aim of the study was to determine the effect of finance on the commercialisation of smallholder farmers. Each objective was analysed using different methods of analysis in order to achieve the overall objective.

3.7.1 Objective 1: To determine the accessibility of financial services among smallholder maize farmers in Eswatini.

Descriptive analysis was used when determining the accessibility of finance among smallholder farmers. Farmers were asked whether they had accessed any financial service, whether formal or informal. The responses were compiled and analysed using Excel and STATA, and the results were generated using graphs, tables, and pie charts. The significance of the results was determined using P-values and F-values, and the mean, median, and mode were employed in the analysis.

3.7.2 Objective 2: To analyse the interdependence between finance and agricultural commercialisation

To measure the interdependence between finance and commercialisation, the analysis of variance (ANOVA) was used. The two-way ANOVA method was used to compare the means of the financed and non-financed farmers. The ANOVA calculates the means, and analyses whether they are statistically different between different sets of groups. The ANOVA in this study was used to determine the differences between the commercialisation characteristics of the financed and non-financed farmers. The ANOVA used the F-statistic to determine the significance of the means. Different sets of results were presented, depending on the financial instruments being analysed. The ANOVA provided the F-test values for the difference between the means and the significance (Kgowedi, et al., 2002; Paterson, 1939). Kgowedi et al. (2002) used the same method to distinguish the factors that affect the choices of money lenders and non-money lenders.

However, this technique has limitations that affect the accuracy of the results. The first limitation is that the model assumes that the sampling method used to collect the sample was a simple random sampling. However, in most cases this is not true, because samples tend to be dependent on each other. The snowballing sampling technique was used in this study, justifying the use of the ANOVA. The ANOVA also assumes that the distribution of the variables is normal. The other limitation is that the model assumes that the groups have equal standard deviations. The analysis of variance can also not detect the endogeneity factors.

3.7.3 Objective 3: To determine the causal effect of different forms of finance on agricultural commercialisation

To analyse the effect of finance on the commercialisation of smallholder maize farmers' in Eswatini, the study employed the ordinary least square (OLS) method, the logit regression method, and the endogenous switching regression model. The OLS and logit models were used to analyse the relationship between commercialisation and the explanatory variables. The results obtained using the OLS and logit regression are likely not to be accurate, due to the endogeneity characteristic of the study (refer to Appendix Table A2, where the results are presented). The Wald test was used to test for endogeneity, and justified the use of the endogeneity switching regression model.

The endogenous switching regression model

The endogenous switching regression method's results are free from endogeneity bias caused by heterogeneous factors such as self-selection biasness, source of finance, and culture and beliefs associated when accessing finance (Ng'ombe , et al., 2017). Access to finance is sometimes determined by policy-makers, government agencies, and financial institutions. The endogenous switching regression model was therefore developed to account for any selection bias that exists due to omissions and heterogeneous factors (Kanburi Bidzakin, et al., 2019).

The endogenous switching regression model separated the farmers into financed and non-financed groups; then the model analysed the commercialisation of the two groups separately. Farmers are risk-neutral, and their decision to obtain credit or insurance, or to use any financial service, was determined by the household utility that the farmer was expecting to gain. The first part of the method is known as the selection regression, because it is used to separate financed farmers from non-financed farmers. In the selection regression model, finance is a dependent variable, while all other observable and non-observable variables factors are independent variables (Maddala, 1983).

$$F_I^* = \partial \beta_i + \mu_i \text{ with } I_i = \begin{cases} 1 & iff\ F_I^* > 0 \\ 0 & iff\ F_I^* \leq 0 \end{cases} \qquad 5$$

given that:

- Finance (F^*_I), being the dependent variable, represents agricultural finance affected by observable variables (age, gender, household size, education) and unobservable

factors, such as interest rates, good payment plans, or payment in-kind (Kuntashula & Mungatana, 2013).

- Finance ($F^*{}_I$) had a value of 1 if the farmer accessed finance, and 0 if the farmer did not access finance.

The regression equations are:

Regime 1 $\qquad C_{1i} = \alpha_1 X_{1i} + \epsilon_{1i}$ if $F^*{}_I = 1$ $\qquad\qquad\qquad$ 6

Regime 2 $\qquad C_{2i} = \alpha_2 X_{2i} + \epsilon_{2i}$ if $F^*{}_I = 0$ $\qquad\qquad\qquad$ 7

where:

- C_{1i} is a dependent variable: commercialisation; income after marketing
- C_{2i} is a dependent variable: commercialisation, given that the farmer did not access finance
- X_{1i} and X_{2i} are independent variables
- α_1 and α_2 are parameters
- ϵ_{2i} & ϵ_{1i} are error terms

$$\text{Cov } (\mu_{0i}, \epsilon_{1i}, \epsilon_{2i}) = \begin{pmatrix} \sigma_0^2 & . & . \\ \sigma_{01} & \sigma_1^2 & . \\ \sigma_{02} & . & \sigma_2^2 \end{pmatrix} \qquad\qquad 8$$

given that:

- σ_0^2 is the variance in the selection equation model.
- The variances in the continuous equations = σ_1^2 & σ_2^2 are variances of the error term in the commercialisation equations. The covariance values between equations are σ_{01} & σ_{02}. However, the covariance between the selection and the continuous equations $\sigma_{12}, \sigma_{10}, \sigma_{20}$ and σ_{21} cannot be determined because these equations cannot be simultaneously observed (Kuntashula & Mungatana, 2013).
- When the covariance values σ_{01} and σ_{02} are significant, then the decision to access agricultural finance and agricultural commercialisation is correlated. This is what is known as an endogenous switching regression (Maddala, 1983).

We assumed $\sigma_0^2 = 1$, because the coefficients are estimated up to a scale factor (Asfaw & Shiferaw, 2010). Beta β was the only scalar factor to get the values error term as:

$$E(\varepsilon_n | I = 1) = \sigma_{nc} \frac{\varphi(\partial\beta/\sigma)}{\rho(\partial\beta/\sigma)} \equiv \sigma_{nc}\lambda_{nc} \qquad 9$$

$$E(\varepsilon_n | I = 0) = \sigma_{oc} \frac{\varphi(\partial\beta/\sigma)}{1 - \varphi(\partial\beta/\sigma)} \equiv \sigma_{0c}\lambda_{oc} \qquad 10$$

where the probability density φ and ρ are the cumulative distribution; however, the residuals do not satisfy the homoscedasticity assumption (Maddala, 1983). The most efficient method, therefore, is full information maximum likelihood (FIML).

$$InC = \sum(I_i\omega_i[ln\{F(\eta_{1i})\} + ln\{f(\epsilon_{1i}/\sigma_1)/\sigma_1\}] + (1 - I_i)w_i[ln\{1 - F(\eta_{2i})\} + \qquad 11$$
$$ln\{f(\epsilon_{2i}/\sigma_2)/\sigma_2\}])$$

where: ω_i is the optimal weight and $\eta_{2i} = (\beta\partial_i + \rho_j\epsilon_{ji}/\sigma_j)/\sqrt{1 - \rho_j^2}$, (Guilactco & Barrios, 2017).

To determine the effect of finance on commercialisation, we focused on the signs and significance of the correlation coefficients (Rho). If the correlation coefficient (Rho (ε, u) = p) is significant, then there is selection biasness. If Rho < 0, then there is negative selection biasness, meaning that smallholder farmers who accessed finance were less likely to be commercialised. Rho is a correlation coefficient between the finance category and commercialisation (Curto & Pinto, 2007). If Rho is less than one (1) but greater than zero (0), it is statistically significant, which means that farmers in that category are less commercialised than those in the base category. The likelihood ratio tests the independence between the reported equations in a given table/output (Ng'ombe , et al., 2017).

The full information maximum likelihood (FIML) model was used to estimate the endogenous switching regression using the *movestay* STATA command (Asfaw & Shiferaw, 2010). The *movestay* STATA command for the maximum likelihood endogenous switching regression model was implemented by Lokshin (2004). The *movestay* command yields consistent standard errors, depending on the joint normality of the error terms in the continuous equations. The dependent variable in FIML was commercialisation. The likelihood test was used to test the independence of the error terms of the model. If the endogenous sample separation is valid, the null hypothesis is rejected (Ali, et al., 2014). This method was used to analyse the effect that finance has on the commercialisation of smallholder maize farmers in Eswatini, and was recommended because it eliminated selection biasness and endogeneity caused by other external factors that were not observed.

3.8 Choice of variables and their descriptions

Different factors were used to estimate the models to be used for the analysis. The explanatory variables were categorised into demographic and socio-economic characteristics, financial capital, human capital, and characteristics of the household heads. The variables of interest were the level of commercialisation (dependent), access to credit, insurance, household savings, non-farm income, maize consumed, gender, age, education level, size of land, experience in farming, household size, and ownership of land.

To estimate the effect of finance on commercialisation using the analysis of variance, only the commercialisation variable and the financial instruments were considered. For each of the analyses, commercialisation was the dependent variable, while the financial instruments were the explanatory variables.

3.8.1 Description of variables

Table 3.1 shows the important variables used to analyse the effect of finance on the commercialisation of smallholder farmers.

Table 3.1: Variables descriptions

Variable	Variable characteristics	Variable description	Hypothesised relationship
	Farming characteristics		
Commercialisation	Commercialisation of farmers	The percentage of maize sold of the amount produced by the household (%)	Variable of interest
Area used	Area used	Amount of area used for production (Ha)	+
Location	Location	Location of the farmer (1= Lubombo; 0= Hhohho)	+/-
Amtcon.	Amount consumed	Amount consumed by the household (Kg)	-
Inc/Crop	Income obtained	Income obtained after sales of crops (E)	+
Training	Farm training	Training obtained from extension officers on agriculture	+
	Finance characteristics		
Insurance	Insurance used	Does the farmer have non-agricultural insurance?	+/-
Credit	Access to credit	Access to credit for agricultural purposes	+
Savings	Household savings accessed	Does the farmer have savings for agriculture?	+
Off-farm inc	Off-farm income	Amount of money earned monthly from off-farm activities	+/-
Agric insurance (proxy)	Agricultural insurance	Preference to adopt agricultural insurance if made available	+
	Human capital		
HEduc	Education	Level of education attained by the farmer (0= zero, 1= primary, 2= secondary, 3= tertiary)	+
FarmEdu	Farm education	Received farming education/training	+
	Household characteristics		
AGEHH	Age of the household head	Age of the farmer (years)	+/-
OCCUP	Occupation	Occupation of the household members (1= farming as the major, 0= other major occupation)	+/-
GENDER	Gender of the household head	Farmers' gender (1= female, 0= male)	+/-
MEMBER	Membership	Does the farmer belong to the association?	+
HS	Size of the family	The size of the household (head count)	-

a) *Commercialisation*

Commercialisation was the dependent variable. All variables were measured on how they affected commercialisation. Commercialisation was measured as the percentage of the amount of maize sold with respect to the total maize production per household.

b) *Financial capital*

Agricultural credit was hypothesised to positively influence the commercialisation decision of smallholder farmers. The credit that was analysed was any form of credit for agricultural purposes. Farmers were asked whether they had obtained credit to purchase farm inputs or had used it for any form of agricultural activity. They were also asked whether they had any insurance policy. All forms of insurance policies were considered, because insurance affects both the finance and the commercialisation activities of smallholder farmers. Farmers were also asked whether they had obtained agricultural insurance. If they had not accessed agricultural insurance, they were asked whether they would consider accessing agricultural insurance if it were made accessible. The variable preference to obtain agricultural insurance was used as a proxy for agricultural insurance.

Farmers were also asked whether they had any form of household savings or savings with any financial institutions. Savings with a cooperative or informal institution were also considered. Any positive response was recorded as access to savings. Last, the off-farm income variable recorded any off-farm activities. These ranged from formal employment to small businesses. Off-farm income was used as a supplement to earn extra income in addition to on-farm income. Farmers were asked more-or-less how much they earned from off-farm activities. During analyses, however, the values were converted to a binary variable.

c) *Human capital*

Commercialisation requires a better understanding of agricultural activities and information (Makhura, 1994). Both formal education and farming education were considered when measuring the human capital of farmers. Formal education was categorised into secondary education and above, and primary education and below. Farming education was any form of training obtained from either friends or extension officers. Farming education is an informal type of education that farmers obtain from sources other than formal institutions.

d) Socio-economic characteristics

The final category to be considered was the household characteristics of farmers. This was a combination of age, gender, occupation, association membership, and family size. The age of the household head was a good proxy for farming experience (Makhura, et al., 2001). Age affects commercialisation because it influences the commercialisation undertaken by farmers; this makes the variable a very important factor to be observed. Access to financial services is expected to favour men, due to traditional beliefs and cultural barriers. Therefore gender was another social-economic characteristic considered. The occupation of the household head can influence the commercialisation decision and financial accessibility. A household head working full-time is expected not to be involved fully in agricultural activities. The last social-economic factor was the household size. Since commercialisation is a percentage of the amount being sold from the amount produced, household size affects the level of consumption. This also affects the amount of commercialised maize.

3.9 Summary

This chapter defined commercialisation and how it can be measured. The theoretical and empirical backgrounds of the study were established. The study reviewed the literature on endogeneity, and an attempt to establish a link with the study was conducted. The chapter also provided a description and the procedures on how the study was conducted. Last, the chapter discussed issues relating to models and statistical analytical techniques.

CHAPTER 4

CHARACTERISITCS OF SMALLHOLDER FARMERS

This chapter presents the demographic, socio-economic, commercialisation, and financial characteristics of households. Simple statistics of means and frequencies were used to present and assess the variables used in the study. This chapter is subdivided into subsections that correspond to each of the above characteristics of households.

4.1 Social and demographic characteristics

This section discusses the inherent characteristic variables of smallholder farmers. Inherent variables can be defined as variables that do not need much effort to obtain, such as gender, marital status, and age (Quazi & Talukder, 2011). Table 4.1 summarises the inherent variables.

4.1.1 Gender, marital status, and age characteristics of respondents

The gender of the household head can influence the commercialisation and financial accessibility perception of the household, and so the gender of the household head was considered, represented by a gender dummy variable, with 1 being female and 0 being either male or '(other)'. As expected, the results showed that male-headed households dominated the study. Sixty-eight per cent of the respondents were male, and only 32% were female. A good explanation for why male-headed households dominated the study might be that, in Eswatini, households are traditionally headed by men, while women are regarded as helpers.

Youths are perceived to be more innovative, productive, and technological adopters than older people. Therefore the age of the head of the household was a significant demographic factor that could affect farming decisions made by the household. The results obtained showed that the oldest respondent was 91 years old, and the youngest was 18 years old. The wide range in age clearly showed the involvement of both old and young people in agriculture, as shown in Table 4.1. To understand the distribution of the age variable, a histogram was used, and a normal distribution curve was obtained. The mean age of the household head was about 52 years old.

Considering the wide range in age, various marital statuses were expected. To present the marital status of the respondents, a dummy variable was used, with married respondents given a value of 1 and any other marital status – such as single, divorced, or widow/widower – was given a value of 0. The study revealed that 61% of the respondents were married and 39% were single, divorced, or widowed.

Table 4.1: Age, gender, and marital status characteristics

Variable		Frequency	Mean	Std. dev	Min	Max
Age of respondents		150	52.26	16.52	18	91
Sex:	*males*	92	0.61	0.49	0	1
	females	58	0.39	0.49	0	1
Marital status: Married (1)		150	0.61	0.489	0	1
Other (0)		150	0.39	0.503	0	1

4.1.2 Household size and farm size

Smallholder farmers produce maize for consumption and sell their surplus output after subtracting their household consumption. In this study, household size was defined as the number of household members who lived together and ate from the same pot (Mbonane, 2018). The larger the household size, the more maize was consumed by the household. This simply means that larger households were less likely to commercialise than smaller households, all things being equal. Each household had an average of about seven household members. The smallest household had one member, and the largest had 23 household members. However, less than 10% of the total households had more than 15 household members. The results on the graph show that the household size distribution was skewed to the right; this means that most of the households had a household size below the median.

Smallholder farmers are constrained from accessing Title Deed Land in Eswatini. All of the farmers in this study cultivated Swazi National Land, which means that none of them had title deeds for their land. The farm size was measured by determining the area cultivated by the household for maize production. Land size is a very important aspect in agriculture commercialisation. The farm size distribution ranged from 0.25 hectares to 10 hectares, with

a typical farmer having about 2.28 hectares, as shown in Table 4.2. The farm size variable was not normally distributed; this is because most of the farmers had limited access to a large farming area for production. From the results obtained, only 4% of the sampled farmers had access to, or cultivated, more than six hectares of land.

Table 4.2: Household size and farm size

Variable	N	Mean	Std. dev	Min	Max
Household size	150	7.47	4.01	1	23
Farm size	150	2.28	1.70	0.25	10

4.1.3 Human capital

Education is an important human asset that determines farmers' ability to make critical commercialisation decisions. Education was divided into formal education (which is basically school education) and informal education (which is farm-based training). Both variables were converted into dummy variables for easier data analysis and interpretation.

Forty-nine per cent of the farmers had only attended primary school education and below, while 51% had reached at least secondary school level or had some tertiary education. The education variable was normally distributed, with most of the respondents having attained at least secondary school education. Sixty-one per cent of the respondents had received informal education in the form of training provided by various stakeholders, such as government workers and non-governmental organisation workers. Forty-seven per cent of the farm training education was provided by extension officers. Other sources of additional training were provided to farmers through farmers' unions and associations, by visiting other farmers, or through demonstrations.

Table 4.3: Education and farm education

Variable	Frequency	Percentage
Formal education		
1. *No education*	24	16.00
2. *Primary education*	49	32.67
3. *Secondary education*	64	42.67
4. *Tertiary education*	13	8.67
Informal education	91	60.67

4.1.4 Farming experience

Over the years, farmers have tended to educate themselves on how to conduct farming business. Therefore experience is another valuable human asset in commercialisation. It is presumed that the more experienced farmers are, the more commercialised they are likely to be. This is because they are more likely to be knowledgeable about farming business and the best methods to use to avoid risks. Farming experience ranged from one year to 70 years. The histogram distribution of farming experience was slightly skewed to the left. However, most of the respondents had more than 10 years of farming experience. This means that most farmers had enough knowledge about agricultural practices and the challenges involved in agriculture.

4.1.5 Association, union or cooperative Active membership

Cooperative, union, and association membership influences the training of farmers and their access to credit and input distribution. With these various services offered through such memberships, commercialisation is also likely to be affected. Therefore it was important to consider the smallholder farmers' membership of any association, unions or cooperative. Despite the importance of being a member of an association, union or cooperative, the results showed that only 11% of the households belonged to any association, union or cooperative. Forty-four per cent were either not sure or were not active members of any association. Figure 4.1 shows the household association memberships of smallholder farmers.
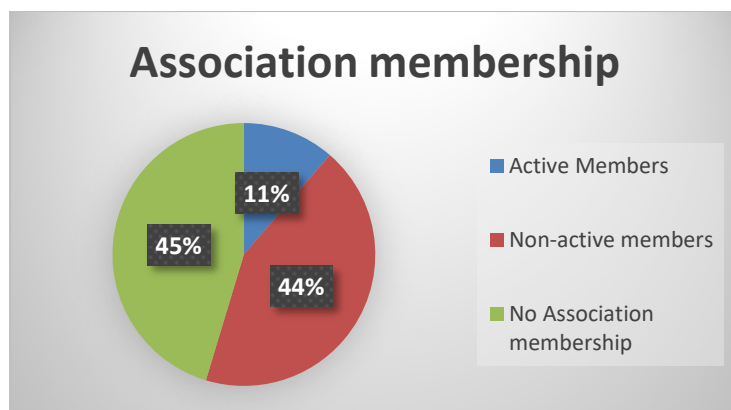
Figure 4. 1 : Association membership

4.2 Dimensions of commercialisation

The dimensions of commercialisation were separated into input and output segments. The input segment was made up of the technological characteristics, while the output segment was made up of the amount of maize produced and the amount of maize sold on the market.

4.2.1 Technological adoption characteristics

Seventy-nine per cent of households had no farm machinery for their agricultural production; instead these farmers depended on basic traditional types of farming tool for production. The remaining 21% of the sampled farmers had at least a plough, tractor, planter, or other farming item of equipment. The results in Table 4.4 show the different types of equipment and farm machinery owned by farmers, and what percentage of the sample owned such machinery.

Table 4.4: Technological adoption

Variable	Frequency	Percentage
No equipment	120	80.00
Tractor	7	4.67
Plough	4	2.67
Planter	2	1.33
Other equipment	9	6.00
Tractor and planter	1	0.67
Plough and planter	4	2.67
All the above equipment	3	2.00
Total	150	100.00

4.2.2 Production and marketing characteristics

Eighty per cent of the households produced maize only. The remaining 20% produced maize and other crops, such as beans, sweet potatoes, potatoes, and other vegetables. When farmers were asked what their expected yields were, the results showed that their expectations were greater than the actual yield, due to the poor rainfall experienced in the 2016/17 farming season. The average expected yield was 4,941kgs, while the average actual production yield was 4,226kgs. The actual maize produced was not normally distributed because of outliers, as shown in Table 4.5. The lowest maize producer produced 100kgs, while the highest maize producer managed to produce 25,000kgs.

The maize produced was either sold or consumed, or a combination of both. Larger households were likely to consume more than smaller households. The size of the household thus affected the amount of maize that was sold. However, the low maize producers tended to produce maize only for consumption. This constituted about 21% of households. The amount of maize sold ranged from 100kgs to 22,800kgs. The distribution of maize being sold was also not normally distributed – as with the amount of maize that was produced.

Table 4.5: Production, consumption, and marketing characteristics (per 100kg)

Variable	N	Mean	Std. dev	min	Max
Actual production	150	42.41	48.65	2	300
Expected production	150	49.41	44.65	1	250
Amount consumed	150	15.88	13.37	0	80
Amount sold	150	25.25	40.38	0	228

4.3 Financial characteristics and accessibility

The results showed that most smallholder farmers were involved in off-farm activities than in any other kinds of financial activity. More than 60% of the sampled smallholder farmer households were involved in off-farm activities. The most accessed types of finance were credit and households savings: about 33% of households had accessed credit, and 32% had accessed household savings. The least-accessed financial instrument was insurance, at 27%. Since agricultural insurance was completely inaccessible, the preference to adopt agricultural insurance was used instead: at least 53% of them would adopt agricultural insurance if it were accessible, as shown in Figure 4.2.
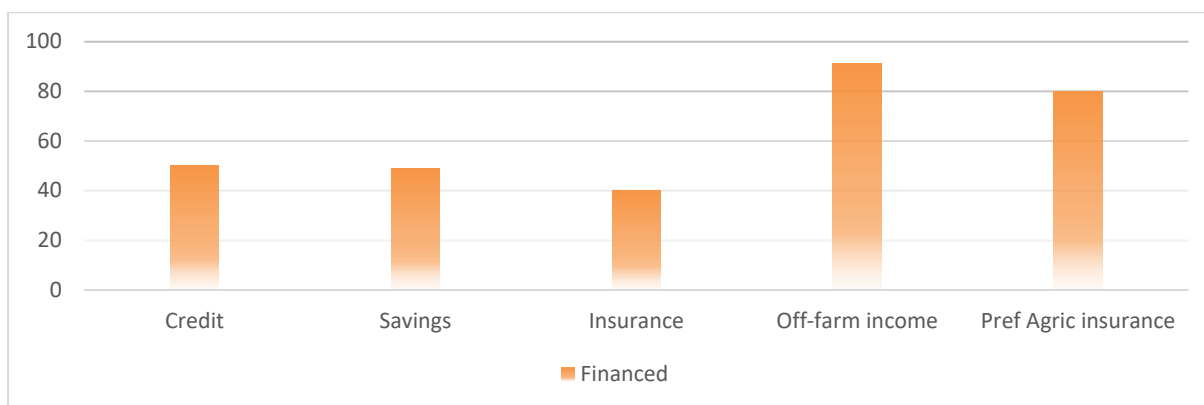
Figure 4. 2: Access to finance

4.3.1 Credit accessibility

Credit accessibility is influenced by both endogenous and exogenous factors. Credit accessibility can be defined as a farmer's ability to access credit or farm inputs for agricultural purposes. The results showed that 33% of the households had accessed credit or obtained agricultural inputs on credit. Only 14% of the households that accessed credit did so from formal financial institutions (Mbonane, 2018). The major source of credit for households was the Rotating Savings and Credit Associations (ROSCAs). The poor access to credit by smallholder farmers was because of a lack of formal financial services, high interest rates on credit, a lack of collateral, and a poor adoption of technology and farm equipment. Annim and Frempong (2018) showed that access to credit among smallholder farmers has been low in most African countries.

As shown in Table 4.6, the informal sector was the main source of credit for smallholder farmers. These were friends, the community, and relatives. This was because smallholder farmers were excluded from accessing credit by the formal sector. Credit exclusion also affected farmers when purchasing farm machinery and inventory. Only 2% of the smallholder farmers who had farm machinery had purchased the farm equipment on credit. This contributed to the low adoption of technology and machinery among smallholder farmers.

Table 4.6: Credit accessibility

Variable	N	Frequency	Percentage
Credit	150	50	33.33
Credit type:			
Formal	50	7	14.00
Informal	50	43	86.00

4.3.2 Household savings accessibility

Thirty-three per cent of the households had household savings kept aside for future investment. However, due to poor financial services and exclusion, most farmers kept the money at home. Sixty-seven per cent of the households that had savings used informal ways to save, and only 33% of the households had formal bank accounts.

Table 4.7: Household savings accessibility

Variable	N	Frequency	Percentage
Savings	150	49	32.67
Savings type:			
Formal	49	16	32.65
Informal	49	33	67.35

4.3.3 Insurance policy accessibility

The results obtained from the study showed that 27% of households had an insurance policy. These included property insurance, life assurance, and health insurance policies. It was strange, although expected, that none of the farmers had agricultural insurance policy. Smallholder farmers were excluded from obtaining agricultural insurance because they were considered to be peasant farmers and thus a high risk.

Table 4.8: Insurance policies

Variable	N	Frequency	Percentage
Insurance	150	39	27.00
Insurance policy type:			
Property	39	2	05.13
Life insurance	39	34	87.18
Health insurance	39	3	07.69
Agricultural insurance	0	0	00.00

   a) *Agricultural insurance*

The study went on to determine how knowledgeable farmers were about agricultural insurance, how familiar agricultural insurance was to them, and their preference to adopt agricultural insurance after being educated about it. From the sampled 150 farmers, only 10% were familiar with agricultural insurance and 3% were knowledgeable enough about it. Therefore the interviewer had to explain and discuss agricultural insurance with the farmers. Later, the farmers were asked if they would consider adopting agricultural insurance (Mbonane, 2018). Fifty-three per cent of the respondents were interested in adopting agricultural insurance, based on the knowledge provided by the interviewer.

The farmers' decision to adopt agricultural insurance depended on the risks they faced. Most of the farmers that considered adopting agricultural insurance were from the Lubombo region. This is because the farmers in that region had experienced drought in recent years, and insurance was the best option for them.

Table 4.9: Knowledge of and preference for agricultural insurance

Variable	N	Frequency	Percentage
Familiar with agricultural insurance	150	15	10.00
Knowledge of agricultural insurance	150	4	02.67
Agricultural insurance (proxy)	150	80	53.33

4.3.4 Farm income

a) On-farm income

Farmers use on-farm income as a source of finance for their farm activities, Farm income also plays a very important role in the commercialisation decision of households. The farm income was determined by obtaining the amount of income earned after selling the produce. As shown in Table 4.10, the typical household obtained an income of R8 255.50, with the highest amount received being R116,130.00; other households did not receive any income. The results are presented in South Africa rand (ZAR) and not Swazi lilangeni for easier understanding; the conversion rate is 1:1 between the two currencies. Twenty-two per cent of the sampled smallholder farmers produced maize for household consumption only. The distribution of the household income was skewed to the left, which clearly justifies the large standard deviation. The location of the household affected the income each received. The results showed that households in the Hhohho region received a higher farm income than households in the Lubombo region. The two regions had different commercialisation activities and climatic conditions.

Table 4.10: Farm income (Rands)

Variable	N	Mean	Min	Max
Average income	150	8255.5	0	116 130
Income per region:				
Income Lubombo	75	3490.87	0	29760
Income Hhohho	75	13020.13	0	116130

b) Off-farm income

Off-farm income was obtained from activities other than agricultural activities. The off-farm income was sourced from formal employment, business, wages for a service rendered, and any other income obtained. A household's monthly earnings ranged from R1, 000 to R20, 000. The average earning was between R4, 000 and R8, 000 a month. Most of the households earned between R1, 000 and R4, 000, which was 48% of the sample. However, not all farmers who earned off-farmer income had formal employment or an occupation. Thirty-five per cent of the households had formal jobs, while the remaining 65% were full-time farmers. These household heads regarded their occupations, not agriculture, as their main source of income.

Table 4.11: Off-farm income

Variable	Obs.	Frequency	Percentage
Off-farm income	150	91	60.67
Occupation	150	52	34.67

4.3.5 Financial endowment

The financial characteristics of households play an important role in their commercialisation decisions. Smallholder farmers also rely on finance for their daily activities, whether on- or off-farm. This section provides the results for the socio-economic characteristics of the financed and non-financed households; thus the farmers were subdivided into financed or non-financed households. Table 4.12 shows the main differences between them.

The average household head was 52 years old. However, the results showed that the financed group of farmers were typically younger than the non-financed group of farmers. On average, the non-financed farmers' household size was found to be smaller than the financed household size. The overall sample was dominated by male household heads; however, the financed households had more female household heads than the non-financed households. The majority of the financed household heads were married (70%), compared with 46% of the non-financed household heads.

Table 4.12: Socio-economic characteristics of smallholder farmers' households

Variable	Finance (N=95)	Non-finance (N=55)	Overall (N=150)
Household size	7.57	7.29	7.47
Farm size	2.57	1.80	2.29
Location (dummy)	0.50	0.51	0.50
Marital status (dummy)	0.71	0.46	0.61
Age	49.48	57.06	52.26
Gender	0.44	0.29	0.39
Association membership	0.55	0.55	0.55
Farm education	0.65	0.53	0.61
Inventory	0.23	0.15	0.20
Occupation	0.40	0.26	0.35
Commercialisation	45.92	32.71	41.08

4.3.6 Combination of financial instruments

The different financial instruments were combined and observed, depending on different financial aspects. However, an analysis of each component was important. From the total sample, 92% of the households had accessed some form of finance, including a willingness to adopt agricultural insurance. Eighty-seven per cent of the sample had accessed at least credit, household savings, off-farm income, or insurance to finance their farming activities. Seventy-five per cent of the sample had accessed credit, household savings, or a preference to adopt agricultural insurance.

Table 4.13 shows the number of smallholder farmers who accessed different combinations of finance. The finance was separated into combinations of four, three, and two financial instruments respectively. Due to the existence of different combinations, only the most important combinations were presented.

Table 4.13: Finance endowment

Variable	N	Frequency	Percentage
All five types	150	138	92.00
Four types of finance			
Credit, savings, insurance, and off-farm income	150	131	87.33
Three types of finance			
Savings, credit, and agricultural insurance	150	113	75.33
Two types of finance			
Off-farm income & agricultural insurance	150	120	80
Off-farm income & insurance	150	105	70
Credit & savings	150	83	55.33
Credit & Pref. agricultural insurance	150	103	68.67
Savings & Pref. agricultural insurance	150	113	75.33

4.4 Summary

This chapter presented the demographic, socio-economic, commercialisation, and financial characteristics of the sampled households. The results showed that the sample was dominated by male respondents and that the majority of the respondents were married. The mean household size was 7.47 household members, and the mean farm size was 2.28 ha. The results also showed that smallholder farmers depended more on off-farm activities for their external finance. They also accessed credit, insurance, and household savings as sources of finance.

CHAPTER 5

EMPIRICAL RESULTS AND DISCUSSION

This chapter presents the empirical research findings and discusses the results obtained. The ANOVA was used to test the effect of finance on commercialisation. The endogenous switching regression model further analysed the effect of financial instruments on commercialisation. The causal effect of finance on commercialisation was estimated using the endogenous switching regression model.

5.1 Agricultural commercialisation by finance

The study implemented the ANOVA to distinguish the commercialisation activities of financed farmers from those of non-financed farmers. The model used the F-test statistics to test the difference between the means of farmers who accessed finance and those who were non-financed (Makhura, et al., 1999). The ANOVA model was able to compare the observed characteristics of financed and non-financed farmers. Thus it was used to test the null hypothesis that farmers who accessed finance were more likely to have more commercial characteristics than farmers that did not have access to finance.

5.1.1 Agricultural commercialisation mean comparison for financed and non-financed smallholder farmers

The mean comparison of smallholder farmers' characteristics was categorised into two groups; financed and non-financed farmers. It was hypothesised that farmers who accessed finance were likely to have high commercialisation means, as opposed to non-financed farmers. The results presented in Table 5.1 show that the commercialisation mean size of credit borrowers was greater than that of non-credit borrowers. As expected, credit borrowers spent more on farm production and thus had higher commercialisation levels. However, credit was inaccessible in the formal sector; it was mainly accessed in the informal sector, where accessibility was based on trust and confidence between the credit lender and the farmers (Kgowedi, et al., 2002). Thus a good number of farmers preferred household savings rather than credit.

Table 5.1: **Finance and commercialisation using ANOVA**

Variable	Financed	Non-financed	Significance
Credit	48.08**	37.57	Yes
Household savings	48.76**	37.35	Yes
Off-farm income	39.33	43.78*	No
Insurance	46.31*	39.17	Yes
Pref. agric-insurance	40.46	41.79	No

*Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level

Farmers have different reasons for having household savings. One of the major reasons could be for future investment. Another reason could be because of high interest rates on credit finance. Household savings have been identified as the most affordable alternative form of agricultural finance. In most cases, farmers would choose household savings because they were the only option available, given the inaccessibility of other financial services. Farmers who had household savings also had higher commercialisation levels than farmers without household savings – a finding that is supported by similar results obtained in Malawi (Brune, et al., 2016). The difference was significant at 5%, as shown in Table 5.1. However, we cannot conclude that farmers who accessed credit and household savings would reveal higher levels of commercialisation because of the endogeneity bias problem of the study.

Smallholder farmers tend to engage themselves in off-farm activities to supplement their household income. Off-farm activities could negatively affect farming and commercialisation activities, because more time is spent on off-farm activities than on on-farm activities. This supports the results in Table 5.1, which show that farmers who are not engaged in off-farm activities have higher commercialisation means. However, the income from off-farm activities tends to support commercialisation activities. This trade-off is why farmers with off-farm income can also have significant commercialisation characteristics. This clearly shows the presence of the endogeneity bias problem in this study: we cannot clearly distinguish what has led to their becoming involved into off-farm activities.

Agricultural insurance was completely inaccessible among smallholder farmers in Eswatini. To have a clear understanding of its likely adoption, the preference for agricultural insurance was determined. The smallholder farmers' preference for agricultural insurance adoption was not significantly different from those who opted not to adopt agricultural insurance. Farmers who preferred to adopt agricultural insurance were found to be less commercialised than

those who neglected the adoption of such insurance. However, the ANOVA results in Table 5.1 were significant at the 10% significance level. Insurance among smallholder farmers is not common, and most farmers cannot afford it. The ANOVA results clearly show that non-insured farmers, on average, were more commercialised. Other factors could have contributed to the reasons that insured farmers were more commercialised than non-insured farmers. One of the reasons could be adverse selection and endogeneity bias. This study tried to capture the endogeneity aspect, not the new economics adverse selection effect problem.

Table 5. 2: Finance and commercialisation using ANOVA

		F-statistic	*Significance*
One-way	Savings	4.411**	Yes
	Credit	3.758**	Yes
	Off-farm income	1.505	No
	Insurance policy	0.710	No
	Agricultural insurance preference	0.066	No
Two-way	Savings	1.063	No
	Credit	1.055	No
	Off-farm income	1.047	No
	Insurance policy	0.825	No
	Agricultural insurance preference	1.204	No

*Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level*

Table 5.2 showed a summary of Table 5.1 along with the combined financial instruments. The difference in significance of the financial instruments could be because credit and household savings are more directly linked to production activities than other instruments. Off-farm income is normally targeted for consumption, while insurance policies are post-production. Also, credit, household savings, and insurance were positively correlated to commercialisation, while off-farm income and a preference for agricultural insurance were negatively correlated to commercialisation. Among the financial instruments, off-farm income and household savings were positively correlated. As farmers engage in off-farm activities, money is kept aside for their farming activities. However, off-farm income negatively affected credit, as seen in the negative and significant correlation coefficient. Also, household savings were positively and significantly correlated to a preference for agricultural insurance.

The insignificance of the variables can be attributed to the sample size of the data and the sampling technique that was used. Also, as the financial variables were combined, the significance level reduced further. The insignificant variables were presented to show the difference between the means, and also to show that they contributed to the total variance. All the insignificant variables were included to avoid overfitting of the model.

5.2 Endogenous switching regression method: Analysis of effect of finance on commercialisation.

To analyse the effect of different financial instruments on commercialisation, endogenous switching regression was employed. The full information maximum likelihood (FIML) method was employed to estimate the final equation, together with the selection decision equation. The results presented in the tables 5.3, 5.4, 5.5 and 5.6 showed that different factors influenced the commercialisation decision. The first column represents the selection equation on accessing finance. The second and third columns respectively present the commercialisation functions for smallholder households that accessed finance and non-financed farmers. The Rho coefficient of correlation sign and significance showed the relationship between finance and commercialisation.

The tables 5.3, 5.4, 5.5 and 5.6 showed the endogenous switching regression results for the different finance variables that were analysed. The results were categorised according to the different levels or combinations of financial instruments (one-way, two-way and three-way). All of the models presented fitted the data well, since the Wald test was significant at 5%,

except for the four-way and other models that were not presented. The results obtained were different from the ANOVA results because of the presence of positive endogeneity.

5.2.1 One-way analysis

5.2.1.1 Effect of household savings on commercialisation

The estimated effect of household savings on commercialisation was significant, as shown in Table 5.3. The Wald test was insignificant, indicating that the endogeneity problem was not present. This means that access to household savings was not influenced by unobservable factors other than the variables used in the model. The selection equation shows that access to household savings was influenced by off-farm income. According to Mishra and Morehart (2001), off-farm income boosts household investment and increases household savings. Access to household savings was also influenced by the size of the farm and of the farm machinery inventory. Farmers' ownership of farm machinery increased household savings, due to the reduction of money spent on household labour.

Commercialisation was also influenced by other factors, such as household size, the regional location of the household, the farm's size, and the farm education obtained through training. The household size negatively affected commercialisation, as expected, because smaller households consume less and are more likely to commercialise. The farm size positively affected commercialisation, because the larger the farm, the more likely it is that the farmer will produce and will commercialise. The household location significantly influenced the commercialisation of smallholder farmers: farmers in the Hhohho region were found to be more commercialised than farmers in the Lubombo region.

Table 5.3: Endogenous switching regression results of household savings, and effect on commercialisation

Variable	Selection	Commercialisation	
		Savings	No Savings
Constant	-1.783	35.041	30.993
Household size	0.014	-1.976**	-1.863**
Farm size (ha)	0.141**	3.085*	3.829
Marital status	-0.178	8.670	8.480
Age	0.066	-1.509	-0.136
Education	0.352	11.467	5.087
Location	-0.001	-31.065	-21.897
Occupation	-0.017	19.305**	3.896
Hired labour	0.146	13.736	6.605
Membership	0.082	28.959	15.746
Gender	-0.188	-2.829	-1.807
Farming education	-0.003	7.254	10.936**
Inventory	0.565**	5.052*	8.718
Farming experience	-0.002	0.456	0.076
Off-farm income	-0.562**		
Rho 1 & 2	0.435***	-0.160	
Wald test Chi test	18.37		
LR Test	0.43		

*Rho is the covariance value of the stochastic disturbance in the outcome equation. *Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level.*

The endogenous switching regression coefficient term Rho_1 was positive and had a statistically significant value of 0.435, implying that access to household savings increased commercialisation activities. The coefficient term Rho_2 was not statistically significant, implying that farmers who did not access household savings were not as commercialised as those who accessed household savings.

a) Effect of credit on commercialisation

The Wald test was significant, indicating the presence of the endogeneity problem, thus justifying the use of the endogenous switching regression model. The selection equation showed that credit accessibility was endogenously affected by off-farm income and gender. Female-headed households accessed credit less than male-headed households. Access to credit was also influenced by heterogeneous factors that were not captured in the study, as seen in the significance of the Wald test. The negative and significant commercialisation determinant variables were household size and the regional location of the household.

Table 5.4: Endogenous switching regression results of credit, and effect on commercialisation

Variable	Selection	Commercialisation	
		Credit	No Credit
Constant	-1.085	20.927	56.034*
Household size	0.015	-0.689	-2.071***
Farm size (ha)	0.057	5.341**	1.631
Marital status	0.373	22.152**	3.198
Age	-0.029	-1.101	-0.723
Education	-0.164	13.511	0.579
Location	0.515	-37.405**	-24.633
Occupation	0.230	9.966	6.745
Hired labour	0.353	5.591	8.836
Membership	-0.184	29.578	22.767
Gender	0.544**	-1.364*	-1.413
Farming education	0.278	7.490	12.573*
Inventory	-0.274	5.717	8.836
Farming experience	-0.012	-0.213	0.076
Off-farm income	-0.471*		
Rho 1 & Rho 2	0.283**	0.392***	
Wald test Chi2	25.25**		
LR Test	0.61		

Rho is the covariance value of the stochastic disturbance in the outcome equation.

*Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level.

The endogenous switching regression results showed that credit was positively correlated with commercialisation, as indicated by the positive Rho values. However, both the coefficient terms Rho_1 and Rho_2 (0.283 and 0.392) were statistically significant at the 5% significance level. This implies that both credit-financed and non-credit-financed farmers were commercialised. Because both correlation coefficients were significant, we cannot conclude that credit had a significant effect on commercialisation. We can conclude, however, that smallholder farmers who accessed credit were not significantly different from those who did not access credit. These findings are supported by Annim and Frempong (2018), who found that accessing credit for consumption purposes did not lead to commercialisation advancement, assuming that part of the credit obtained was used for consumption. However, an energetic farmer is likely to be more productive; and in certain instances, credit obtained for consumption can lead to commercialisation.

For credit to have a positive impact, credit constraints must be minimised (Dong, et al., 2010). Other determinants of commercialisation were household size, marital status, location, and farming education. The negative and significant determinant variables were household size and location, while the positive and significant determinants were marital status, farm size, gender, and farm education.

b) Effect of off-farm income on commercialisation

Theoretically, depending on the endogenous and exogenous factors, off-farm income can affect commercialisation either positively or negatively (Nasir & Hundie, 2014). Considering the endogeneity effect, off-farm income was positively correlated with commercialisation, indicated by the positive and significant Rho_1 value of 0.369. The covariance estimate for farmers without off-farm income was insignificant, suggesting that there would be a significant difference in the average commercialisation between the two categories of farmers, caused by unobservable factors. We can conclude that farmers who earned off-farm income were likely to commercialise more than those who did not. Similar results were obtained by Woldenhanna and Oskam (2001), who showed positive correlations between commercialisation and off-farm income. However, the results depend on different factors: how much income is earned, expenditure on farm inputs, time spent on off-farm activities, and many more. The reason for the positive correlation was the better off-farm activities in which household members were engaged. Also, not all of the household members were engaged in off-farm activities at the same time; thus farming activities were not significantly affected.

Table 5.5: Endogenous switching regression results of off-farm income, and effect on commercialisation

Variable	Selection	Commercialisation	
		Off-farm income	No off-farm income
Constant	1.231	35.470	35.470
Household size	0.086**	-1.087	-0.841
Farm size (ha)	0.012	4.928**	3.406
Marital status	-0.063	12.268	2.770
Age	-0.988**	-0.976	-0.956
Education	0.309	4.049	12.024
Location	0.380	-10.961	-29.728
Occupation	0.476*	14.649**	0.787
Hired labour	0.161	2.035	13.111**
Membership	-0.411	3.654	22.075
Gender	0.771**	-13.126	1.549
Farming education	0.066	12.498**	8.971
Inventory	0.389	4.040	18.139*
Farming experience	0.005	-0.070	-0.306
Household savings	0.528*		
Credit	-0.549**		
Land ownership	1.002*		
Rho 1 & 2	0.369***	-0.087	
Wald Chi2 (13)	29.42***		
LR test Chi2 (1)	0.27		

Rho is the covariance value of the stochastic disturbance in the outcome equation.
*Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level.*

The results obtained are different from those obtained using the ANOVA test. The presence of endogeneity can significantly change results. This justifies the use of the endogeneity switching regression method. According to DAFF (2012), only 8% of smallholder farmers in South Africa rely entirely on agriculture. In Eswatini, more than 48% of smallholder farmers

tend to engage into non-agricultural activities to supplement their household income (Musi, et al., 2018).

 c) *Effect of insurance accessibility on commercialisation*

Smallholder farming is a risky business because of its over-dependence on rainfall. Insurance helps to mitigate the risks faced by smallholder farmers. In Eswatini, however, smallholder farmers are completely excluded from accessing agricultural insurance. Thus the results presented below were for different forms of insurance excluding agricultural insurance. The results obtained showed that the Wald test was not significant at 5%, but was significant at 10%, indicating the low presence of endogeneity.

Table 5.6: Endogenous switching regression results of insurance, and effect on commercialisation

Variable	Selection	Commercialisation	
		Insurance	No Insurance
Constant	-1.427	1.210	13.758
Household size	-0.373	-30.361**	-3.912
Farm size (ha)	0.014	-1.857	4.753***
Marital status	0.309	16.207	3.196
Age	0.002	0.160	0.381
Education	0.374	23.090	3.868
Location	-0.753	-44.945**	-16.348
Occupation	0.381	27.292**	9.103
Hired labour	-0.030	6.623	9.038
Membership	0.269	20.982	15.403
Gender	0.263	-15.675*	2.434
Farming education	0.164	3.395	15.499***
Inventory	-0.011	30.056***	-0.231
Farming experience	-0.005	0.144	-3.821
Rho 1 & 2	0.254**	-0.103	
Wald Chi2 (13)	21.82*		
LR test Chi2 (1)	0.06		

 Rho is the covariance value of the stochastic disturbance in the outcome equation.

*Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level.*

The results show that the commercialisation determinants were farm size, the location of the farmer, occupation, and farm education. However, only farm size was significant at the 5% significance level. The endogenous switching regression results show that insurance was positively correlated with commercialisation. The covariance term Rho_1 0.254 was significant, while Rho_2 -0.103 was not significant at the 5% significance level. This suggests that farmers who accessed insurance commercialised more than farmers who had not accessed insurance. On average, the commercialisation between the two categories of farmers was statistically different. The results for the preference to adopt agricultural insurance were correlated to insurance and other financial variables; thus the results could not be analysed.

5.2.2 Two-way analysis

Since independent financial instruments only weakly stimulated the commercialisation of Eswatini farmers, two-way analyses were conducted by combining the financial instruments. On average, the accessibility of the two-way financial instruments combination was influenced by different factors. The marital status of the household head positively influenced insurance accessibility, while the age of the household head negatively influenced it. The household's farm size positively influenced the accessibility of credit and savings (S, C). Household size and land ownership influenced the decision to access the financial combination of credit and off-farm income (C, O). Financial instruments also influenced the accessibility of other financial variables. For example, household savings influenced the decision to access the financial combination of insurance and off-farm income (I, O). The two-way endogenous switching regression results showed that the combinations of credit and off-farm income (C, O) and of insurance and off-farm income (I, O) were significant, but that they negatively affected commercialisation. These results suggest that, if farmers accessed a combination of credit and off-farm income (C, O) or off-farm income and insurance (I, O), their level of commercialisation would be negatively affected. The negative effect is due to the presence of farmers with off-farm income. As observed in the analysis of variance, off-farm income had a negative influence on the commercialisation of smallholder farmers. Kimhi (1999) obtained similar results using the endogenous switching regression in analysing off-farm workers' participation. However, farmers who accessed household savings and credit (S, C) finance were not significantly different from those who did not access household savings and credit (S, C). This is because the both coefficients Rho_1 and Rho_2 were significant at 10%. Thus we cannot conclude that (S, C) influenced the commercialisation decision of smallholder farmers, because even non-financed farmers were commercialised;

while smallholder farmers who accessed a combination of insurance and a preference to adopt agricultural insurance showed a significant and positive effect on commercialisation, as observed by the positive and significant Rho value of 0.159. The effect of the combination of the finance instruments of insurance and a preference to adopt agricultural insurance (I, A) had a positive and significant effect on commercialisation, as shown in Table 5.7. This implies that, although agricultural insurance was not accessible to smallholder farmers in Eswatini, it had quite a significant effect on stimulating the commercialisation activities of smallholder farmers.

Table 5.7: Endogenous switching regression results – two-way analysis

Variable	C,O	I,O	S,C	I,A
Constant	20.186	27.144	8.785	3.715
Household size	-1.824**	-1.993**	-1.488*	-1.120
Farm size (ha)	2.920*	2.317	3.350**	3.530
Marital status	10.923*	7.213	13.610	8.867
Age	0.186	0.259	0.337	0.338
Education	3.798	4.531	10.152*	14.724**
Location	-18.738	-13.796	-21.37	-29.052**
Occupation	8.738	7.625	10.152**	13.310**
Hired labour	2.675	4.324	5.169	6.585
Membership	14.981	12.070	15.365	18.638
Gender	1.120	-3.016	-2.816	-1.698
Farm education	15.68***	14.749**	8.287	6.762
Inventory	2.990	8.762	7.170	4.198
Farming experience	0.004	-0.130	-0.325	-0.042
Rho	-0.488	-0.656	0.195	0.159**

Rho is the covariance value of the stochastic disturbance in the outcome equation.

*Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level.

5.2.3 Three-way analysis

The endogenous switching regression three-way analysis used a combination of three financial instruments, as shown in Table 5.8. The results indicated that households that accessed a combination of savings, credit, and off-farm income (S, C, O) were not significantly commercialised than those that did not. The endogenous switching regression coefficient term Rho_1 -0.329 was negative and insignificant. These results mean that farmers who did not access the combination of savings, credit, and off-farm income were not more commercialised than those who did. Similar results were obtained in the analysis of the effect of savings, off-farm income, and insurance (S, O, I) on commercialisation. Farmers who accessed the combination of savings, off-farm income, and insurance were no less commercialised than those who did not. This is because the endogenous switching regression coefficient term Rho_1 -0.411 was negative and insignificant at 1%, while the coefficient term Rho_2 was positive and significant. All other combinations of three-way finance were insignificant at the 10% significance level, meaning that, as farmers obtained more financial instruments, their commercialisation levels dropped. This is an important finding for all relevant stakeholders. Another important finding is that farmers who did not access a combination of three financial instruments tend to be more commercialised.

Table 5.8: Endogenous switching regression results – three-way analysis

Variable	S,C,O	S.O.I	S,C,A	S,C,I
Constant	18.139	18.370	9.867	11.904
Household size	-1.536**	-1.601**	-1.400**	-1.051
Farm size (ha)	2.973**	2.181	3.186**	2.738*
Marital status	7.726	6.550	6.485	6.911
Age	0.201	0.239	0.493**	0.310
Education	7.178	8.896	8.685	14.910**
Location	-19.528	-15.798	-28.62**	-28.133**
Occupation	9.071	7.405	11.39**	10.453*
Hired labour	7.376	8.761	8.357	6.810
Membership	11.420	10.061	16.451	17.305
Gender	-0.001	-3.689	1.354	-4.101
Farm education	11.843**	9.903*	7.702	6.032
Inventory	2.662	5.037	3.889	5.234
Rho	-0.329	-0.411	-0.175	-0.209

Rho is the covariance value of the stochastic disturbance in the outcome equation.

*Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level.*

5.2.4 Effect of other factors on commercialisation

The commercialisation of smallholder farmers was also significantly influenced by other factors. These included household size, farm size, occupation, and farming education, as seen in Appendix Table A.2. The size of the household negatively influenced commercialisation activities, while farm size, occupation, and farming education positively affected the commercialisation decisions, implying that farmers with large household sizes are less likely to commercialise, while farmers with large farm sizes and farmers who received training are likely to be more commercialised. The results were expected, as the reviewed literature had shown that the marital status of the household head has a significant impact on smallholder farmers' access to finance (Odoh, et al., 2009). All of the three-way combination analysis was not significant at 10%.

5.4 Discussion

To avoid endogeneity bias, the analysis of the effect of finance on commercialisation required a consideration of endogeneity. The study analysed the effect of finance on commercialisation using 150 smallholder farmers in Eswatini. Its findings showed that endogeneity bias was a serious problem, as the results of the ANOVA were different from the endogeneity switching regression results. Other econometric models such as the ordinary least squares (OLS) and logit model in Table A.2 were used to compare the results and the adjusted R-squared was 0.2570. Other than the adjusted R-squared been low, the OLS and Logit models suffered from endogeneity bias. Thus estimation without considering the endogeneity bias yields inaccurate results. However, the use of simple econometric methods gave a guide to identifying what factors affected commercialisation.

Using the ANOVA, finance significantly influenced the commercialisation decision of smallholder farmers. In addition, the financed farmers had higher commercialisation levels than non-financed farmers. Financed farmers also engaged in off-farm activities more than non-financed farmers. On the other hand, off-farm activities negatively affected the commercialisation levels of smallholder farmers. The difference between the means showed that credit and household savings were significantly different between the financed and non-financed farmers. The results for off-farm income, an insurance policy, and a preference to adopt agricultural insurance were not significant. However, these results suffered from endogeneity bias.

Evaluating the effect of finance on commercialisation using the endogenous switching regression method confirmed that finance did indeed increase smallholder farmers' commercialisation. Other variables – household savings, off-farm income, and insurance – were significant, while credit was insignificant. This was not surprising, since smallholder farmers tend to divert agricultural credit and use it for consumption rather than investing in agricultural activities (Oboh & Ekpebu, 2011). The importance of accounting for endogeneity bias when studying the effect of finance on agricultural commercialisation cannot be over-emphasised (Dong, et al., 2010). This method has its own limitations, but it has given the best estimates so far. As observed in using the ANOVA method, credit was positive and significant, while off-farm income and insurance were insignificant. The endogenous switching regression method yielded different results. The difference in the results confirms the presence of endogeneity bias, accounted for by the endogenous switching regression (Kuntashula & Mungatana, 2013). The major cause could be that financed farmers were

already commercialised, and so were able to access finance easily. The other reason could be that non-commercialised farmers chose not to access finance.

The preference to adopt agricultural insurance was dependent on the environmental factors that farmers had experienced. Farmers who were faced with greater risks were more interested in purchasing agricultural insurance (Mbonane, 2018). This is a clear indication of why the preference to adopt agricultural insurance was not significant. However, when combined with an insurance policy, the combined variable was significant. When other financial instruments were combined, the results were insignificant. It is important, therefore, not to provide different financial services at the same time, as this affects farmers' commercialisation decisions.

Table 5.9: Summary of endogenous switching regression results

		Model completed	*Coefficient direction*	*Significance*
1-way	**Household Savings (S)**	**Yes**	**0.435****	**Yes**
	Credit (C)	**Yes**	**0.283**	**No**
	Off-farm income (O)	**Yes**	**0.369****	**Yes**
	Insurance policy (I)	**Yes**	**0.254****	**Yes**
	Agric insurance pref (A)	**No**	**0.106**	**No**
2-way	**SC**	**Yes**	**0.159**	**No**
	CO	**Yes**	**-0.488**	**No**
	IO	**Yes**	**-0.656**	**No**
	IA	**Yes**	**0.295****	**Yes**
3-way	**SCA**	**Yes**	**-0.175**	**No**
	SCI	**Yes**	**-0.209**	**No**
	SCO	**Yes**	**-0.329**	**No**
	SOI	**Yes**	**-0.411**	**No**

***Source: Own source.** *Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level.*

The study's findings show that finance alone was not enough to stimulate the commercialisation of smallholder farmers. Other characteristics were also necessary for finance to influence the commercialisation of smallholder farmers. One of the major

characteristics was access to sufficient land for maize production, which it needs for commercialisation to be achieved. With limited land, commercialisation activities become constrained (Von Braun, et al., 1991). However, with developments in technology, land size does not become a priority in commercialisation. Other factors, such as household size, labour, gender, and education, are equally important in the commercialisation of smallholder farmers. The significance of these other factors can be seen in the results presented in Table A.2.

5.5 Summary

This chapter presented the study's results and a discussion of them. The results showed that endogeneity can be a serious factor, and should not be ignored. The difference in the significance of the results for the ANOVA and the endogenous switching regression model proved that the study suffered from self-selection biasness and the endogeneity bias problem. A further summary of the results and the conclusion are presented in the next chapter.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

This chapter summarises the study by giving a summary, conclusion, limitations and recommendations.

6.1 Summary

The aim of the study was to establish the effect of finance on the commercialisation of smallholder farmers in Eswatini. The main objective of the study was achieved, together with the specific objectives. Understanding the effect of finance on commercialisation is important. This can help to improve the performance of the agricultural sector. Unfortunately, the study suffered from the endogeneity bias problem. To obtain more accurate results, the endogenous switching regression method was used.

Smallholder farmers in Africa, and specifically in Eswatini, are financially excluded; and this has affected the commercialisation of the agricultural sector. Policy-makers implement policies with little knowledge of their impact when they are implemented. Different policies are being implemented to help smallholder farmers to commercialise, but none have yielded positive results thus far. With more than half the population involved in the agricultural sector, the commercialisation of that sector can develop the economy of Eswatini, and the country as a whole.

In this study, different methods were used to analyse the results in order to reach a clear understanding. The ANOVA showed that only credit and household savings significantly affected the agricultural commercialisation of smallholder farmers. Other financial instruments, such as off-farm income and the preference to adopt agricultural insurance, negatively influenced the commercialisation of farmers. However, these results suffered from the endogeneity bias problem. This is because the commercialisation decisions of farmers can be influenced by other external factors that were not captured in the study. Also, these external factors can influence their decision to access finance.

The bivariate correlation analysis results in Appendix Table A.1 showed that commercialisation was significantly correlated with household savings only. The difference in the results proved that the iteration between finance and commercialisation was not strong enough. There was also a high possibility of the endogeneity bias problem between finance and commercialisation. Therefore, further analyses were conducted to determine the effect of finance on commercialisation, considering the endogeneity effect of the financial instruments.

The endogeneity switching regression model was used to explain the effect of finance on commercialisation. This method was first developed to solve labour economics problems due to endogeneity bias. The endogenous switching regression results showed slightly different results from those of the analysis of variance, the ordinary least square, the logit model, and the correlation analysis. After considering the endogeneity effect and the self-selection biasness, access to credit had no significant effect on commercialisation. Only household savings, insurance, and off-farm income were significant. Off-farm income, which was previously negative, had a positive effect when using the endogenous switching regression method, as shown in Table 5.9. Further analysis was conducted by combining the financial instruments. The results showed that only a combination of insurance policy and a preference to adopt agricultural insurance had the capacity to significantly improve the commercialisation of smallholder farmers. This implies that the provision of more financial instruments can reduce the commercialisation of smallholder farmers. If farmers simultaneously had to obtain credit, open a savings account, pay insurance policy premiums, and engage in off-farm activities to obtain additional income, their level of commercialisation would be negatively affected. Overall, the study proved that endogeneity bias can alter the results of the study, and should not be ignored.

6.2 Conclusions

The empirical analysis in this study showed that endogeneity and self-selection biasness can significantly impact the effect of finance on commercialisation. The most important discovery of this study was that, if endogeneity analysis is not considered, the results will be different and the effect parameters may be wrongly estimated. One important financial instrument that had different results was credit. Using the ANOVA, credit had a significant effect on agricultural commercialisation. Using the endogeneity switching regression method, credit was found to be insignificant. This was because of the endogeneity bias caused by other external factors that affected farmers' commercialisation and finance accessibility decisions.

The study managed to discover the relationship between finance and the commercialisation of smallholder farmers. The results obtained in this study suggested that finance significantly influenced commercialisation activities among smallholder farmers. The financial instruments that significantly affected commercialisation were household savings, insurance, and off-farm income. Thus increasing savings, insurance, and off-farm income would significantly increase the commercialisation of smallholder households. This simply means

that increasing finance can improve smallholder farmers' commercialisation activities. With increased agricultural commercialisation activities, Eswatini would potentially be food secure.

We cannot ignore other factors, such as climate change, farm education, farm size, and household size, which had an insignificant effect on commercialisation activities. There is the need for favourable climatic conditions, adequate farm training services, sufficient area for cultivation, and a household size that is proportional to the output. All of these, and many other factors not captured in the study but considered through the use of the endogeneity switching regression model, affect the finance and commercialisation of smallholder farmers. Further analysis would be required to analyse each variable critically; and this is a potential area for study.

6.3 Limitations of the study

The data used in this study came from only two regions of Eswatini, and was not country-wide because of limited resources and time. This resulted in the use of the purposive sampling method to represent the entire country; however, more accurate results could have been obtained if the sample size has been broader and wider. Due to the sampling technique and sample size used in the study, the results could have been slightly different from more accurate results.

Due to the collinearity of the variables, the endogenous switching regression model was unable to present some of the results. The model used the distribution of the error terms; but if the errors terms are not normally distributed, results cannot be obtained. This resulted in the selected financial instruments or combination of financial instrument not analysed.

6.4 Recommendations

The recommendations will guide policy-makers and relevant stakeholders on how the results obtained in this study can be useful. The recommendations below are based on the study's findings and the reviewed literature. The relevant stakeholders should take the recommendations into account when dealing with smallholder agricultural finance and commercialisation.

1. The study's findings proved that commercialisation can be achieved through an increase in the accessibility of finance for smallholder farmers. However, providing too many financial instruments and services at the same time can negatively affect the commercialisation of smallholder farmers. The government and other relevant stakeholders should provide household savings, insurance, or off-farm income services separately, or allow smallholder farmers to choose from the different financial instruments. In addition, the accessibility of finance should be accompanied by other services, possibly including farm training, providing markets for farmers, adequate areas for cultivation, and other support services. Thus investment in infrastructure, agricultural technology, and education must be the government's priorities. This is important, because finance alone does not significantly influence the commercialisation decisions of smallholder farmers.

2. Financial institutions must critically analyse the endogeneity aspect of smallholder farmers before disbursing loans and other financial services. As seen in the research findings, the autonomous behaviour of farmers can yield different results. Farmers are autonomous beings, and can make irrational decisions based on the environment or on household characteristics. Thus other factors, such as farm education, should not be ignored when offering financial services to smallholder farmers. Household size and farm size are also other significant factors to be monitored to achieve the commercialisation of smallholder farmers. Financial institutions should design their policies in such a way that the loan being disbursed is proportional to the farm size and household size. For finance to affect commercialisation positively, all of these – and many other factors – must be put in place.

3. Insurance and Preference to adopt agricultural insurance had significant effect on commercialization, and the combination was the only significant two-way combination variable in the analysis. This is despite the inaccessibility of agricultural insurance among smallholder farmers. Weber et al. (2016) showed that agricultural

insurance subsidies can drastically increase insurance adoption among smallholder farmers. Since agricultural insurance has the potential to improve commercialisation activities among smallholder farmers, subsidizing agricultural insurance could increase smallholder farmers' commercialisation. Smallholder farmers tend not to invest in agriculture due to high risks, and this affects their commercialisation potential. If the government subsidised agricultural insurance and ensured its accessibility, commercialisation would increase among smallholder farmers.

4. The study highlighted some of challenges faced by smallholder farmers, especially the inaccessibility of formal financial services. Formal financial institutions that have high liquidity can significantly improve the agricultural sector in Eswatini. They need to invest in the agricultural sector in order to improve financial inclusion. Access to formal financial services by smallholder farmers is very important for the economic development of the agriculture sector and of the country as a whole (Masuku, 2009). When a country has a well-developed financial sector that can support the agricultural sector, economic growth can result (Hlophe, 2018). Thus formal financial services need to be well-established in Eswatini.

APPENDIX A: List of Tables

Table A.1: Correlation values of commercialisation and determinant variables

	Commercialisation	Household savings	Credit	Insurance policy	Off-farm income	Agricultural insurance
Commercialisation	1.00					
Household savings	0.1701*	1.00				
Credit	0.1574	-0.0101	1.00			
Insurance policy	0.1003	0.0943	0.1173	1.00		
Off-farm income	-0.0691	0.1826*	-0.1834*	0.0535	1.00	
Pref. agricultural insurance	-0.0211	0.2241*	0.0094	-0.0705	0.0675	1.00

Source: Own source. *Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level

Table A. 2: Factors affecting commercialisation

Variable	OLS model	Logit model
Dependent variable:	Commercialisation	Commercialisation
Household size	-1.375**	-0.013
Farm size (ha)	3.869**	0.064***
Marital status: Married (=1, otherwise=0)	5.865	0.055
Age	0.255	0.005**
Education: Secondary/up = 1, below secondary = 0	6.109	0.056
Location (Lubombo= 1, Hhohho=0)	-25.400**	-0.118
Occupation (=1, Otherwise = 0)	8.185	0.141*
Inventory/ farm machinery	5.611	0.070
Hired labour	7.352	0.219***
Association membership	12.205	-0.121
Gender	-1.422	-0.128
Farming education	11.802**	0.203***
Household savings	7.902	0.146*
Credit	6.893	0.125
Insurance policy	1.476	0.082
Off-farm income	-3.566	-0.112
Agricultural insurance preference	3.859	0.033
Amount consumed	-0.630***	0.012***
R-squared	0.3467	
Adjusted R-squared	0.2570	

*Commercialisation as the dependent variable: *Significant at the 10% level; **Significant at the 5% level; ***Significant at the 1% level*

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