Key Factors Influencing Smallholder Market Participation in the Former Homelands of South Africa: Case Study of the Eastern Cape

By

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DECLARATION

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Date: December 2015

DEDICATION

I dedicate this master's thesis to my entire family and the Lujizweni No 5 Community at large, for moulding me into the man I am today. It was only through God's amazing Love and Grace that you were able to turn a dusty boy into something much more than just a Master's graduate.

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"For I know the plans I have for you, declares the Lord, plans to prosper you and not to harm you, plans to give you hope and a future" – Jeremiah 29:11 (NIV)

Thank you Lord God Almighty, for being my hope and strength and for blessing me with the ability to do the work!

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ABSTRACT

This study uses a double-hurdle (DH) model to examine the key factors influencing market participation decisions among maize-producing households in the former homelands of South Africa. In the first stage of the double-hurdle model, using data on South African rural maize growers, the decision whether or not to participate (binary variable) is used to estimate the maximum likelihood estimation (MLE), which is assumed to follow a probit model. In the second stage, the conditional quantity sold (continuous variable) is assumed to follow a truncated normal regression model, whereby the MLE is estimated by fitting a truncated normal regression into the quantity sold.

The results of the double-hurdle regression point specifically to five key factors that were found to have a positive statistical effect on rural smallholders' market participation decisions, and on the conditional quantity of maize they traded (viz. household size, land size, access to credit and government transfers for the first stage, which was estimated using the probit model, and age, education and employment status of the household head, use of tractor when cultivating, government transfers, quantity produced, market price, and own transport to the market for the second stage which was estimated using truncated normal regression).

Based on the findings highlighted above, it is recommended that the integration of rural smallholders as market participants cannot be achieved without effective policy interventions that create and sustain an enabling environment that encourages greater participation. This includes improving access to land and road infrastructure; providing extension services and making available relevant advice and information related to both production and marketing aspects; and enhancing the accessibility of both credit and production input.

Key words: *double-hurdle model, market participation, quantity sold, rural households*

OPSOMMING

Hierdie studie maak gebruik van die *dubbel-hekkie* (DH) model om die vernaamste faktore te ondersoek wat besluite oor markdeelname onder mielieproduserende huishoudings in die voormalige tuislande van Suid-Afrika beïnvloed. In die eerste stadium van die *double-hurdle* model, met gebruik van data oor landelike Suid-Afrikaanse mieliekwekers, is die besluit oor deelname of andersins (binêre veranderlike) gebruik om die maksimum-aanneemlikheidsberaming (*maximum likelihood estimation (MLE)*) te skat wat aanvaar word om op ’n probit-model te volg. In die tweede stadium is die voorwaardelike hoeveelheid verkoop (kontinue veranderlike) aanvaar om op ’n afgeknotte normale regressiemodel te volg, waardeur die MLE beraam word deur ’n afgeknotte normale regressie in die hoeveelheid verkoop te pas.

Die resultate van die *dubbel-hekkie* regressie dui spesifiek op vyf sleutelfaktore wat gevind is om ’n positiewe statistiese effek op landelike kleinboere se markdeelnamebesluite te hê, en op die voorwaardelike hoeveelheid van mielies wat hulle verhandel (naamlik grootte van die huishouding, grootte van die grond, toegang tot krediet en regeringsoordragte vir die eerste stadium, wat geskat is deur gebruik te maak van die probit-model, en ouderdom, opvoeding en indiensnemingstatus van die hoof van die huishouding, gebruik van trekker tydens bewerking, regeringsoordragte, hoeveelheid geproduseer, markprys en eie vervoer na die mark vir die tweede stadium, wat geskat is met afgeknotte normale regressie).

Gebaseer op die bevindings wat hierbo uitgelig is, word daar aangeraai dat die integrasie van landelike kleinboere as markdeelnemers nie moontlik is sonder doeltreffende beleidsingrypings wat ’n instaatstellende omgewing skep en onderhou wat groter deelname sal aanmoedig. Dit sluit in verbeterde toegang tot grond en pad-infrastruktuur; verskaffing van voorligtingdienste en relevante raad en inligting m.b.t. produksie- en bemarkingsaspekte; en die verbetering van toegang tot beide krediet en produksie-insette.

Sleutelwoorde: *dubbel-hekkie model, markdeelname, hoeveelheid verkoop, landelike huishoudings*

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KEY ABBREVIATIONS

DAFF	Department of Agriculture, Forestry and Fisheries
DEDEAT	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism
DH	Double Hurdle
DLA	Department of Land Affairs
EC	Eastern Cape
ECSECC	Eastern Cape Socio Economic Consultative Council
GAA	Group Areas Act
GDP	Gross Domestic Product
GHS	General Household Survey
GMOs	Genetically Modified Organisms
GVA	Gross Value Added
HH	Household
MLE	Maximum Likelihood Estimator
Stats SA	Statistics South Africa

1. INTRODUCTION

1.1. Context

In 2013, South Africa marked the centenary of the Natives Land Act No. 27 of 1913 which was aimed at regulating the acquisition of land by "natives"[1]. The Act which became law on 19 June 1913 defined certain portions of land in the country as native reserves[2] (also known as scheduled areas). These reserves which housed the majority of the African population were originally limited to some 6% of South Africa's land area. Outside the reserves, Africans owned a further 0.7% of the land and lived on another 3.6%, owned by the state or by European settlers— bringing the total land for their use to just over 10% (Mbongwa *et al*., 1996; Vink & van Zyl, 1998; Ngqangweni, 2000).

In 1936 when the Native Trust and Land Act No. 18 was passed a further 7% of land became theoretically available for occupation by Africans. As a result the land area occupied by black people (including the 6% originally allocated) was limited to 13% of the total country's land area on which more than 3.5 million people (approximately 80% of the country's population) resided and farmed[3]. On the other hand the white minority (approximately 20% of the country's population) was effectively left in control of the remaining majority (87%) of the country's commercial agricultural land (van Rooyen & Njobe-Mbali, 1996; Vink & Kirsten, 2003).

Furthermore, the Land Acts simultaneously placed certain restrictions on the buying or leasing of land by blacks and whites. Ultimately, the Acts decreed that a black person could only buy or lease land from other blacks, and conversely, a white person could only buy or lease land from other whites, unless the transaction was approved by the Governor General (Loveland, 1999).

Both the Land Act of 1913 and of 1936 had a profound effect on black people across South Africa. These laws effectively laid the foundation upon which other laws such as the Mines and Works Act of 1911 and the Native Labour Regulation Act of 1911, both of which were

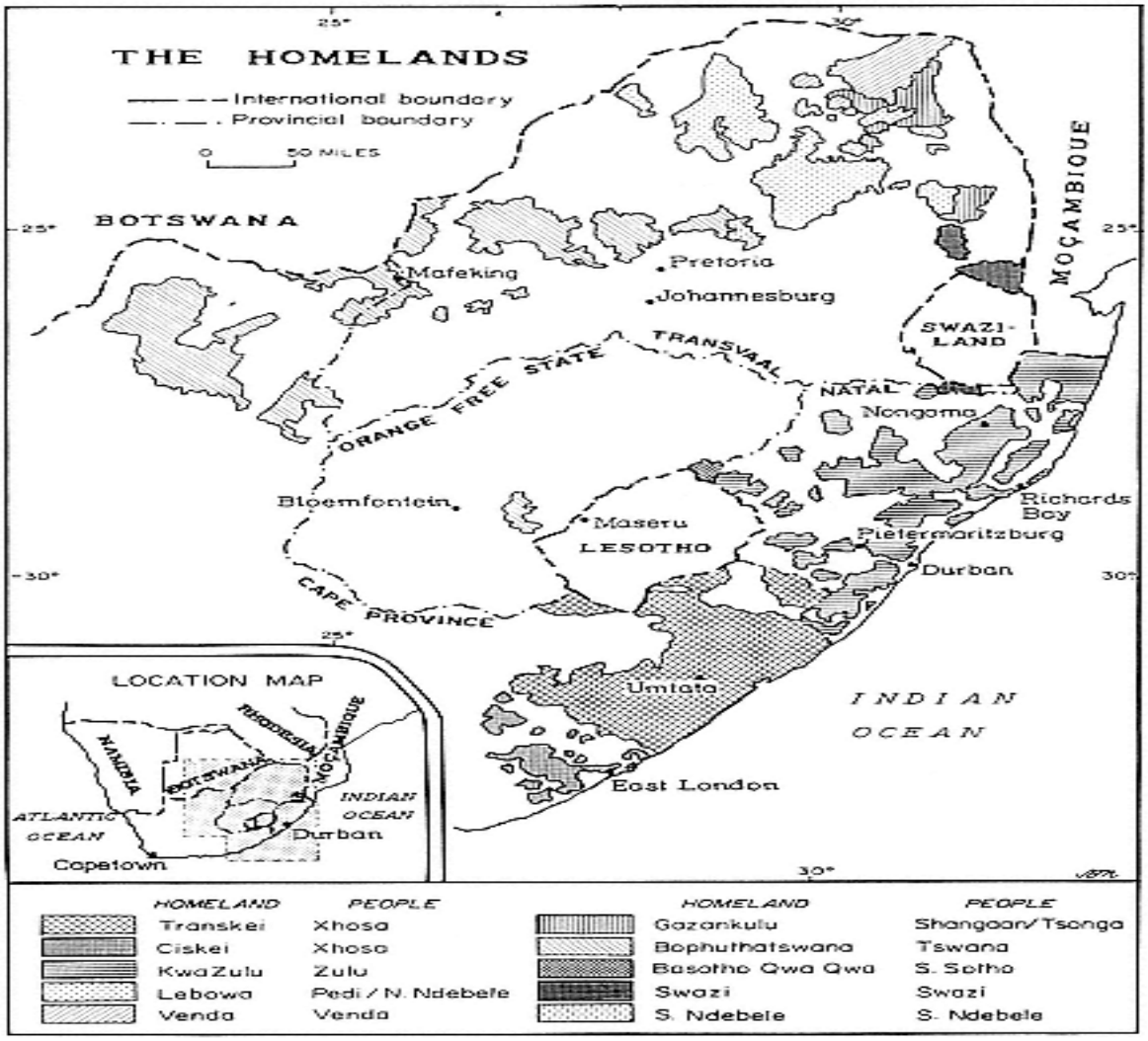
[1] See Vink & van Zyl (1998). The term then used to refer to black South Africans (also referred to as Africans).
[2] These were designated areas introduced by the Union government (after it was established in 1910) with the intention of segregating black South Africans from whites and to support white commercial farmers. For more detail see Vink & van Zyl (1998)
[3] South African History Online (Undated).

aimed at providing cheap labour for white enterprises (Wickens, 1981). This supported the supremacy of white agriculture and forced black farmers out of the farming business into the labour force that was required by the emerging mining sector (Ndibongo-Traub, 2002). Subsequently, all these laws resulted in devastating socio-economic consequences for the African population, whose survival had traditionally been dependent on land as their prime asset for agricultural purposes—this was and even today remains a detrimental impact of the Land Acts, particularly on black farming households, as black men were forced to become migrant workers, leaving behind their own farming practices and families to become workers on white farms and in the white-owned mining industry. The impact of this was evident in the production output of African farmers, which was estimated to have dropped to about 20% of total production and could not keep up with the growing population of the reserves since the implementation of the Land Act (Simkins, 1981; Ngqangweni, 2000). Prior to the implementation of the Land Acts and the other legislation that came with it, Africans pursued vibrant and sustainable agricultural activities and their output was enough for their subsistence and nutrition needs and to sell at markets (Bundy, 1979; Mbongwa *et al*., 1996; Vink & van Zyl, 1998; Ngqangweni, 2000).

1.2. The formation of the Homelands

In 1948, the then government of South Africa had focused much of its policy-making upon the political as well the social segregation of the country's black population. Under apartheid ideology introduced from 1948, government decided unilaterally that black people in South Africa consisted of various ethnic groups or "nations", each of which was bound to a national unit with boundaries that coincided with the reserve boundaries defined by the Land Acts (Vink & van Zyl, 1998). Employing the policy of apartheid the government created national units made of the Pedi, Sotho, Tsonga, Tswana, Venda, Xhosa, and Zulu ethnic groups through the Native Authorities Act of 1951 and the Promotion of Bantu Self-Government Act No. 46 of 1959 (Vink & Van Zyl, 1998). Ultimately, the government designated 10 rural areas as homelands[4]; namely Bophuthatswana, Ciskei, Gazankulu, KaNgwane, KwaNdebele, KwaZulu, Lebowa, Transkei, Qwaqwa and Venda as shown by the map below.

[4] Also known as 'Bantustans', the homelands were supposedly politically autonomous territories set aside for Africans and that were meant to provide the ideological justification for apartheid (South African History Online, Undated).



Map 1: The former Homelands of South Africa with their corresponding ethnic groups

Source: (Butler & Rotberg, 1978)

Each homeland was granted a certain measure of self-government and later independence. As a result, in 1963 Transkei became the first self-governing homeland, after which 9 other homelands followed (Vink & Van Zyl, 1998). The creation of Homelands in South Africa meant that Africans could only legally access land in rural areas under a system that required them to apply for permission to occupy land. This had further implications for Africans' agricultural development, as Africans were deprived of the right to use their lands as security against loans needed for further development. It is estimated that the ultimate size of the homelands was about 17 million hectares—this included the granted land under the Land Acts of 1913 and 1936 and other isolated areas of land occupied by blacks located outside the homelands (Vink & Van Zyl, 1998).

By the end of the 1980s, 86 million hectares of commercial farmland (87% of all farmland, or 68% of the total surface area) was in the hands of the white minority, who are responsible for 95% of agricultural production in South Africa (Vink & Kirsten, 2003; Lahiff, 2009). In contrast, the majority of the black population only had access to land in the former homelands which was poorly developed and lacked all the necessary infrastructure, where land rights did not exist and the system of land administration was in disarray in the hands of traditional authorities (Lahiff, 2009). The result of this is the current extreme inequalities in income and land distribution in the country.

It is against this backdrop that, at the end of the apartheid regime in 1994, the new South African government embarked on a comprehensive programme of urban and rural land reform designed to redress the imbalance in land holding and secure the land rights of historically disadvantaged people (Lahiff, 2009). The land reform policy was officially launched in April 1997 with the aim to redistribute 30% of white owned land to previous disadvantaged black people in order to ensure both equity (in terms of land access and ownership) and efficiency (in terms of improved land use), while contributing to the development of the rural (and ultimately the national) economy (DLA, 1997). The programme is carried out through three broad components: land redistribution,[5] land restitution[6] and land tenure[7].

While significant progress has been made in some aspects of the land reform programme in redressing the injustices and/or discriminatory practices of the past, there is widespread concern that the land reform programmes have not yet made a significant impact on either reducing the highly unequal distribution of land or on improving the livelihood and economic opportunities of the majority of the rural population (Thwala, 2010).

Since agriculture is considered the economic engine for rural growth and development, greater participation in the sector is needed by rural households, coupled with greater and sustainable productivity. Even though agriculture is important for rural households' livelihoods, agricultural performance by rural households has declined over the years. Only

[5] Aimed at changing the racially skewed land ownership patterns and reallocating land to the landless and emerging farmers for residential and agricultural development purposes.
[6] Aimed at restoring land rights to those dispossessed by the segregation created by the past discriminatory policies and legislation of forced removals in urban and rural areas.
[7] Aimed at securing and extending the land rights of those previously disadvantaged.

2.6 million rural households are involved in farming in South Africa, with the Eastern Cape being the province with the second most agricultural households (approximately 21% of agricultural households), after KwaZulu-Natal which has approximately 25% of agricultural households (DAFF, 2012; Stats SA, 2013). However, considering that the Eastern Cape is the second biggest and the third most populated province in South Africa, with more than 60% of its population residing in rural areas, 21% representation in agriculture is significantly low. One of the main reasons for this low representation is that rural smallholders are facing various challenges that constrain their growth and ability to farm effectively and produce marketable surpluses (DAFF, 2012). Some of the constraints they face relate to a lack of access to land, poor physical and institutional infrastructure, lack of assets, information and access to government services, and a lack of access to production inputs.

1.3. Objective of this Study

The main objective of this study was to determine the key factors that influence market participation and the quantity of maize sold among rural households in the former homelands of the Eastern Cape Province of South Africa. While it is widely acknowledged that there are a number of factors influencing market participation, and that some of those factors are not common to all households, in this study it was assumed that analysing all factors affecting the probability of market participation by an individual household was impractical. Therefore the focus throughout the study was only on those variables that were considered the key determining factors in the study area. These factors include household characteristics, household private assets and public services, and production and market conditions.

In the endeavour to achieve the objective of this study, it was hypothesized that household size, land size, household asset endowment, access to credit, government support services, quantity produced, market price and distance to market will all collectively influence households' market participation decisions and the quantity of maize they sell or buy. Lastly, to prove the stated hypothesis and achieve its objective, this study implemented a double-hurdle (DH) model, following on the work of Boughton *et al*. (2007), Barrett (2008) and Reyes *et al*. (2012). To achieve this objective, this study:

1. Provides an overview of the evolution of the land policy that led to the formation of the former homelands in South Africa.
2. Makes use of various data sources to provide an overview of the Eastern Cape and its demographics as the study area.
3. Implements a double-hurdle regression model to analyse key factors influencing market participation and the conditional quantity sold using the data of smallholder farmers collected from five maize-producing districts in the Eastern Cape. Implementing the double-hurdle model allowed for the estimation of whether or not to participate in the market following a probit model in the first stage, while the second stage was estimated by assuming a truncated normal distribution.
4. Uses the results obtained to recommend policy interventions that could to be used in policy formation and the implementation of agricultural development programmes that could lead to increased productivity and enhanced market participation by rural households.

1.4. Market Participation

A review of agricultural economics literature reveals that agricultural households can be classified into three categories based on their participation position in the market: net sellers, net buyers and autarkic (non-participants) (Goetz, 1992; Key *et al*., 2000; Boughton *et al*., 2007; Burke, 2009; Reyes *et al*., 2012). In this study, this classification is presented in the diagram below:

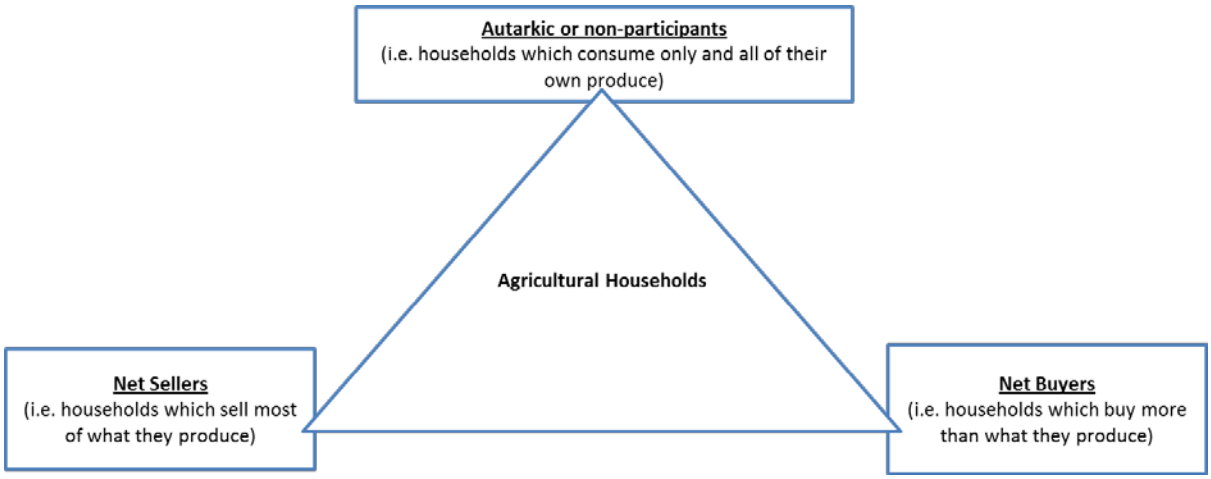


Figure 1: Classification of agricultural households according to their participation position

Source: Based on Goetz (1992), Key *et al*. (200), Boughton *et al*. (2007), Burke (2009) and Reyes *et al*., (2012)

Market participation holds considerable potential for unlocking the suitable opportunity sets necessary for providing better incomes and sustainable livelihoods for smallholder farmers (Omiti, et al., 2009). In addition, markets provide households the opportunity to benefit from trade, which means that they can sell their surplus and purchase goods and services as they need, according to their comparative advantage (Barrett, 2008). Lastly, market participation ensures that, as households' incomes increase, the demand for their goods and services also increases, hence enhancing their development (Boughton, et al., 2007).

While there seem to be significant benefits that can be derived from market participation, rural households appear to opt out of the markets (Barrett, 2008). According to Barrett (2008), who is often recognised for his work on the subject, the problem with market participation is that it is a consequence as much as a cause of development – farming households must have access to market prices, production technologies, adequate private and public goods and services, and physical and institutional infrastructure in order to produce a marketable surplus. The availability of these abovementioned key factors promotes higher productivity and production when entering the market, and likewise the lack thereof hampers participation and conditional production volumes when entering the market.

1.5. Outline of the Study

This study is divided into five chapters. In the first chapter, the context of the study is given, providing historical events that led to the creation of the homelands in South Africa. Further detailed discussion on this is continued in Chapter 2, where the historical background on land holdings, tribal rule and the land reform policy in South Africa, particularly in the Eastern Cape, is presented. The econometric model used in estimating the key factors affecting market participation and the conditional quantity sold is discussed in Chapter 3. Chapter 4 provides the results and interpretation of the regression analysis. Chapter 5 provides the conclusions and recommendations arising from the study.

2. THE STUDY AREA: EASTERN CAPE DEMOGRAPHICS AND ECONOMIC INDICATORS

This chapter provides the background to the Eastern Cape Province as study area. The chapter first provides the background overview of the province, highlighting its size, location and its various districts. In the second section, the chapter turns its focus on providing the province's demographics (population and household size). The third and the final section of this chapter concentrates on highlighting economic indicators of the province with a special focus on poverty, inequality and unemployment, education, economic performance, land tenure and land use. Various sources of data are used in the chapter to extract all relevant information. These source include the General Household Survey (GHS) (2012), which is conducted on regular basis by Statistics South Africa, the Eastern Cape Socio-Economic Review (2013) documented by the Department of Economic Development, Environment Affairs and Tourism, and the Eastern Cape's Development Indicators (2012) which is documented by the Eastern Cape Socio-economic Consultative Council.

2.1. Background

The Eastern Cape is the second largest province in South Africa, covering over 168 960 km^2 (approximately 13.5% of South Africa's land area), after the Northern Cape (with a land area of 372 889 km^2). It is located on the south-east of South Africa along the Indian Ocean seaboard, and houses two of the country's former homelands, Ciskei and Transkei. Both former homelands are characterised by high levels of poverty and unemployment, which may be linked directly to the historical economic neglect of these areas during the apartheid and colonial eras.

The province is divided into two metropolitan municipalities (the Nelson Mandela and Buffalo City metropolitans) and six district municipalities (namely Amatole, Alfred Nzo, Cacadu, Chris Hani, Joe Gqabi and OR Tambo district municipalities), as shown by the map below.

Map 2: The Eastern Cape with its two metropolitan municipalities and six district municipalities

Source: ECSECC (2012)

These districts are characterised by their rural nature, dispersed settlement patterns, high population figures, infrastructure and service backlogs and communal land ownership. Districts such as Cacadu are comprised of predominantly Karoo and coastal municipalities that are characterised by free hold land tenure, commercial farming, established tourism sectors and higher levels of infrastructure provision. Metropolitan Municipalities are the production centres of the province, with high concentrations of infrastructure and economic activity resulting in higher employment levels (DEDEAT, 2013).

2.2. Demographics: Population and households

According to the 2011 census, the Eastern Cape is home to an estimated population of 6.7 million, which is approximately 12.7% of South Africa's population. This makes the province the third most populated province after Gauteng and KwaZulu-Natal, which have populations of 12.2 million (23.7% of national) and 10.2 million (10.8% of national) respectively (DEDEAT, 2013). Of the Eastern Cape population, approximately 67% live in the former homelands (Stats SA, 2012). Approximately 885,500 people live in Amatole district, approximately 804,500 in Alfred Nzo district, approximately 457,340 in Cacadu district, approximately 794,670 in Chris Hani district, approximately 350,470 in Joe Gqabi and approximately 1,372,000 in OR Tambo district. Nelson Madndela and Buffalo City metropolitans have an estimated population size of approximately 1,165,445 and 760,704 people respectively (DEDEAT, 2013).

The population of the province is predominantly black. This is reflected in the number of black households, representing 88% of all households in the province in 2010, while in the same year, white and coloured households each represented approximately 6% of all households. The population of the province is relatively young, with 70% under the age of 34 years. This is the second most youthful population in the country, behind Limpopo Province which has 72% of its total population under the age of 34 years and above the national average of 65.7%. The Gauteng Province has the smallest proportion under the age of 34 with 59.1% (DEDEAT, 2013).

Population growth in the Eastern Cape has been growing relatively slowly but steadily. In 2010 the annual population grew by 0.2%, slower than the rest of the country's population growth of 1% in the same year (ECSECC, 2012). The slow population growth rate in the province is indicated in the average size of households which has shrunk by just over 1% since 2010 to 3.8 people per household in 2012 (DEDEAT, 2013). This is however in common with the rest of the country's growth rate of households' average size. In the early 2000s, the growth rate of households in the Eastern Cape was recorded around 2% (ECSECC, 2012). This is however, not the only reason for slow population growth in the province—migration to other provinces such Gauteng and Western is also a major cause.

2.3. Economic Indicators

2.2.1. Poverty, unemployment and migration

Poverty and unemployment in South Africa are often viewed as social phenomena that occur especially in rural provinces like the Eastern Cape (PROVIDE, 2005). Similar to the case in the rest of South Africa, poverty in the Eastern Cape is widespread and deeply entrenched in the former homeland areas. Due to South Africa's history of colonialism and apartheid, poverty in the former homelands is intergenerational and structured (Stats SA, 2012). Based on the survey conducted by the Eastern Cape Socio Economic Consultative Council (ECSECC) in 2012, inequality in South Africa worsened from a Gini coefficient of 0.68 in 2007 to 0.69 in 2010. In line with this, the Eastern Cape has also become more unequal, with a Gini coefficient that worsened from 0.636 in 2007 to 0.646 in 2010 (ECSECC, 2012).

According to the Living Conditions Survey 2008/2009, published by Statistics South Africa in 2012, the Eastern Cape is ranked as one the poorest provinces in South Africa. The results of the survey indicated that, between 2008 and 2009, about 26.3% of South Africa's population lived below the food poverty line of R305 per person per month[8] (Table 1). The results also indicated that the Eastern Cape was the second poorest province, with a poverty headcount of 37.7% after Limpopo, which reported a poverty headcount of approximately 48.5%. Notable amongst the poorest provinces, KwaZulu-Natal occupied third spot on the list, reporting a poverty headcounts of 33%, while the Western Cape and Gauteng recorded the lowest poverty headcounts of only 9% and 10.1% respectively (Stats SA, 2012).

Owing to its poverty status in the country, more than 30% of all households in the province receive social grants, making it the province with the widest coverage of social assistance in South Africa. Despite only accounting for approximately 13.5% of the national population, the Eastern Cape received an estimated 17.5% of all grants disbursed in 2010, with the two biggest types of grants disbursed being the Child Support Grant and the Old Age Grant (Hamann & Tuinder, 2012).

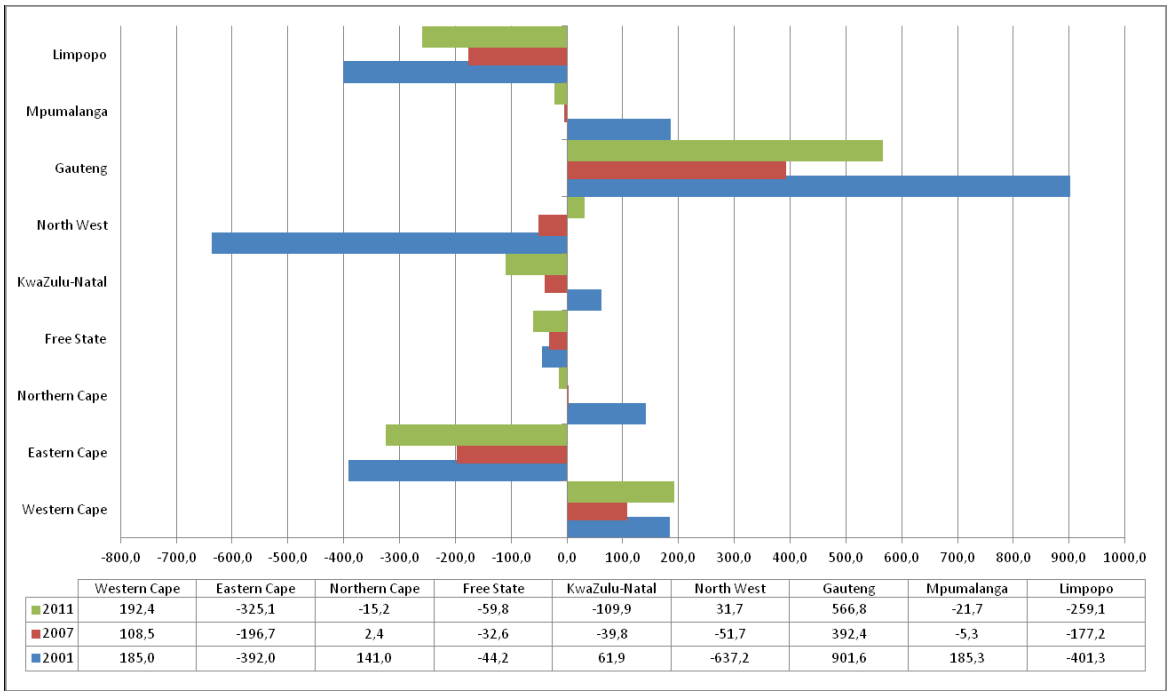
[8] This indicated a poverty gap of 8.5% under P1 and poverty severity of 3.8% under P2—these were determined using a food poverty line of R305.

Table 1: Poverty indicators by province

	Food poverty line (R305)		
Province	Poverty headcount (P_0)	Poverty gap (P_1)	Severity of poverty (P_2)
Eastern Cape	35.7	11.8	5.3
Free State	24.6	7.1	2.9
Gauteng	10.1	2.6	1.0
Limpopo	48.5	16.6	7.8
Mpumalanga	32.1	10.9	5.1
Northern Cape	26.0	7.9	3.3
North West	26.3	8.8	4.1
KwaZulu Natal	33.0	10.7	4.8
Western Cape	9.0	2.2	1.0
South Africa	**26.3**	**8.5**	**3.8**

Source of data: Stats SA (2012)

Due to the widespread poverty and high levels of unemployment in the province, many people, particularly young people, are leaving the province and migrating to other provinces in search of better employment opportunities. According to Stats (2012) through its 2001 Census, 2007 Community Survey and 2011 Census conducted, Gauteng remains the province attracting the highest number of migrants from other provinces. Figure 2 shows that, in 2011, Gauteng saw an inflow of 901 622 migrants from other provinces, followed by the Western Cape, with a gain of 192 401 people in the same year. On the other side, the Eastern Cape showed the biggest losses, with 325 078 people leaving the province in 2011 to the most industrialised provinces of Gauteng and the Western Cape for better opportunities (Stats SA, 2012).

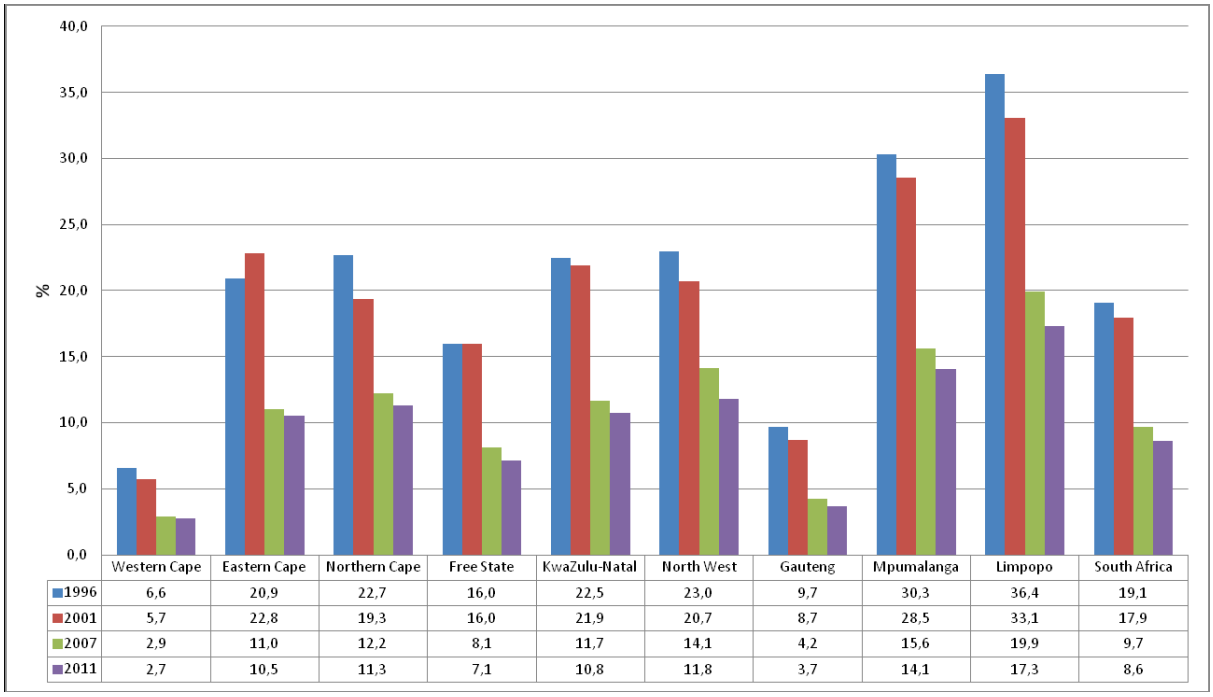


	Western Cape	Eastern Cape	Northern Cape	Free State	KwaZulu-Natal	North West	Gauteng	Mpumalanga	Limpopo
2011	192,4	-325,1	-15,2	-59,8	-109,9	31,7	566,8	-21,7	-259,1
2007	108,5	-196,7	2,4	-32,6	-39,8	-51,7	392,4	-5,3	-177,2
2001	185,0	-392,0	141,0	-44,2	61,9	-637,2	901,6	185,3	-401,3

Figure 1: Net migration in thousands from Census 2001 and 2011 and Community Survey 2007
Source: Stats SA (2012)

2.2.2. Education levels

Figure 3 shows the percentage of people with no formal education in all the provinces of South Africa from 1996 to 2011. The graph shows that the Western Cape has the lowest proportion of people with no formal education in all the years, with only 2.7% in 2011, followed by Gauteng and the Free State at 3.7% and 7.1% respectively. Limpopo has the highest proportion of people with no formal education, with 17.3%, followed by Mpumalanga and North West with 14.1% and 11.8% respectively. The Eastern Cape showed a steady decrease in the number of people with no formal education over the period 1996 to 2011. In 1996, 20.9% of the people in the Eastern Cape had no formal education, and this number had decreased to 10.5% in 2011 (Stats SA, 2012).



	Western Cape	Eastern Cape	Northern Cape	Free State	KwaZulu-Natal	North West	Gauteng	Mpumalanga	Limpopo	South Africa
1996	6,6	20,9	22,7	16,0	22,5	23,0	9,7	30,3	36,4	19,1
2001	5,7	22,8	19,3	16,0	21,9	20,7	8,7	28,5	33,1	17,9
2007	2,9	11,0	12,2	8,1	11,7	14,1	4,2	15,6	19,9	9,7
2011	2,7	10,5	11,3	7,1	10,8	11,8	3,7	14,1	17,3	8,6

Figure 2: Level of education by province
Source: Stats SA (2012)

2.2.3. Economic Performance

The Eastern Cape, like the rest of South Africa, has a dual economy, with both developed and underdeveloped regions. There are two urban industrial manufacturing centres (the Nelson Mandela Bay and Buffalo City metropolitans), which house first-world components, while the rural hinterland, particularly in the former homeland areas of Ciskei and Transkei, is characterised by poverty and is generally underdeveloped.

The economy of the Eastern Cape is strongly driven by the tertiary sector. Overall, the tertiary sector accounted for approximately 77% of the provincial gross domestic product (GDP) in 2011 (DEDEAT, 2013). However, the province contributes only 2.7% to the county's GDP, despite comprising approximately 13.5% of the population (DEDEAT, 2013). This is due to fact that the Eastern Cape has a strong rural character—with a large proportion of the population living in rural areas, and only about a third living in towns. In contrast to the rest of South Africa, a significant percentage of households in the province are involved in some form of farming, which forms part of the primary sector. However, in most cases the farming activity is not an important source of income for the households; rather, they engage in farm production to supplement their income from other sources, hence the economy of the Eastern Cape makes a smaller contribution of the primary sector. Although

the primary sector is the smallest sector in all district municipalities, agriculture remains the largest activity and the primary driver within the primary sector (DEDEAT, 2013). Table 2 shows the share of per capita gross value added (GVA) accrued to the primary sector and other sectors between 2002 and 2011 across all district municipalities in the Eastern Cape.

Table 2: Sectoral contribution to province's GDP

Sectors	2002	2011	% Point Change
Primary Sector	2.7	2.2	-0.5
Agriculture, forestry and fisheries	2.5	2.1	-0.5
Mining and quarrying	0.2	0.1	-0.1
Secondary Sector	22.3	21.2	-1.2
Manufacturing	19.6	17.5	-2.2
Electricity, gas and water	1.1	1.1	0.0
Construction	1.6	2.6	1.1
Tertiary Sector	75.0	76.7	1.7
Wholesale and retail trade	14.5	13.8	-0.7
Transport, storage , and communication	8.8	8.9	0.1
Finance, real estate and business services	20.1	22.4	2.4
Personal services	10.2	10.3	0.1
General government services	21.5	21.2	-0.2
All industries at basic prices	**100**	**100**	

Source: DEDEAT (2013)

2.2.4. Land tenure and access

The passing of the Land Acts changed the landscape of South Africa and its far reaching impacts can be seen in the development of the Eastern Cape. Access to land, its use in economic activities and the ownership thereof is an essential component of economic development. At present there are two land tenure systems in use within the Eastern Cape: The formal system of title deeds and transfer of ownership and a second system referred to as an 'off register' system under communal tenure (DEDEAT, 2013).

The former Ciskei and Transkei areas are considered off register. The Land Administration system for off-register land rights collapsed post-1994 due to changes in the constitution and institutional restructuring and is currently executed on an informal basis outside of approved and dedicated national and provincial organisational structures. The collapse of the land administration system within these areas affects aspects of land use planning and

economic development, as it impacts on the legal issuing of land rights, issuing of land use rights, recording of land rights and maintenance and storage of original and current records of land rights. Complex or uncertain land ownership systems discourage investment, small business development and exclude the majority of the Eastern Cape's residents from using land as an economic asset, thus excluding them from participating in the economy. This creates problems that are escalating in their complexity as years pass and the Land Administration system within these areas becomes more informal and more difficult to bring back into a system of Land Administration. The system is now largely governed by informal or ad hoc land allocations and is administered by officials who are either outside the formal government establishment, or who perform these functions outside of their formal responsibilities (DEDEAT, 2013). The impact of this form of land tenure is seen in how significant increases in built up areas have occurred in the last ten years due to unmanaged settlement sprawl. Land that as it appears in the records or on a map should be unoccupied and available for agriculture or other development is occupied with human settlements, reducing the amount of land available for economic activities (DEDEAT, 2013).

2.2.5. Land use

The dominant land use in most of the Eastern Cape is grazing, along with dryland agriculture in the eastern section of the province (Hamann & Tuinder, 2012). Agriculture in the province is dominated by intensive beef and fruit farming in the south-western parts, and subsistence farming (mainly of livestock and maize) in the northern-eastern regions. The Karoo region is limited to sheep farming, while other areas are suitable for chicory, pineapples, citrus, deciduous fruit and tea.

Furthermore, given the vast tract of land available[9] and climatic conditions that are favourable for agriculture, it is estimated that the Eastern Cape has the potential to produce 1,2 million tons of maize per annum (ECDC, 2015). In a good year, Eastern Cape-based maize millers purchase 15 000 tonnes of maize grain and between 80% and 90% of this is sourced outside the province (Tregurtha, 2009). According to Tregurtha (2009) if maize could be produced in the Eastern Cape and delivered to local millers at below the cost of intra-provincial imports, maize meal prices for local consumers may be reduced – bearing in mind that maize is a dominant staple commodity in the Eastern Cape and other rural parts of

[9] According to ECDC (2015) the provincial government plans to avail about 460 000 hectares of land for crop production.

South Africa. In turn, this essentially could reduce poverty in the province, since the ultra-poor in most of South Africa spend more than 50% of their monthly income on food (Tregurtha, 2009). According to the findings of Ndibongo-Traub (2002), these ultra-poor households spend about 16% to 20% of their income on maize meal.

3. METHODOLOGY

This chapter provides the theoretical framework that forms the basis of the economic model, followed by an explanation of the economic rationale for analysing households' marketing decisions and, lastly, presents the econometric model used to empirically test the study's hypothesis.

3.1. Theoretical Framework

The concepts of comparative advantage and gains from trade[10] are perhaps the most significant contribution to economic theory, in that they provide the rationale that underlies an individual household, firm or nation's decisions to participate in markets (Barrett, 2008). Through specialization and trade, markets provide households the opportunity to benefit from trade (Barrett, 2008; Reyes *et al*., 2012). However, despite the theoretical view of positive gains from trade, empirical evidence (Broughton *et al*., 2007; Barrett, 2008) indicates the lack of market participation by the majority of rural agricultural households in Africa.

There are a number of reasons why market participation is not seen widely amongst rural households. In general, factors such as market prices, production technologies, adequate private and public goods and services, physical infrastructure (i.e. the infrastructure that allows households to access the markets, e.g. roads, transport, extension services, etc.), as well as institutional infrastructure (e.g. property rights or land ownership) all play a critical role in influencing rural households' decisions to either trade or remain self-sufficient (Barrett, 2008). The reality is that households that face higher market prices, and have access to production technologies, private and public goods and/or services, and adequate physical and institutional infrastructure, are more likely to produce more marketable surpluses and thereby increase disposable income (Boughton *et al*., 2007; Barrett, 2008).

The objective of this study was to empirically determine the key factors that influence rural smallholders' market participation behaviour, with a focus on staple crops (maize in particular) in the Eastern Province of South Africa. To achieve this objective, an idealized,

[10] These were first developed in the 19th century by David Ricardo, following Adam Smith's seminal work, *The Wealth of Nations*.

non-separable[11] household model of market participation behaviour was developed (Boughton *et al*., 2007; Barrett, 2008; Reyes *et al*., 2012). One of the key features[12] of this model is that market access is not assumed to be uniform, as households may face different transaction costs in relation to market participation and thereby self-select out of markets (Barrett, 2008).

Under this model, it is assumed that households maximise their utility, *U*, by consuming a vector of agricultural commodities ($\boldsymbol{C_c}$) for *c* crops, and a Hicksian composite of other tradable goods and/or services (**X**). This utility is constrained by income (***Y***), derived from the sales of any or all crops, and from off-farm income. Here, the production of each crop is associated with a crop-specific production technology ($f_c(A_c,G)$), which is a function of privately held quasi-fixed (i.e. non-tradable) production assets such as land, labour, machinery and other production inputs ($\mathbf{A}_c$), as well as the availability of public goods and services, such as roads, extension services, property rights, etc. (**G**). The farming household chooses whether or not to participate in the markets as a seller ($\boldsymbol{M_{cs}}$) or as a buyer ($\boldsymbol{M_{cb}}$). When a farmer enters the market as a seller, the vector M_{cs} takes the value of 1, and 0 if otherwise. Likewise, if the household elects to enter the market as a buyer, the vector M_{cb} takes the value 1 for every crop bought and 0 otherwise[13]. Net sales of a particular crop, $NS_c \equiv f_c(A_c,G) - C_c$, are positive if and only if $M_{cs} = 1$ (i.e. if the household elects to enter the markets as a seller), and negative if and only if $M_{cb} = 1$ (i.e. if the household elects to enter the markets as a buyer).

The household's choice therefore can be represented by the following optimisation problem (Reyes *et al*., 2012):

$$U_{max}\, f(C_c, x) \qquad (1)$$

[11] This implies that production decisions are made as if the household was maximising profits, while consumption decisions are made as if the household was maximising utility (i.e. production and consumption behaviours are estimated simultaneously).

[12] The other features relates to the geographically differential integration of markets into the global economy because of spatial differences in costs of commerce. For more insight, refer to Barrett's (2008) article (page 301).

[13] As highlighted in Broughton *et al*. (2007), Barrett (2008), Burke (2009) and Reyes (2012), households will not both buy and sell the same crop in this simple, one-period model, because of the price wedge created by transactions costs, which means that, at any optimum, there exists a complementary slackness condition, $M_{cb} * M_{cs} = 0$.

subject to the income constraint (Reyes, et al., 2012)

$$Y - p_x x + \sum_{c=1}^{c} [p_c^*(M_{cs} + M_{cb})(f_c(A_c, G) - C_c)] = 0 \quad (2)$$

and the nontradables' availability constraints

$$A = \sum_{c=1}^{c} A_C \qquad (3)$$

$$f_c(A_c, G) \geq C_c\,(1 - M_{cb}) \text{ for c } = 1, 2, 3, \ldots, \text{C} \quad (4)$$

As such, the households face a parametric market price, p_{cm}, which is affected by crop- and household-specific transaction costs per unit sold, $\tau_c(A, G, Y, Z, NS_c)$. As highlighted by Boughton *et al*. (2007), Barrett (2008) and Reyes *et al*. (2012), transaction costs are assumed to be a function of households' productive assets (*A),* access to public goods and services (G), liquidity from off-farm income (*W)*, household-specific characteristics (e.g. education levels, gender, age) – represented by the vector *Z*, and net sales volumes – indicated by *NS*. Each household-specific crop price is determined by the following household net market positions (Broughton *et al*. 2007; Reyes *et al*., 2012):

$$p_c * = p_{cm} + \tau_c(A, G, W, Z, NS_c) \;\; if \; M_{cb} = 1 \; (i.e. net \; buyer) \quad (5)$$

$$p_c * = p_{cm} - \tau_c\,(A, G, W, Z, NS_c) \;\; if \; M_{cs} = 1 \; (i.e. net \; seller) \quad (6)$$

$$p_c * = \; p_a \qquad\qquad if \; M_{cb} = M_{cs} = 0 \; (i.e. aurtarkic) \quad (7)$$

where p_a is the autarkic (i.e. non-tradable) shadow price that equates household supply and demand. Here, each household-specific crop price is determined by the household's net market position. The second equilibrium condition for non-tradables implies that, if the household does not purchase crop *c* (i.e. $M_{cb} = 0$), production must be greater than or equal to the quantity of crop *c* consumed (may be a net seller) and, if the household does purchase crop *c* (i.e. $M_{cb} = 1$), production must be greater than or equal to zero (may produce crop *c*, or not; regardless of which the household is a net buyer) (Reyes *et al*., 2012).

To solve the optimisation problem, it is essential that households find the optimal (C_c, X, A_c,) choices and the associated utility level conditional on the feasible combination of M_{cs} and M_{cb}, then choose the market participation vector that yields the maximum utility (Barrett, 2008; Reyes *et al*., 2012).

3.2. Empirical Framework

In the literature, empirical studies on market participation have focused largely on agricultural households engaging in the production of high-value cash crops, livestock or dairy[14]. In contrast, research focusing on smallholder market participation with respect to staple commodities is thin, with only two papers cited (Goetz, 1992; Key *et al*., 2000). Although both these papers analyse households' participation in staple commodity markets, the approach in which they model participation decisions is distinctly different.

For example, Goetz (1992), in his study of rural agricultural households from South-East Senegal, separated the households' discrete decision of whether to participate in the coarse grain[15] market from their continuous decision of how much to sell or buy conditional on participation. In order to do this, Goetz used a selectivity model[16] that allowed him to first estimate the probability that a household would enter into the selling or buying state as a function of its decision. To perform this estimate, he postulated a reduced form, with the following specifications:

$$b_i^* = \gamma_1' z_{1i} + \xi_{1i} \quad where \;\; b_i = 1 \;\; if \; b_i^* > 0 \; or \; i \in B \; and \; 0 \; otherwise; \; (8)$$

$$s_i^* = \gamma_2' z_{2i} + \xi_{2i} \quad where \;\; s_i = 1 \;\; if \; s_i^* > 0 \; or \; i \in S \; and \; 0 \; otherwise. \; (9)$$

where b_i^* is a probability state of buying, s_i^* is a probability state of selling, B represents the buying state, S represents the selling state, and z_i represents a set of explanatory variables,

[14] For example, Dolan and Humphrey, (2000) analysed the trade linkages between producers and exporters of fresh vegetables in Kenya and Zimbabwe and UK supermarkets; Humphrey *et al*. (2004) examined participation in horticultural exports from Africa to the United Kingdom, focusing on value chain governance and the extent to which the outcomes achieved through vertical coordination could be obtained through the further development of grades, standards and certification; Minot and Ngigi (2004) analysed the fruit and vegetable exports from Côte d'Ivoire and Kenya; MacPeak (2004) studied livestock sales decisions made by pastoral nomads in northern Kenya; Barrett et al. (2006) while Bellemare and Barrett (2006), and later Burke (2009) studied livestock and dairy in Ethiopia and Kenya.

[15] No specification as to what type of grain .

[16] According to Goetz (1992), a selectivity model endogenously switches households into alternative market participation states, correcting for bias caused by the exclusion of unobserved variables affecting both the discrete and continuous decisions.

which include factors such as coarse grain prices, prices of substitute goods, equipment ownership, number of persons in a household, age variable, and access to information, road, transport, etc. The independent variable, b_i^*, must be greater than zero if b_i is equal to one, i.e. if the household is in the buying state (buyer). Likewise, the independent variable, s_i^*, must be greater than zero if s_i is equal to one, i.e. if the household is in the selling state (seller).

In the second stage, Goetz (1992) estimated a switching regression model of purchase/sales behaviour allowing for households to select themselves into buying and/or selling states, which was postulated as follows:

$$\text{State } i \in B\text{: } q_i = \beta_1' x_{1i}^q + \varepsilon_{1i} \;\; \forall \delta' z_i \geq -\xi_i \quad (10)$$

$$\text{State } i \in S\text{: } q_i = \beta_2' x_{2i}^q + \varepsilon_{2i} \;\; \forall \delta' z_i \geq -\xi_i \quad (11)$$

Here, when the household (i) is a buyer (B) or a seller (S), q_i represents the quantity bought or sold, conditional on a vector of explanatory variables[17] x_i^q.

The results[18] suggest that factors other than relative output price changes stimulated marketed surpluses in Senegal. For instance, market information significantly raised the probability of market participation by selling households, while access to coarse grain-processing technology significantly increased quantities transacted by both sellers and buyers, conditional on participation.

While Goetz (1992) estimated a selectivity model (which allowed for the identification of the role of proportional transactions costs in household market participation) with sequential market participation and volume decisions, Key *et al*. (2000) used an alternate approach to tackle market participation. Using data from smallholder corn producers in Mexico they estimated the structural model with a simultaneous decision on market participation and production level. This approach allowed them to separately identify the role of proportional and fixed transaction costs in the household supply decision and test separately for the importance of these transactions costs in the estimation.

[17]According to Goetz (1992), these variables in principle are the same as those affecting the decision of whether to participate in the market as a buyer or seller.
[18] See Goetz (1992) for detailed results.

For the empirical analysis, Key *et al*. (2000) assumed linear expressions for the supply functions and the PTCs, as follows:

Where p is the decision price of the good considered, q is produced quantity, Z_q is the exogenous shifter in production, t_p^s represents the unobservable difference between the market price (p^m) and the price received by the household, while t_p^b represents the unobservable difference between the price paid by households and the market price (p^m). Z_t^s and Z_t^b represents the variables explaining selling and buying transactions costs for net seller and net buyers respectively.

$$q(p, Z_q) = p\beta_m + Z_q\beta_q \qquad (12)$$

$$t_p^s = -Z_t^s\beta_p^s \quad (13)$$

And

$$t_p^b = -Z_t^b\beta_p^b \quad (14)$$

This leads to linear expressions for the supply by sellers, q^s, and by buyers, q^b:

$$q^s = p^m\beta_m + Z_t^s\beta_p^s + Z_q\beta_q \quad (15)$$

And

$$q^b = p^m\beta_m + Z_t^b\beta_p^b + Z_q\beta_q \quad (16)$$

For the autarkic households, supply is a function of the unobserved lost opportunity for non-market participation, hence, Key *et al*. (2000) postulated the following linear approximation of autarkic level q^a as:

$$q^a = Z_q\beta_q^a + Z_c\beta_c^a \quad (17)$$

where Z_c, the exogenous shifter in consumption, now includes Z_u, T and A (the exogenous shifter in utility, the exogenous transfer of other incomes and an endowment in goods considered respectively) to simplify notation.

Key *et al*. (2000) also used a linear expression for the production threshold levels q^s and q^b:

$$q^s = Z_t^s \boldsymbol{\alpha}_t^s + Z_q \boldsymbol{\alpha}_q^s + Z_c \boldsymbol{\alpha}_c^s \quad (18)$$

And

$$q^b = Z_t^b \boldsymbol{\alpha}_t^b + Z_q \boldsymbol{\alpha}_q^b + Z_c \boldsymbol{\alpha}_c^b \quad (19)$$

For econometric specification, which was obtained by adding error terms to the three supply equations and the two production threshold equations and defining the market participation regimes, Key *et al*. (2000) postulated the following equations, in which q^{s*} is the latent supply if the household is a seller; when q^{s*} was higher than the threshold for market participation, it was observed that $q^{b*}$and q^{a*} were defined similarly. (Makhura, et al., 2001)

$$q^{s*} = p^m \beta_m + Z_t^s \beta_t^s + Z_q \beta_q + u_1 \quad (20)$$

$$\equiv Z_1 \beta_1 + u_1 \quad (21)$$

$$q^s = Z_t^s \alpha_t^s + Z_q \boldsymbol{\alpha}_q^s + Z_c \alpha_c^s + u_2 \quad (22)$$

$$\equiv Z_2 \beta_2 + u_2 \quad (23)$$

$$q^{b*} = p^m \beta_m + Z_t^b \beta_t^b + Z_q \beta_q + u_3 \quad (24)$$

$$\equiv Z_3 \beta_3 + u_3 \quad (25)$$

$$q^s = Z_t^b \alpha_t^b + Z_q \alpha_q^b + Z_c \alpha_c^b + u_3 \quad (26)$$

$$\equiv Z_4 \beta_4 + u_4 \quad (27)$$

$$q^{a*} = Z_q \beta_q^a + Z_c \beta_c^a + u_5 \equiv Z_5 \beta_5 + u_5 \quad (28)$$

The results[19] of the model indicate that both types of transaction costs play a significant role in explaining household behaviour, with proportional transaction costs being more important in the selling rather than in the buying decisions.

[19] See Key *et al*. (2000) for detailed results.

While the analyses in the two previously discussed papers (Goetz, 1992; Key *et al*., 2000) used different approaches to whether households make sequential participation and volume decisions, or if they make these decisions simultaneously, a second branch of market participation studies[20] combined the sequential approach of Goetz (1992) and the simultaneous approach of Key *et al*. (2000).

For example, Bellemare and Barrett (2006) developed an ordered probit model that allows for the consideration of buyers and sellers of livestock separately by first segregating producers into buyers, autarkic and sellers. Since these three categories are logically ordered, and since it is informative to distinguish between net buyers and net sellers, rather than to just lump them together as "market participants", Bellemare and Barrett (2006) first estimated an ordered probit participation decision (using maximum likelihood estimation), and then, in the second stage, estimated a truncated normal regression of net sales or net purchase volume (using Heckiman's two-step approach[21]).

The specification of Bellemare and Barrett's ordered probit model is as follows:

First stage: Ordered probit

$$(y_{1i} = 0) \quad \text{for a net buyer} \quad (29)$$

$$(y_{1i} = 1) \quad \text{for autarkic} \quad (30)$$

$$(y_{1i} = 2) \quad \text{for a net seller} \quad (31)$$

where y_{1i} denotes the category of net buyer, autarkic or net seller to which household *i* belongs. As explained earlier, the specification of the first-stage decision is that of an ordered probit.

Second stage: Truncated normal regression

$$y_{2i} > 0 \quad \text{for the total units of livestock purchased by household } i \quad (32)$$

$$y_{3i} > 0 \quad \text{for the total units of livestock sold by household } i \quad 33)$$

[20] Bellemare and Barrett (2006), Burke (2009), and later Reyes et al. (2012)
[21] For a more detailed explanation, see Heckman (1979)

Bellemare and Barrett (2006) used panel data of 337 pastoralist households from eleven sites in the arid and semi-arid lands of northern Kenya and southern Ethiopia. Each household was observed quarterly between June 2000 and June 2002. All nine time periods were pooled together and the dataset was treated as a cross-section, first because of the highly unbalanced nature of the panel, and second due to the inherent complexity that an extension of the ordered probit to a panel setting would involve[22].

The figure below illustrates Bellemare and Barrett's ordered probit model for household market participation decisions.

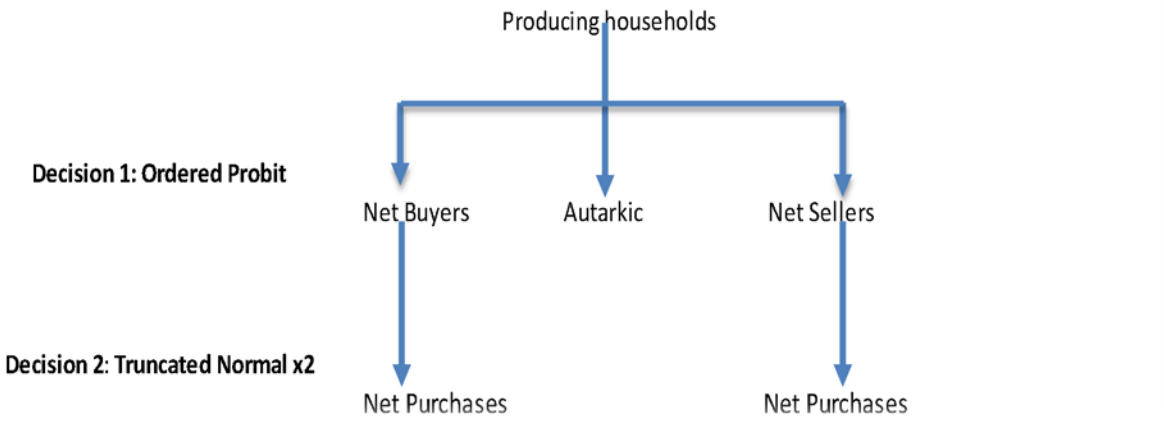


Figure 4: Graphical representation of Bellemare and Barrett's two-tiered market participation model

Source: Burke (2009)

By testing the correlation between the first and second stages, Bellemare and Barrett (2006) established whether decisions on participation and the degree of participation (i.e. quantities bought and sold) were made sequentially or simultaneously in the livestock market of Kenya and Ethiopia.

The results[23] indicated that fixed costs of market participation and the complex property rights in animals that accompany the cultural livestock gifting and lending institution impede market participation.

Bellemare and Barrett (2006) offer a general two-stage or double-hurdle model and corresponding econometric method that enables testing between the sequential approach

[22] The number of observations per time period ranged from 233 to 255, and not necessarily when ordered from last to first period.

[23] See Bellemare and Barrett (2006) for detailed results.

postulated by Goetz (1992) and the simultaneous approach postulated by Key et al. (2000). Following on the work of these authors, Burke (2009) in his analysis of Kenya's daily market from Kenya he added an additional stage of analysis to the the two-stage model postulated by the previously mentioned authors, resulting in a three-stage, or triple-hurdle, model.

Using a nationally representative sample, Burke (2009) first distinguished producers from non-producers using probit analysis in the first stage, based on the following specifications, where y_1 represents the level of milk, and w_1 is a binary indicator function:

$$w_1 = 1[y_1 > 0] \quad (34)$$

$$w_1 = 0[y_1 = 0] \quad (35)$$

In the second stage, similar to the first stage of Bellemare and Barrett (2006), Burke (2009) used an ordered probit to identify factors within producing households that determine whether they are net buyers, autarkic households, or net sellers. Finally, in the third stage, the determinants of buyer and seller quantities are identified in separated log-normal regressions, which are appropriate given the truncated nature of the dependent variables.

$$Pr(w_1 = 1|\ x_1, \Upsilon) = \Phi(x_1, \Upsilon) \quad (36$$

$$Pr(w_1 = 0|\ x_1, \Upsilon) = 1 - \Phi(x_1, \Upsilon) \quad (37)$$

Here, Φ is the standard normal cumulative distribution function, x_1 are the independent variables thought to determine production, and Υ is a vector of parameters to be estimated.

In the second stage, similar to the first stage of Bellemare and Barrett (2006), Burke (2009) used an ordered probit to identify factors within producing households that determined whether they were net buyers, autarkic households, or net sellers, following the specification:

$$w_2 = 0[y_1 - y_2 < 0] \quad (38)$$

$$w_2 = 1[y_1 - y_2 = 0] \quad (39)$$

$$w_2 = 2[y_1 - y_2 > 0] \quad (40)$$

where y_2 is defined as the level of milk consumption, and w_2 is the ordered indicator function. According to Burke (2009), $w_2$is zero for producing households that are net buyers

of milk, w_2 is one for autarkic producing households, and w_2 is two for producing households that are net sellers of milk. Then, following the ordered probit model, Burke (2009) defined the latent variable:

$$w_2^* = x_2\,\beta + e \qquad e|\ x_2 \sim Normal\ (0,1) \quad (41)$$

$$w_2 = 0 \qquad \text{if} \quad w_2^* < \alpha_1 \quad (42)$$

$$w_2 = 1 \qquad \text{if} \quad \alpha_1 < w_2^* < \alpha_{12} \quad (43)$$

$$w_2 = 2 \qquad \text{if} \quad w_2^* > \alpha_1 \quad (44)$$

Then, letting x_2 be the independent variables explaining market participation:

$$Pr(w_2 = 0|\ x_2, \alpha, \beta) = Pr(w_2^* \leq \alpha_1 |\ x_2) = \Phi(\alpha_1 - x_2\beta) \quad (45)$$

$$Pr(w_2 = 1|\ x_2, \alpha, \beta) = \Phi(\alpha_2 - x_2\beta) - \Phi(\alpha_1 - x_2\beta) \quad (46)$$

$$Pr(w_2 = 2|\ x_2, \alpha, \beta) = 1 - \Phi(\alpha_2 -|\ x_2\beta) \quad (47$$

Thus, the distribution of w_2 is the ordered probit:

$$f(w_2 |\ x_2) = [\Phi(\alpha_1 - x_2\beta)]^{1[w_2=0]}[\Phi(\alpha_2 - x_2\beta) - \Phi(\alpha_1 - x_2\beta)]^{1[w_2=1]}[1 - \Phi(\alpha_2 - x_2\beta)]^{1[w_2=2]} \quad (48)$$

Finally, in the third stage, Burke estimated a log-normal regression model to identify the determinants of buyer and seller quantities. By defining y_3 as the net purchases for net buyers, while y_4 is the net sales for the net sellers, Burke specified the following mathematical conditions:

$$y_3 = y_2 - y_1, \text{if } y_2 > y_1, \text{and is undefined otherwise} \quad (49)$$

$$y_4 = y_1 - y_2, \text{if } y_1 > y_2, \text{and is undefined otherwise} \quad (50)$$

As stated above, each of these random variables is assumed to be log-normal, so, letting x_3 be the independent variables explaining net purchases, and x_4 those explaining net sales, the individual distribution of each can be written:

$$f(y_3 \mid x_3, \delta_3) = \phi[\{\log(y_3) - x_3\delta_3\}/\sigma_3\}]/(x_3\sigma_3) \quad (51)$$

$$f(y_4 \mid x_4, \delta_4) = \phi[\{\log(y_4) - x_4\delta_4\}/\sigma_4\}]/(x_4\sigma_4) \quad (52)$$

where ϕ is the standard normal probability density function.

The results[24] indicate that there is unexploited potential for smallholder income generation in the dairy market. First, it seems that farm households are more likely to engage in dairy production and marketing in areas where rainfall (and thus crop incomes) are less reliable. Technical education is also an important determinant at every stage of the decision process, from production to sales volume, among net sellers, which could provide a policy lever for raising national production. Among producers, the use of improved technologies such as grade cows and zero-grazing feeding notably increases the probability of being a net seller and having higher net sales volumes, with all coefficients significant at the 1% level in the latter stages of the model.

In a more recent study, which also contributed to expanding the thin literature on staple commodity market participation, Reyes *et al*. (2012) used a double-hurdle regression analysis to estimate the factors influencing marketing decisions among potato growers in the central highlands of Angola. According to Reyes *et al*. (2012), the model was used to identify the determinants of market participation and quantity of potatoes sold, focusing on the effect of gender of the household head, transaction costs and productive asset endowments on marketing behaviour, following mostly on the work of Bellemare and Barrett (2006). Reyes *et al*. (2012) implemented a double-hurdle regression approach and the unconditional (on market participation) average partial effects for the quantity of potatoes sold. In the model, the decision of whether to sell a crop (a binary variable) was used to estimate the maximum likelihood estimator (MLE) of the first hurdle, which followed a probit model[25]. In the second hurdle, the continuous variable of quantity traded followed a truncated normal distribution.

The data used in this study came from the cross-sectional household- and village-level survey implemented by World Vision's ProRenda project in Angola in 2009. The survey was

[24] For the detailed results of this study, see Burke (2009).

[25] The model is called truncated because the distribution of *y* is truncated at zero to guarantee non-negativity (Cragg, 1971)

implemented in three provinces of the central highlands of Angola: Huambo, Bie and Bengela. These provinces were chosen because they have the most productive lands within the highland because of good rainfall distribution and environmental conditions. The survey included a total of 656 households across 40 communities. The households were selected using a clustering sampling methodology. This means that the villages were selected first; then, within those villages, households were selected. While the villages were selected systematically using probability proportional to size, the households were classified into four categories (based on gender of household head and participation in farmer organisation) and, within each category, a random systematic sample of households was selected.

The household-level survey collected information about households' socioeconomic characteristics, productive and non-productive assets, participation in farmer organisations, and production and marketing information on beans, potatoes, onions, carrots and cabbages. The village-level survey collected information regarding the distance between the village and the main commercial town, the availability of public services (e.g. telephones, electricity, banks, health clinics, local markets) and public transportation, and the quality of the road between the village and the main commercial town. The independent variables included in the regressions were classified into five categories: (1) household characteristics, (2) private assets, (3) public assets and quasi-fixed factors, (4) production- and marketing-related variables, and (5) squared and interaction terms (Reyes *et al*., 2012).

The double results[26] of the hurdle regression suggest that (1) male-headed households were more likely to sell potatoes, (2) owning productive assets and having access to government extension services, conditional on market participation, positively affected the quantity sold, (3) transaction costs, conditional on market participation, negatively affected the quantity sold, and (4) quantity produced was a marginally significant positive factor in both the likelihood of selling potatoes and the quantity sold. In contrast, the unconditional average partial effects suggest that (1) potato sales were gender neutral, (2) owning productive assets had no statistical effect on quantity sold, (3) transaction costs negatively affected the quantity sold, and (4) having access to extension services and the quantity produced both positively affected the quantity sold.

[26] See Reyes *et al*. (2012) for details.

The studies discussed above all have significant relevance to the current study. They provide a basis or foundation – an overall framework – for where this study fits into the limited literature on household market participation in Africa. First, this thesis focuses on maize, because it is a very important and common staple commodity amongst rural household in the former homelands of South Africa[27]. This therefore is the first contribution of the study, as it gives an indication of into which branch of household market participation this study fits. Secondly, not ignoring the effect of transaction costs on smallholder market participation that other authors focused on, the focus of this study is mainly on the effect of key factors[28] affecting rural households' market participation decisions.

Of particular relevance to this study is the work by Bellemare and Barrett (2006). As already discussed, Bellemare and Barrett (2006) developed a two-stage econometric method that allowed them to test whether rural households in developing countries make market participation and volume decisions simultaneously or sequentially. However, in contrast to Bellemare and Barrett, whose analysis of participation focused on high-value products, this study focuses on a staple commodity, but follows the same rationale as used by Bellemare and Barrett (2006). Furthermore, this study implements a double-hurdle model[29], similar to that of Reyes *et al*. (2012), which makes it possible to test whether rural households in the former homelands of South Africa make market participation and volume decisions simultaneously or sequentially.

3.3. Econometric Estimation

As mentioned before, the purpose of this study was to determine the key determining factors that influence market participation decisions and quantity of maize sold amongst rural households. In order to achieve this objective, a double-hurdle model, which allows for variation in the explanatory variables affecting market participation versus volume sold, was utilised (Reyes *et al*., 2012). Under this approach, the first hurdle estimates the decision of

[27] This indicates that this study fits into the staple commodity literature of market participation.
[28] Household characteristics, production assets, government support, production and market conditions.
[29] Also known as two-tiered model, proposed by Gragg (1971). Like all two-stage models, this model also requires all observations to be producers, hence allowing researchers to focus on staple crops and on sub-population producers.

whether or not to participate in the market (i.e. to sell or buy a crop) and, conditional on that decision, the second hurdle estimates the quantity traded (i.e. quantity sold).

In implementing the double-hurdle model, this study follows the work of Reyes *et al*. (2012)[30]. In the first stage, the focus was strictly on maize-producing households and their decisions on whether or not to participate in the market. The decision to participate (a binary variable), denoted by y_{1i} (subscript $1\ and\ i$, indicating the first stage and a particular household respectively), is dependent on the household characteristics **H** (gender of the HH head, age of the HH head, education of the household head, size of HH, employment status of the HH head); household assets **A** (land size, land tenureship, use a tractor, own a bakkie, own mobile phone, access to electricity, access to credit); the form of government intervention, **G** (extension services, government transfers); marketing conditions **M** (selling price, quantity purchased, purchasing price, point of sale, distance to the market, transport to the market, road condition, co-op membership); and production conditions **p** (labour, use of fertiliser, use of GMO seeds, water supply). This relationship can be summarised by the following equation, where ε is the error term;

$$y_{1i} = \int (H, A, G, M, p) + \varepsilon \qquad (53)$$

$$0 \leq \int(z) \leq 1 \qquad (54)$$

Given the above equation, this study assumed that it follows a normal probability distribution, where $\int$(z) falls between 0 and 1. In this case, the farmer faces two hurdles while deciding whether or not to participate in the market and, conditional on the decision to participate, the second hurdle estimates the quantity sold (Reyes *et al*., 2012). Since the $\int$(z) is assumed not to follow linear probability distribution, linear regression was not considered appropriate for the tool to explain market participation. As mentioned above, the best alternative to the linear regression model, which is usually used to estimate ordinary least squares (OLS), is to implement the double hurdle, where the first stage of the decision on whether to sell is used to estimate the maximum likelihood estimator (MLE), which is assumed to follow a probit model. Using the MLE allows for the assumption that $\int$(z) is normally distributed and non-linear (Wooldridge, 2009).

[30] They implemented a DH model to determine market participation and sale of potatoes by smallholder farmers in the central highlands of Angola.

$$\mathrm{P}(y_{1i} = 1/x_{1i}) = f(H, A, G, M, P) \qquad (55)$$

$$\begin{aligned}\mathrm{P}(y_{1i} = 1/x_{1i} = f(\beta_0 + \beta_{Gender} + \beta_{Age} + \beta_{Edu} + \boldsymbol{\pi}_{HH\ size} + \beta_{Emploment\ status} \\ + \alpha_{Land\ size} + \alpha_{Tractor} + \alpha_{Bakkie} + \alpha_{Mobile\ phone} + \alpha_{Electricity} + \alpha_{Credit} \\ + \delta_{Extension} + \delta_{Govern\ Transfers} + \mu_{Selling\ price} + \mu_{Quntity\ purch} \\ + \mu_{Purch\ price} + \mu_{Point\ of\ sale} + \mu_{Distance\ to\ market} + \mu_{Transport} \\ + \mu_{Road\ conditio} + \mu_{Coop\ membership} + \rho_{Labour} + \rho_{Fertilizer} + \rho_{GMO\ seeds} \\ + \rho_{Water\ supply}) \qquad (56)\end{aligned}$$

To derive the reduced form of the above equation, the process is as follows, where Φ is the standard cumulative distribution function, $\beta, \alpha, \delta, \mu, \rho$ are parameters to be estimated:

$$\Pr(y_{1i} = 1/x_{1i}) = \Phi(x_{1i}\beta, x_{1i}\alpha, x_{1i}\delta, x_{1i}\rho), for\ participant\ or\ seller \qquad (57)$$

$$\Pr(y_{1i} = 0/x_{1i}) = 1 - \Phi(x_{1i}\beta, x_{1i}\alpha, x_{1i}\delta, x_{1i}\rho), for\ \ non - participant \qquad (58)$$

As already mentioned, the probit model in this study was estimated using MLE. By definition, maximum likelihood estimation is the method of estimation applied where the parameter estimates $\beta, \alpha, \delta, \mu\ and\ \rho$ are chosen to maximise the log-likelihood function (Wooldridge, 2009). Since the maximum likelihood estimation is based on the distribution of the dependent variable y (participation in this case) given the explanatory variable x, the heteroscedasticity[31] in $Var\ (y|x)$ is automatically accounted for (Wooldridge, 2009). To obtain the maximum likelihood estimator, the following likelihood function (denoted by L) is constructed:

$$\begin{aligned}L(y_{1i}|x_{1i}; \beta) = [\Phi(x_{1i}\beta, x_{1i}\alpha, x_{1i}\delta, x_{1i}\rho)]^{y_{1i}}[1 - \Phi(x_{1i}\beta, x_{1i}\alpha, x_{1i}\delta, x_{1i}\rho)]^{1-y_{1i}}, y_{1i} \\ = 0,1, \qquad (59)\end{aligned}$$

From the above equation it can easily be noted that, when y_{1i} = 1, $\Phi(x_{1i}\beta, x_{1i}\alpha, x_{1i}\delta, x_{1i}\rho)$ is obtained and, when y_{1i}= 0, $1 - \Phi(x_{1i}\beta, x_{1i}\alpha, x_{1i}\delta, x_{1i}\rho)$ is obtained[32].

Letting $\log(L)$ denote the log-likelihood function of the probit model and observation i be a function of the parameters and data $(y_{1i}|x_{1i})$, which is obtained by taking the log summation of equation (60):

[31] According to Wooldridge (2009), this is the term used to describe the variances if the error term, given the explanatory variables, is not constant.
[32] See details in Wooldridge (2009, p. 579).

$$\log(L) = \sum_{i=1}^{n} \{y_{1i} log[\Phi(x_{1i}\beta, x_{1i}\alpha, x_{1i}\delta, x_{1i}\rho)] + (1 - y_{1i}) log[1 - \Phi(x_{1i}\beta, x_{1i}\alpha, x_{1i}\delta, x_{1i}\rho)]\} \qquad (60)$$

It should be noted that, since Φ is strictly between zero and one for a binary model like probit, $\log(L)$ is well defined for all values of β, meaning that the function is strictly concave (Wooldridge, 2009). In general, it can be proven that the MLE is consistent and also the most efficient estimator of the probit model, given some regularity conditions such as correctly specifying a parametric model, an identified β and a log-likelihood function that is continuous in β (Wooldridge, 2009).

In the second stage, the focus is on the quantity sold. Letting Q_{2i} (subscript $2\ and\ i$ indicating the second stage and a particular household respectively) be the continuous variable explaining the proportion of quantity traded, where q_b and q_s, which are defined as net purchases (quantity bought) and net sales (quantity sold) respectively. It must be noted that, as this is mainly about the quantity sold by participants, represented by equation (61), the quantity bought by non-participants is explored only for interests' sake.

$$Q_{2i} = q_b - q_s, if\ q_b > q_s\ non - participants \qquad (61)$$

$$Q_{2i} = q_s - q_b, if\ q_s > q_b\ participants \qquad (62)$$

The quantity traded is assumed to follow a truncated normal distribution. Therefore, the MLE is obtained by fitting a truncated normal regression model to the quantity traded (Cragg, 1971; Burke, 2009; Reyes *et al.*, 2012). Although it might be true that the probability of market participation and the analysis of quantity traded, conditional on market participation, could be determined by different factors, as highlighted by Burke (2009), when one focuses on grain production it is obvious to assume that some factors influencing the decision to participate in the market could also affect the extent of participation. In this case, such factors include household characteristics **H** (gender of the HH head, age of the HH head, education of the household head, size of HH, employment status of the HH head); household assets **A** (land size, tractor, access to credit); form of government intervention **G** (extension services, government transfers); marketing conditions **M** (quantity, produce purchased, purchasing price, distance to the market, transport to the market); and

production conditions **p** (labour, use of fertiliser, use of GMO seeds). The estimation specification equations therefore are as follows:

$$Q_{2i} = x_{2b}\beta + x_{2b}\alpha + x_{2b}\delta + x_{2b}\mu + x_{2b}\rho + \varepsilon \qquad (63)$$

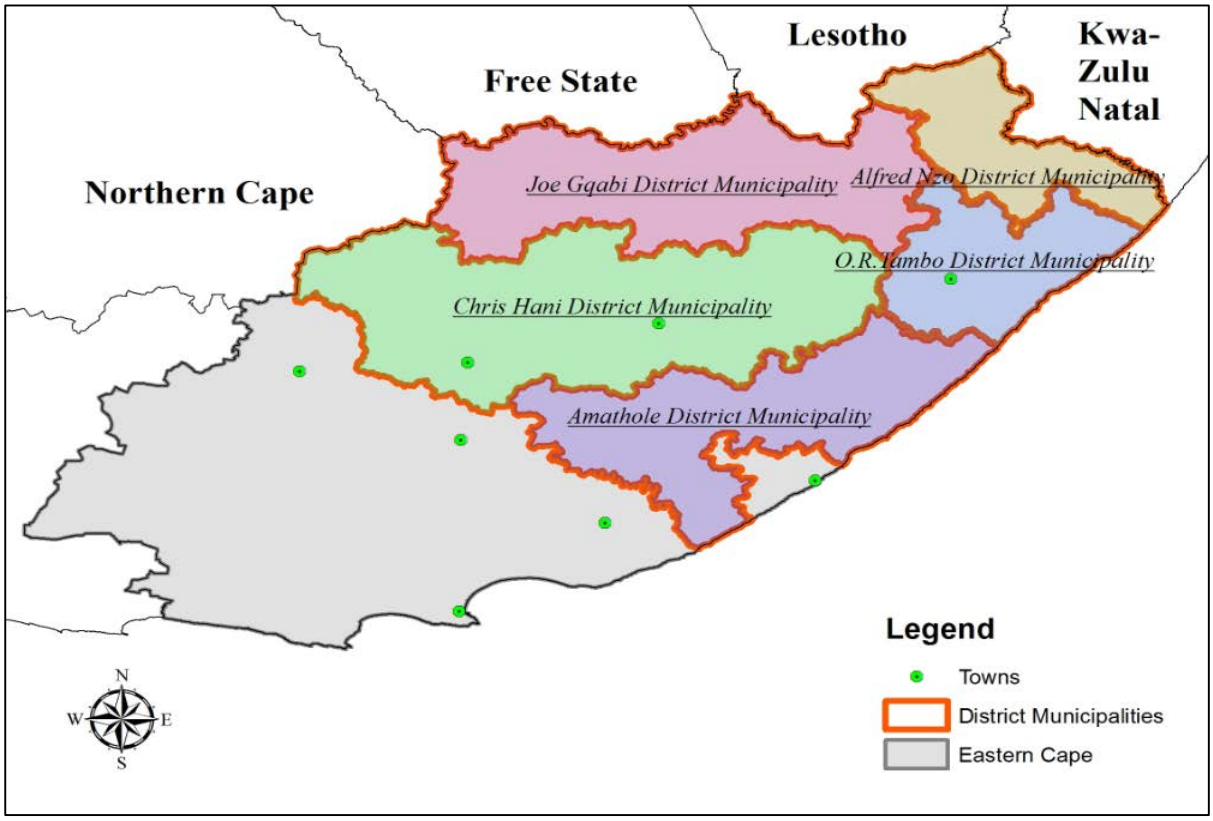
And

$$Q_{2i} = x_{2s}\beta + x_{2s}\alpha + x_{2s}\delta + x_{2s}\mu + x_{2s}\rho + \varepsilon \qquad (64)$$

where parameters $\beta, \alpha, \delta, \mu \; and \; \rho$ are identical to those in the first stage, x_{2b} defines the independent variables explaining net purchases, and x_{2s} defines those explaining net sales.

3.4. Data

The study uses cross-sectional data that was collected by using questionnaires. The data was obtained from five of the six district municipalities in the Eastern Cape province, being Amathole, Alfred Nzo, Chris Hani, Joe Ngqabi and OR Tambo district municipalities (see Map 2 below). Cacadu district municipality, the sixth district municipality making up the province, was not included in the study because it has limited grain production compared to the aforementioned districts (Stats SA, 2012).



Map 2: The districts where the survey was conducted.

The survey included a total of 68 smallholder maize-farming households that were randomly selected to participate in the study. The survey was limited to farmers' responses and, due to time constraints, only a limited number of households could be surveyed. Although the sample size of 68 observations is significantly smaller than that of similar international studies (e.g. Goetz, 1992; Bellemare & Barrett, 2006; Burke, 2009; Reyes *et al*., 2012), because of the uniqueness of study this was considered a fair representation of the Eastern Cape households that were actively participating in small-scale grain farming.

In addition, as mentioned in the previous section, this study selected MLE as a tool to estimate participation decisions and quantity sold or purchased. Although the statistical properties of maximum likelihood estimators and conventional wisdom collectively suggest that sample size should be important both to estimation and inference, other research fields routinely report models examining samples of 50 or fewer (Hart & Clark, 1999)[33]. In fact, Hart and Clark (1999) argue that there is no clear indication in the literature with regard to what constitutes an adequate sample size and how to avoid sample size-related problems. Based on this argument, the sample size presented in this study was considered sufficient.

Similar to Goetz (1992), Barrett (2008) and Reyes *et al*. (2012), the independent variables included in this study's econometric estimation were classified into five categories, as follows: (1) household characteristics (gender of the household head, age of the household head, education of the household head, household size, household head employment status); (2) household/private assets (land size, land tenureship, tractor use, bakkie ownership, mobile phone ownership, access to electricity, access to credit); (3) government support (extension services, government transfers); (4) marketing conditions (selling price, quantity purchased, purchase price, point of sale, distance to the market, transport to the market, condition of road, and co-op membership); and (5) production conditions (labour, use of fertiliser, use of GMOs, access to water). In total, there were 26 independent variables, with two dependent variables (market participation estimated in the first stage of the DH model and quantity sold estimated in the second stage). All independent variables

[33] In the research of Hart and Clark (1999),, the objective was to provide an initial glimpse into the nature of inferential problems when using ML in small samples. They concluded that sample sizes of 30 to 50 observations per independent variable are sufficient when using ML estimation.

were included in the descriptive statistical analysis in which the means were analysed. The table below shows all the independent variables that were used in the estimation of the probit model for market participation and truncated normal regression model for quantity sold. The regression analysis was conducted using Stata Software.

Table 3: Independent variables included in the production and marketing decision regressions

No	Variable[34]	Models included[35]
	Dependent:	
	Market participation (1 = yes)	1
	Quantity sold (tons)	2
	Household (HH) characteristics:	
1.	Gender of HH head (1 = male)	1,2
2.	Age of HH head (years)	1,2
3.	Education of HH head (years)	1,2
4.	Size of HH (#)	1,2
5.	Employment status of HH head (1 = employed)	1,2
	Private assets:	
6.	Land size (ha)	1,2
7.	Land tenureship (1 = communal)	-
8.	Use of tractor (1 = yes)	1,2
9.	Own bakkie (1 = yes)	-
10.	Own mobile phone (1 = yes)	-
11.	Access to electricity (1 = yes)	-
12.	Access to credit (1 = yes)	1,2
	Government support-related variables:	
13.	Extension services (1 = yes)	2
14.	Government transfers (1 = grants)	1,2
	Marketing-related variables:	
15.	Selling price (rand per ton)	-
16.	Quantity purchased (tons)	2
17.	Purchasing price (rand per ton)	1,2
18.	Point of sale (1 = nearest town)	-
19.	Distance to the market (km)	2
20.	Transport to the market (1 = own)	2
21.	Road condition (1 = good)	-
22.	Co-op member (1 = yes)	-
	Production-related variables:	
23.	Labour (1 = family)	2
24.	Use fertiliser (1 = yes)	2
25.	Used GMO seed (1 = yes)	-
26.	Farming system (1 = rain-fed)	-

[34] These variables were included because they were theoretically expected to affect production and marketing decisions.

[35] Model 1 = probit for estimating market participation; Model 2= truncated normal regression for estimating quantity sold.

Note (-) indicates all those variables that were omitted by Stata due to response variation deficiency.

4. RESULTS AND DISCUSSION

This chapter discusses the findings of the study. The descriptive statistical analysis of the sampled household characteristics, private and public assets, marketing and production conditions is presented in the first section. The second section presents the empirical results of the double-hurdle regression analysis.

4.1. Descriptive Analysis

Descriptive statistics provides a useful summary of the sample and of the observations that were made when performing empirical and analytical analysis as in the case of this study. The summary of the results of the descriptive statistics is provided in Table 3, where column 1 shows all variables that were used in the descriptive statistics analysis, column 2 shows results obtained from all sampled households, column 3 shows results pertaining to non-participants and column 4 shows results pertaining to participants.

4.1.1. Household characteristics

The results reveal that the proportion of male-headed households (79%) is significantly higher than that of female-headed households (21%). The mean age was 54 years for the sample households, 51 years for non-participants and 58 years for participants. Although this is consistent with the South African phenomenon, Reyes *et al*. (2012) found that the mean age of non-participant and participant households in the central highlands of Angola was 42 and 39 years respectively. In contrast to the South African phenomenon, and based on the findings of Reyes *et al*. (2012), it appears that, in rural Angola, people are finding attractive economic opportunities in agriculture. Around 38% of the sampled households participated in the market, of whom 80% were male-headed households.

Table 4: Independent variables included in the marketing decision regressions

		Maize[36]	
	Whole sample n = 68	Non-Participants n = 43	Participants n = 25
Demographics	Mean	Mean	Mean
Dependent variables:			
Market participation (% yes)	38	0	100
Quantity sold (ave tons)	12	n/a	12
Independent variables:			
Household (HH) characteristics:			
27. Gender of HH head (% male)	79	79	80
28. Age of HH head (ave years)	54	51	58
29. Education of HH head (ave years)	5	3	7
30. Size of HH (ave)	5	5	5
31. Employment status (% employed)	72	79	60
Private assets:			
32. Land size (ha)	2.7	1	5
33. Land tenureship (% communal)	100	100	100
34. Use of tractor (% yes)	69	55	92
35. Own bakkie (% yes)	25	0	68
36. Own mobile phone (% yes)	100	100	100
37. Access to electricity (% yes)	100	100	100
38. Access to credit (% yes)	22	2	56
Government support-related variables:			
39. Extension services (% yes)	35	5	88
40. Government transfers (% grants)	44	47	40
Marketing related variable:			
41. Quantity produced (tons)	7	2.7	15
42. Selling price (rand per ton)	1 500	n/a	1 500
43. Quantity purchased (tons)	0.5	0.5	0.4
44. Purchasing price (rand per ton)	763	781	731
45. Point of sale (% nearest town)	100	100	100
46. Distance to the market (ave km)	30	36	19
47. Transport to the market (% own)	26	0	76
48. Road condition (% good)	100	100	100
49. Coop member (% yes)	37	0	100
Production-related variables:			
50. Labour (% family labour)	88	100	68
51. Use fertiliser (% yes)	100	100	100
52. Used GMO seed (% yes)	37	0	100
53. Farming system (% rain-fed)	100	100	100

[36] In this study, maize was planted by all observed households, as it is a staple commodity in the former homelands

On average, a typical household head attended about five years of schooling, where the range varied from those who had never attended school to those who had attended more than 12 years of schooling. This meant that most of the sampled household heads were literate, indicating that they could at least read and write. The level of literacy was significantly better for those household heads who participated in the market, indicating on average seven years of schooling compared to three years by non-participants. This implies that most market participants had post-primary education. The finding is consistent with the finding of Makhura *et al.* (2001), who stated that human capital represented by the household head's formal education was posited to increase household understanding of market dynamics and therefore improve decisions about the amount of output sold, inter alia. The overall mean household size was five for all three categories. This contributes positively to households relying on family labour rather than on hired labour.

4.1.2. Household private and public assets

The fact that 100% of the respondents did not own the land they occupied was not surprising, given the fact that the land in most of the former homelands, particularly in the rural areas, is owned by the state. Hence the land is occupied under communal tenureship governed by traditional institutions which grants the powers to traditional authorities such as headmen and chiefs to distribute it to rural dwellers in the form of plots, without granting any title deed as proof of ownership. Surprising, however, was the average landholding size of 2.7 ha for the sampled households. This, however, was bettered by an average landholding size of 5 ha for participants compared to that of 1 ha for non-participants. The results also indicate that 92% of the participants used a tractor to cultivate and 68% of them own a bakkie, while 55% of the non-participants used a tractor and none owned a bakkie. All sampled household owned a mobile phone and had access to electricity. The results indicate that only 35% of the sampled household had access to extension services, of which 88% were participants. Furthermore, 44% of the sampled households received government grants[37], of which 47% were non-participants.

[37] These include pension, old age grants and child grants.

4.1.3. Production and marketing conditions

In this category, around 88% of the sampled household depended on family labour, with 100% of all non-participants utilising family labour while 68% of participants used solely family labour. The rest supplemented their family labour force with hired (as seasonal) labour. All sampled households used fertiliser and were dependent on rain-fed water, with the participants using mostly inorganic fertiliser while the non-participants used organic fertiliser. Furthermore, all those who participated used GMO seeds, were members of cooperatives and sold the surplus produced to the nearest town. Of these, 76% used their own transport to transport their marketable surplus to the market, while the rest used hired transport. Finally, most participants were located 19 km from the nearest town and all of them, including the non-participants, indicated that the road to the market was in a good condition, which made it easy for them to reach their markets. In contrast, the average distance to the nearest market for non-participants was 36 km. The implication of this is that market participation will decrease with greater distance travelled to the market. Thus the greater the distance from the farmer to the market, the less likely the farmers are to participate in the market.

4.2. Results of the Double-Hurdle Regression

The results from the double-hurdle model are presented in Table 4, with column 1 showing the results from the first stage, which used a probit estimator (MLE) to estimate the determinants of the probability of participating (selling) in the market, and column 2 showing results from the second stage, which were obtained by fitting the MLE to the truncated normal regression to estimate the determinants of the quantity of maize sold, conditional on the decision to participate. For further details on how the regression results are interpreted in both stages of the DH model, refer to the footnotes provided under Table 4.

As was mentioned in Chapter 1, it was considered impractical for this study to assess all factors influencing market participation, hence the focus of the discussion will be only on those factors that were found to be key determinants of market participation in the study area.

Table 5: Double-hurdle model for maize market participation and quantity sold (MLE), vce(robust)[38]

	Stage 1: Probability of participating Probit Estimator		**Stage 2:** Quantity sold (tons) Truncated-Normal Regression estimator	
	n = 68		**n = 25**	
	Pseudo R^2 = 0.8833[39]		Prob > chi^2 = 0.0000	
Independent variables[40]	Coefficient[41]	p-value	Coefficient	p-value
Gender of HH head (1 = male)	-1.490219	**0.027	-.3206287	0.817
Age of HH head (years)	-.1016909	0.193	.0502059	0.738
Education of HH head (years)	.6751262	1.82	.4893688	0.196
HH size (#)	1.006502	**0.021	-2.420947	*0.088
Employment status (1 = employed)	-.3748926	0.719	4.76524	0.294
HH land size (ha)	1.574472	***0.000	2.936698	***0.000
Used tractor (1 = yes)	.1474435	0.693	1.480767	0.396
Access to credit (1 = yes)	-2.159237	*0.078	-.4262632	0.696
Extension services (1 = yes)	-	-	7.836526	***0.002
Government Transfers (1 = yes)	.7819622	*0.082	1.813396	0.414
Quantity purchased (tons)	-	-	.9725245	0.544
Price bought (2015 rand/ton)	-.0034537	0.180	.0077494	0.364
Distance to the market (ave km)	-	-	.0131982	0.888
Transport to the market (1 = own)	-	-	1.571504	0.164
Labour (1 = family labour)	-	-	2.612485	0.238
Use fertiliser (1 = yes)	-	-	5.149472	*0.090
Constant	-3.527762	0.464	-18.84601	0.231

[38] vce(robust) uses the robust or sandwich estimator of variance. This estimator is robust to some types of misspecification, as long as the observations are independent.

[39] The Pseudo R^2 has a value of 0.883 for the first stage of the DH model, which implies that the 10 independent variables in the probit together account for 88.3% of the explanation for why tomato farmers participate or do not participate in the agricultural output market. Generally speaking, the higher the pseudo R^2 statistic, the better the model fits our data. This is despite the fact that, although the model accounts for a significant amount of the variation in whether or not smallholder farmers participate in the market, there are also other variables not included in this study's model that influence this decision.

[40] Excluding those variables omitted by Stata in both stages of the model.

[41] Coefficients are not partial effects due to the non-linear nature of the likelihood function at all stages of the DH model. The results are interpreted in both stages of the DH model, with a positive coefficient sign on the independent variable implying that a unit increase in that independent variable will lead to an increase in market participation and quantity sold, whereas the negative coefficient sign implies that a unit decrease in the independent variable may lead to a decline in market participation and quantity sold.

Notes: *, **, *** indicate that the corresponding coefficients are significant at the 10%, 5%, and 1% levels respectively. Coefficients and p-values were obtained using the *margins* command in Stata. This is due to the non-linear nature of the likelihood function at all stages of the DH model.

4.2.1. Results of the probit model: market participation

The results of the probit model indicate that only five of the 10 variables had a positive significant effect on market participation decisions. Household land size was positively associated with market participation, with a statistically significant effect of 1%. This means that, if the mean land size increases by 1.5 hectares to above the mean 2.7 ha, the probability of participation will improve. The reason for this could be attributed to the fact that a larger area of agricultural land provides a greater opportunity for surplus production (Makhura *et al*., 2001). While on the topic of land, it is important to state that, since all the survey respondents indicated occupying and farming on communal land, there was no control group for comparison. For this reason, therefore, land tenureship was considered irrelevant for this study. The results of the probit model also indicate that household size was positively associated with market participation, with a statistically significant effect of 5%. Although the larger the household, the greater its consumption demand, larger household size could provide a strong source of labour, given the fact that most rural households depend mainly on family labour.

Interestingly, the gender of the household head was found to be statistically significant at the 5% level, although the coefficient was negative and not what was expected. Given the fact that the results of the descriptive statistics indicated that 38% of the sampled households that participated were male-headed households, it was also found that, when pulling up the population of female-headed households, 38% again were participants. Given this finding, the study therefore assumes that women were participating equally. This finding is in contrast with the finding of Reyes *et al*. (2012), who found that male-headed households in the central highlands of Angola were more likely to participate in the market compared to female-headed households. Other variables that had a positive effect on household market participation decisions were household head education, use of tractor, and government transfers.

4.2.2. Results of the truncated regression: quantity of maize sold

Similar to the results of the probit model, the results of the truncated regression model suggest that land size is positively associated with the amount of maize entering the market. This is in line with the finding of Makhura *et al*. (2001), which suggests that an increase in

land size will lead to an increase in the quantity of maize sold. However, this could be affected negatively by an increase in household size, as this has a negative statistical effect on the conditional quantity sold, although it is statistically significant at the 10% significance level. The impetus for the negative effect is that an additional household member could lead to a decrease in the amount of maize going to the market, as the household's consumption demand increases. Another important finding of the truncated regression model suggests that access to extension services and the application of fertiliser were both positively associated with the quantity sold and were statistically significant at the 1% and 10% significance levels respectively. Although the coefficient of gender has a negative sign, it had no significant effect on the quantity of maize sold.

The other variables that had a positive effect on the quantity of maize entering the market included age, education and employment status of the household head, use of tractor when cultivating, government transfers, quantity produced, market price, and own transport to the market.

5. CONCLUSIONS AND RECOMMENDATIONS

This study used a double-hurdle model to examine the effect of key factors influencing market participation amongst rural smallholders in the former homelands of the Eastern Cape province in South Africa by focusing on rural household characteristics (such as gender, age, education of the household head, household size and land size), household assets, government support and production, and market conditions. The study used data obtained from rural smallholder households from five maize-producing districts in the Eastern Cape.

The results specifically point to five constraining factors that were found to have a positive effect on rural smallholders' market participation decisions and on the conditional quantity of maize they trade (viz. household size, land size, access to credit and government transfers for the first stage, which was estimated using the probit model, and household size, land size and extension services for the second stage, which was estimated using truncated normal regression). Given the challenge of endogeneity or collinearity in data, all other variables were omitted from the DH regression analysis.

The results from the descriptive statistics indicate that a high proportion of respondents were male-headed households. However, although male-headed households were highly represented in the sample, the regression results suggest that just over one third of male-head households participated. It also was found when pulling up the data on the population of female-headed household, also just over one third participated, indicating that gender was less likely to influence the decision on market participation for the population group surveyed in this study. Likewise, gender had no significant effect on the quantity of maize sold. Furthermore, the results indicate that household size had a positive statistical effect on market participation, owing to the fact that larger household size provides a strong source of labour and most rural households depend mainly on family labour. However, household size had a negative statistical effect on the conditional quantity of maize sold. This possibly was due to the fact that an additional household member could lead to a decrease in the amount of maize going to the market as the household's consumption demand increases, resulting in a reduction in surplus produce. As was expected, land size had a positive statistical effect both on the decision to participate in the market and on the conditional

quantity of maize sold, with a very high level of significance of 5% for both stages of the DH model. This is clearly indicative of the fact that innovations that enhance rural households' access to land can be instrumental in raising their ability to exploit market opportunities. Furthermore, the results indicate a positive correlation between land size and quantity produced. Those households that have access to larger land plots produced higher tonnages of maize. This finding is consistent with that of Boughton *et al*. (2007). Moreover, in line with what Randela *et al*. (2008) suggested, this finding suggests that the impact of land size is an indication that increased market participation is also a function of land productivity. Given this view, it also is important that policy makers focus on policy interventions that improve land productivity, because land size and productivity are both central to an inclusive development process and their contribution is crucial to market participation in rural areas. Lastly, other important factors that had a positive statistical effect on the quantity of maize sold were access to extension services and application of fertiliser.

Other variables that had a positive effect on both market participation and quantity sold were education of household head, use of tractor, and government transfers, while age, education and employment status of the household head, use of tractor when cultivating, government transfers, quantity purchased, market price and own transport to the market had a positive effect only on the quantity sold.

Given the findings highlighted above, it is clear that the integration of rural smallholders into market participants cannot be achieved without effective policy interventions that create a sustain and enabling environment for greater participation. This would include improving land access (which would require the involvement of government to administer and instigate a proper, consistent and equitable distribution of land to rural households); improving road infrastructure; providing extension services and making available relevant advice and information related to both production and marketing aspects; and enhancing both credit and production input accessibility. In all these aspects, government support is crucial, but its interventions need to be based on a thorough understanding of the effect of each of these factors on smallholders' productivity, market participation and quantity marketed. Most importantly, government needs to understand that each of these key factors can never function in isolation from the others. For example while accepting that land is an important agricultural resource, it must be recognise that land is not the only key

factor to increasing productivity and enhancing market participation. No amount of land will help rural agricultural households unless complementary investments are made in productive technologies and infrastructure, government support services, agricultural training and marketing systems. Lastly, through the provision of extension services, rural households should be encouraged to create and participate in farmers' organisations in the communities in which they are situated. It is through such organisations that those already participating actively in the market can transfer their farming and marketing experience to those who are not, but are willing to participate.

The findings of this study are important because they provide an essential understanding of the effect of the main factors facing rural households in their market participation decisions and in relation to the conditional quantity sold. In the light of the findings of this study, further research should look more deeply into the relationship between market participation, quantity sold and household food security.

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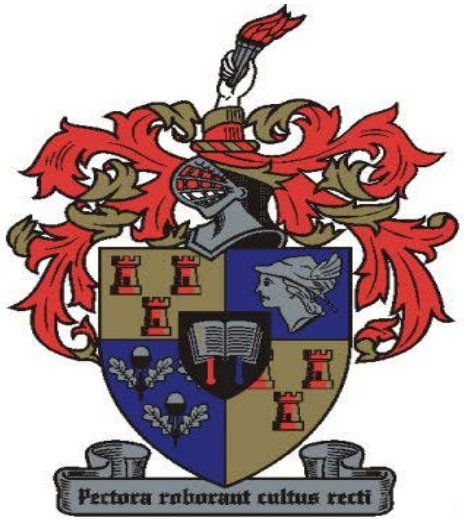
APPENDICES

Appendix A: Full Regression Results from the Double Hurdle Model

Stage 1: Market Participation Probit Model						
Independent variables:	vce(robust)					
	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
hh_gender	-1.490219	.6723896	-2.22	0.027	-2.808079	-.1723596
hh_age	-.1016909	.0781797	-1.30	0.193	-.2549204	.0515386
hh_educ_yrs	.6751262	.371047	1.82	1.82	-.0521126	1.402365
hh_size	1.006502	.4361877	2.31	0.021	.1515899	1.861414
hh_empl~y	-.3748926	1.041421	-0.36	0.719	-2.416041	1.666256
hh_land_si~a	1.574472	.4443997	3.54	0.000	.7034646	2.445479
used_tra~o	.1474435	.3740928	0.39	0.693	-.585765	.880652
acces_to~o	-2.159237	1.224762	-1.76	0.078	-4.559725	.2412522
transfer~n	.7819622	.4500246	1.74	0.082	-.1000697	1.663994
price_bought	-.0034537	.0025782	-1.34	0.180	-.0085069	.0015995
_cons	-3.527762	4.815869	-0.73	0.464	-12.96669	5.911168
Stage 2: Quantity sold Truncated Normal Regression						
hh_gender~e	-.3206287	1.384402	-0.23	0.817	-3.034006	2.392749
hh_age	.0502059	.1499833	0.33	0.738	-.243756	.3441678
hh_educ_yrs	.4893688	.3784205	1.29	0.196	-.2523217	1.231059
hh_size	-2.420947	1.419192	-1.71	0.088	-5.202512	.3606172
hh_employ~y	4.76524	4.544126	1.05	0.294	-4.141084	13.67156
hh_land_si~a	2.936698	.8095736	3.63	0.000	1.349963	4.523433
used_tract~o	1.480767	1.742774	0.85	0.396	-1.935007	4.896541
acces_to_c~o	-.4262632	1.090555	-0.39	0.696	-2.563711	1.711185
extension_~o	7.836526	2.565575	3.05	0.002	2.808091	12.86496
gov_transf~n	1.813396	2.218438	0.82	0.414	-2.534662	6.161454
quantity_p~s	.9725245	1.604116	0.61	0.544	-2.171486	4.116535
price_boug~n	.0077494	.0085388	0.91	0.364	-.0089864	.0244852
distance_f~m	-.0131982	.0939408	-0.14	0.888	-.1973188	.1709223
tronsport_~n	1.571504	1.127833	1.39	0.164	-.6390092	3.782017
labour_fam~0	2.612485	2.212701	1.18	0.238	-1.72433	6.949299
fert_ogani~0	5.149472	3.036543	1.70	0.090	-.8020431	11.10099
_cons	-18.84601	15.74302	-1.20	0.231	-49.70175	12.00974
/sigma	1.350294	.1506299	8.96	0.000	1.055064	1.645523

Appendix B: Questionnaire



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AGRICULTURAL HOUSEHOLD MARKET PARTICIPATION SURVEY 2015

HOUSEHOLD QUESTIONNAIRE

SECTION A: HOUSEHOLD IDENTIFICATION

Province .....

District Municipality .....

Local Municipality .....

Village .....

Date .....

SECTION B: HOUSEHOLD CHARACTERISTICS

Please mark with an X or tick where applicable, otherwise write a number or fill in the requested information

<table>
<tr><td colspan="7">B.1. Household Representative (Where head is not present)</td></tr>
<tr><td colspan="2">1. Gender:</td><td colspan="2">2. Age:</td><td colspan="3">3. Relation to head:</td></tr>
<tr><td>Male…1</td><td>Female…2</td><td colspan="2">(Number)….</td><td>Wife…2</td><td>Sibling…3</td><td>Other (specify)…4</td></tr>
<tr><td colspan="7"><u>B.2. Household Head Information</u></td></tr>
<tr><td colspan="2">1. Gender:</td><td colspan="2">2. Age:</td><td colspan="3">3. Marital status:</td></tr>
<tr><td>Male…1</td><td>Female…2</td><td colspan="2">(Number)….</td><td>Single…1</td><td>Married…2</td><td>Divorced…3</td><td>Widowed…4</td></tr>
<tr><td colspan="2">4. How many years of schooling</td><td colspan="5">5. Highest educational level</td></tr>
<tr><td colspan="2">(Number)….</td><td>No formal education…1</td><td>Primary level…2</td><td>Secondary level…</td><td>Tertiary level…3</td><td>Other (specify)…4</td></tr>
<tr><td colspan="7"></td></tr>
</table>

B.3. Household Income and Food Security

1. **How many people in this household?** (Number).....
2. **Besides income from agriculture, what is (are) the other source(s) of income?**

Formal employment…1 >>>	Full-time…1 Part-time…2 (Specify type of employment)...	Informal employment…2 (Specify type of employment)…	Self-employment…3 (Specify)…	Pensioner…4	Grants…5>>>	Old Age…1 Child grant…2 Disability…3 Other (specify)…4	Other…5 (Specify)…

3. **Based on the previous question, please indicate the income bracket you fall under (R)**

<1 000…1	1 000-10 000…2	10 000-20 000…3	20 000-30 000 …4	30 000-40 000 …5	40 000-50 000 …6	> 50,000 …7

4. **In the past 7 days, did the HH have enough food?**

Yes…1	No…2 >>>	How many days? (Number)...

6. **Meals eaten at this HH a day?**

Two…1	Three…2	Other (specify)…3

7. **What is this HH main staple meal?**

Maize…1	Wheat…2	Sorghum…3	Rice…4	Other (specify)…5

SECTION C: HOUSEHOLD ASSETS

<table>
<tr><td colspan="5">1. What is HH tenure status of main residence and agricultural land?</td><td colspan="2">2. What is the size of the agricultural land you have access to (hectares)</td><td colspan="2">3. If own land, is there a title deed or legal documents to prove ownership?</td></tr>
<tr><td colspan="2">Privately owned…1
v</td><td>Communal…2</td><td>Rent or lease…3</td><td>Other (specify)…4</td><td>(Number)….</td><td>Yes…1</td><td>No…2</td></tr>
<tr><td>Bought…1</td><td>Inherited…2</td><td colspan="4"></td><td colspan="2"></td></tr>
<tr><td colspan="2">4. Do you have access to credit?</td><td colspan="3">5. If yes from what source?</td><td colspan="2">6. Can the land occupied or farmed on by this HH be used as collateral when applying for credit?</td></tr>
<tr><td>Yes...1</td><td>No…2</td><td>Commercial banks…1</td><td>Micro-financial Institutions…2</td><td>Other (specify)…3</td><td>Yes…1</td><td>No…2</td></tr>
<tr><td colspan="7">7. If and when credit is granted for this HH, what is it usually used for?</td></tr>
<tr><td>Purchase agricultural inputs …1</td><td>Purchase agricultural machinery…2</td><td>Purchase land…3</td><td>Enhance or purchase irrigation equipment …4</td><td>Subsistence HH needs…5</td><td colspan="2">Other (specify)…6</td></tr>
<tr><td colspan="3">8. In the previous season, how did the HH cultivate its agricultural land?</td><td colspan="4">9. Was the tractor used own, or hired?</td></tr>
<tr><td>Used tractor…1</td><td>Used animal-drawn plough…2</td><td>Other (specify)…3</td><td colspan="2">Own…1</td><td colspan="2">Hired…2</td></tr>
<tr><td colspan="7">10. Does the HH own any or some of the following?</td></tr>
<tr><td>Farm machinery (plough, planter, fertiliser or pesticides machine, irrigation equipment)…1</td><td>Truck… 2</td><td>Bakkie…3</td><td>Mobile phone…4</td><td>Electricity…5</td><td colspan="2">Other (specify)…6</td></tr>
</table>

SECTION D: AGRICULTURAL PRODUCTION

1. In the previous season, did you cultivated any or some of the following crops on agricultural land?			**2. Other than crop farming, are you also involved in any or some of the following farming enterprises?**	
Crop	Area planted (hectares)	Harvest/yield (tons)	Enterprise:	Number
Maize…1			Livestock…1: Cattle Sheep Goats	
Soybeans…2				
Pumpkin…3				
Butternut…4			Piggery…2	
Potatoes				
Sweet potato…5			Poultry…3	
Cabbage…6				
Spinach…7			Other (specify)…4	
Carrots…8				
Tomatoes…9				
Onion…10				
Other (specify)…11				

3. Indicate the number of employees who usually assist with farm work					
Type of employee	Full-time employees…1	Casual employees…2	Family members…3	Other…4	Total:
Number:					

4. During the previous production season, did you use any or some of these inputs?				
Fertiliser…1	Animal (cattle) manure…2	Natural seeds…3	Genetically modified or maize hybrid seeds…4	Other (specify)…5

5. Where did you obtain your seeds?				
Previous harvest…1	Local seed shop…2	Co-operatives…3	Government…4	Other (specify)…5

6. Indicate the type of farming system you use						
6.1. Farming system		6.2. If irrigation system, indicate source of water				
Dryland…1	Irrigation…2>>>	Own built dam…1	Community dams…2	River…3	Borehole…4	Other (specify)…5

SECTION E: GOVERNMENT ASSISTANCE

1. In the past 12 months, did the HH receive any form of government support?		**2. Besides government support, has the HH received any other social support from elsewhere?**	
Yes…1> No…2	Extension services…1 Agricultural inputs…2 Tractors for land cultivation…3 Free electricity…4 Social grant…5 Other (specify)…6	Yes…1> No….2	Co-operative…1 Church…2 Community projects…3 Other (specify)…4

SECTION F: MARKETS AND MARKET CONDITIONS OR INFRASTRUCTURE

F.1. Markets

1. Which markets do you usually use for purchasing food commodities or selling your produce?

Formal…1	Informal…2	Do not sell (home consumption)…3

2. If you sell to the formal markets, indicate type of formal market				**3. Is there a legal contractual agreement between you and your formal markets?**	
Retailers…1	Fresh produce markets…2	Maize millers…3	Other (specify)…4	Yes…1	No…2

4. During the previous marketing and harvesting period, did members of this HH consume, produce, buy or sell any or some of the following foodstuffs	**5. How much did the HH consume?**		**6. How much did the HH purchase?**		**7. How much was spent?**	**8. How much was own produce ?**		**9. How much was sold?**		**10. How much was sold produce?**
	Unit	Qty	Unit	Qty	Price	Unit	Qty	Unit	Qty	Price
1. Grains										
Maize…1										
Wheat…2										
Sorghum…3										
Millet…4										
Rice…5										
Other (specify)…6										

	Unit	Qty	Unit	Qty	Price	Unit	Qty	Unit	Qty	Price
1. <u>Starches Vegetables</u>										
Potatoes…1										
Sweet potatoes…2										
Pumpkin…3										
Butternut…4										
Squash…5										
Other (specify)…6										
	Unit	Qty	Unit	Qty	Price	Unit	Qty	Unit	Qty	Price
2. <u>Legumes</u>										
Soybeans…1										
Green Peas…2										
Other (specify)…3										
	Unit	Qty	Unit	Qty	Price	Unit	Qty	Unit	Qty	Price
3. <u>Vegetables</u>										
Cabbage…1										
Spinach…2										
Carrots…3										
Tomatoes…4										
Onion…5										
Peppers….6										
Other (specify)…7										

	Unit	Qty	Unit	Qty	Price	Unit	Qty	Unit	Qty	Price
4. <u>Meat and Meat Products</u>										
Beef, including mince and sausage…1										
Lamb/mutton…2										
Chicken …3										
Chevon (goat meat)…4										
Pork and bacon…5										
Eggs…6										
Milk…7										
Other…8										

<u>F.2. Market Conditions or Infrastructure</u>

1. Where do you sell most of you produce?					**2. How far is the marketing point?**
Farm gate…1	Around the village…2	Roadside…3	Nearest town…3	Other (specify)…4	(Number)…… km

3. How does the marketable produce get to the marketplace?

Own transport…1	Hired vehicle…2	Public transport…3	Buyers' transport…4	Move by donkey cart…5	Other (specify)

4. Complete the below for type of payments and how long it take to receive the payments

4.1. How are you paid				**4.2. Time taken for payment**				
Cash…1	Cheque…2	Electronic…3	Other (specify)…4	Immediately…1	24 hr…2	More than 24 hr…3	Week…4	Other (specify)…5
4.3. What type of road you use to the market				**4.4. How is the condition of the road you use to the market**				
Tarred only…1	Gravel only…2	Both…3		Fine…1	Good…2	Bad…3		

5. What are your sources of market information?

5.1. Sources	**5.2. Type of information (provided)**				
Public administration…1	Prices…1	Date for sale…2	Buyers…3	Market opportunities …4	Other (specify)…5
Buyer…2					
Extension officers…3					
Other farmers…4					
Media…5					
Other (specify)…6					

6. How often do you receive market information?

Daily…1	Weekly…2	Monthly…3	Quarterly …4	Annually…5	Other (specify)…6

7. How is price set during sales?

I set the price…1	We negotiate…2	It is market driven…3	It is dictated by the buyer…4	Other (specify)…5

List what you consider to be the major problems you face in marketing your goods

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Suggest ways in which such problems can be addressed

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