FACULTY OF AGRONOMY AND FORESTRY ENGINEERING

Effects of increasing staple food prices on maize market participation and intensity in Malawi

A Thesis presented to

Eduardo Mondlane University

The faculty of Agronomy and forestry engineering

Department of Economics and agricultural development

In Partial Fulfilment

Of the Requirements for the

Degree Master of Science in Agricultural Economics

By Kitty Maluwa

December, 2015

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DECLARATION

I Kitty Maluwa, hereby declare that this thesis is my original work and has not been presented for any other award in any other University. Where other sources of information have been used, they have been rightly acknowledged. No part of this thesis may be reproduced without the prior written permission of the author and/or Eduardo Mondlane University.

Kitty Maluwa

Date:

ABSTRATO

O aumento dos preços de alimentos básicos nos últimos sete anos têm imposto um fardo pesado sobre os decisores políticos modernos dia com a preocupação de que a pobreza extrema ea fome vai prevalecer em toda a terra. Há necessidade de se implementar políticas efetivas que irão minimizar o risco e aumentar a contribuição dos pequenos agricultores para fazer sua economia nacional através da participação de mercado. Comercialização de agricultura familiar é uma das formas eficazes para impulsionar os rendimentos dos agricultores e estimulam o crescimento economias dependentes agrícolas nos países em desenvolvimento. A fim de tornar as políticas eficazes, a política deve ser feita com base em evidências empíricas sobre a forma como as decisões de marketing de pequenos agricultores respondem a mudanças nos preços. Usando dados do painel de 2004/2005 e 2008/2009 o estudo comparado tanto a participação de mercado e intensidade nos mercados de milho em diferentes ambientes de preços utilizando o modelo de barreira dupla de Cragg. Os resultados mostram que o aumento dos preços dos alimentos forte e positivamente afetar a decisão dos pequenos agricultores a participar nos mercados de milho, mas não muito impacto sobre a quantidade de milho vendida. Políticas que incentivem a produtividade de milho devem ser implementadas para aumentar a quantidade de milho vendida. Também essencial ao lado de tais intervenções são estratégias para melhorar o acesso ao mercado através da redução dos custos de transacção que surgem informações de marketing, devido à procura e transporte.

Palavras-chave: *a participação no mercado, os custos de transação de casal obstáculo, aumentando os preços dos alimentos*

ABSTRACT

Increasing staple food prices over the last seven years have imposed a cumbersome burden on modern day policy makers with the concern that extreme poverty and hunger will prevail across the earth. There is need to implement effective policies that will minimize the risk and boost the contribution smallholder farmers make to their national economy through market participation. Commercializing smallholder agriculture is one of the effective ways to boost farmers' incomes and stimulate the growth agricultural dependent economies in developing countries. In order to make effective policies, policy must be made based on empirical evidence on how smallholder farmers' marketing decisions respond to changes in prices. Using panel data from 2004/2005 and 2008/2009 the study compared both market participation and intensity in maize markets in the different price environments using Cragg's the double hurdle model. Results show that increasing food prices strongly and positively affect smallholder farmers' decision to participate in maize markets but not much impact on the quantity of maize sold. Policies that encourage maize productivity should be implemented to enhance the quantity of maize sold. Also essential alongside such interventions are strategies to improving market access by reducing transaction costs that arise due marketing information seeking and transportation.

Key words: *market participation, double hurdle transaction costs, increasing food prices*

APPROVAL

This thesis has been submitted with our approval as university supervisors.

Signed

.....

Dr. Helder Zavale (Eduardo Mondlane University)

Date

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Signed

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(Eduardo Mondlane University)

Date

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DEDICATION

To my Dad

Dr Alfred Maluwa

My Mum

Veronica Mary Maluwa

My Brothers

Philip and Victor

My Love Brian Kaseka

"I thank God that you are always there for me and for your moral, social, inspirational, and financial support, I love you all."

God bless you all

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First and foremost, all praise and honour be unto Jesus Christ my personal Lord and saviour for his grace and favour bestowed upon me to make it this far. I owe it all in to him for without him I am nothing. In him I live, move and my being.

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1 INTRODUCTION

1.1 Background

Since the year 2000, world has undergone three major food price increase predicaments following the economic crisis (see figure one below). The first strong upward trend in staple food prices was observed in January 2007 and lasted to March 2008, where prices increased up to 51%. The second price shock one transpired between January 2010 and February 2011 where prices spiked by 40%. The third one although occurred in the mid 2012 to early 2013 (Benson, *et al*, 2012; Bellemare, 2014). Figure one below shows the upward trend in price trend of some major staple food prices on the global market.

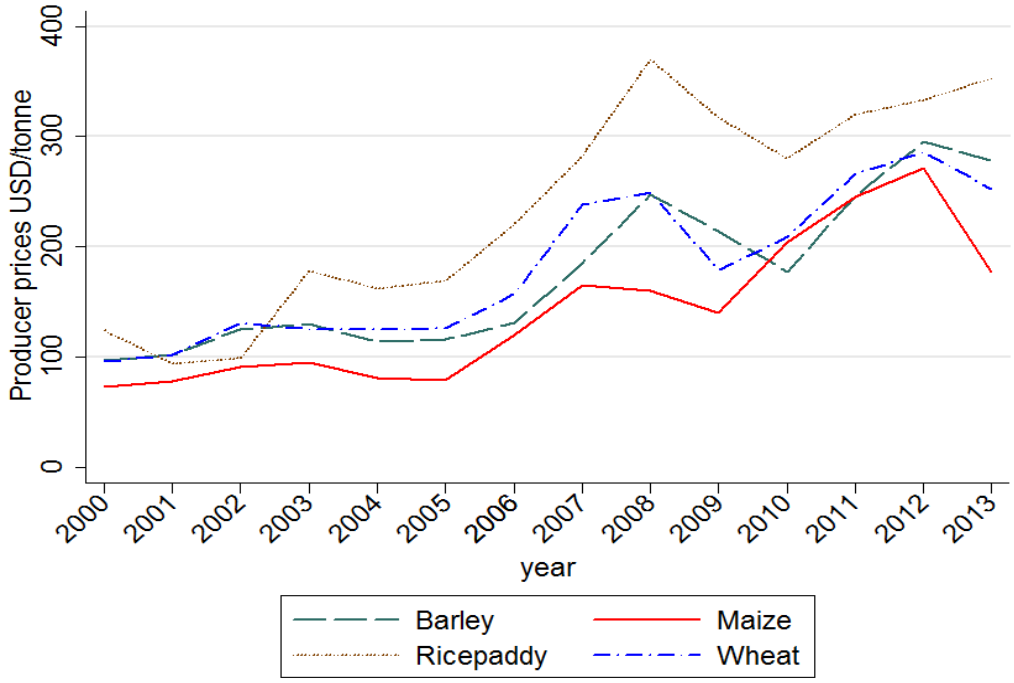

Figure 1: Staple crop price trends on the global market from 2000 to 2010

Source: FAOSTAT

Even though food prices tend to increase annually, using the coefficient of variation to measure the significance of the price changes between these years it becomes apparent that the hikes were rather extraordinary (Minot, 2013). This trend of increasing food prices poses a challenge to economists with the apprehension that poverty might increase rapidly across the earth due to the reduced access to adequate and appropriate amount of food (Gilbert, 2010; FAO, 2013; Bellemare, 2014). For instance, between 2005 and 2008 alone, the number of undernourished people rose from 850 million to 963 million, and reached the historical peak of 1.02 billion people in 2009 (FAO, 2013). It is estimated by the Development Committee of

the World Bank-IMF (2011) that the global food price increament resulted in adding 44 million people in poverty.

The increasing trend in global food prices could be attributed to the gradual increase in food production, processing, and marketing costs emerging from the sharp increase in energy costs. Due to the increase in energy costs worldwide in 2007, the America and European governments introduced subsidies on the production of bio fuels to serve as an alternative source of energy. This in turn augmented the demand for food crops like cereals on the markets for to be used for fuel production. Secondly increase in demand for meat and meat products meant that more cereals were demanded for animal feed, thus increasing food prices on the market. Another revolting cause is due to the crisis of climate change in other regions, where adverse effects include floods and droughts thus less production of food crops. This has placed a disincentive for investors to invest in the agricultural sector in various regions (Benson, *et al*, 2012).

High global food prices negatively affect various sectors of any national economy. The sectors adversely affected include, national budgets, local markets, households and individuals. The impact of higher global food price depends on the local conditioning factors of each country and economy. These conditioning factors include, trade policies implemented by the local governments, structure of import and exports, type of households (i.e. resilient, vulnerable) and type of individuals (i.e. children, women, men). Figure two below shows the impacts of increasing global food prices on an agricultural dependent developing economy (Benson, *et al*, 2012; Minot, 2013).

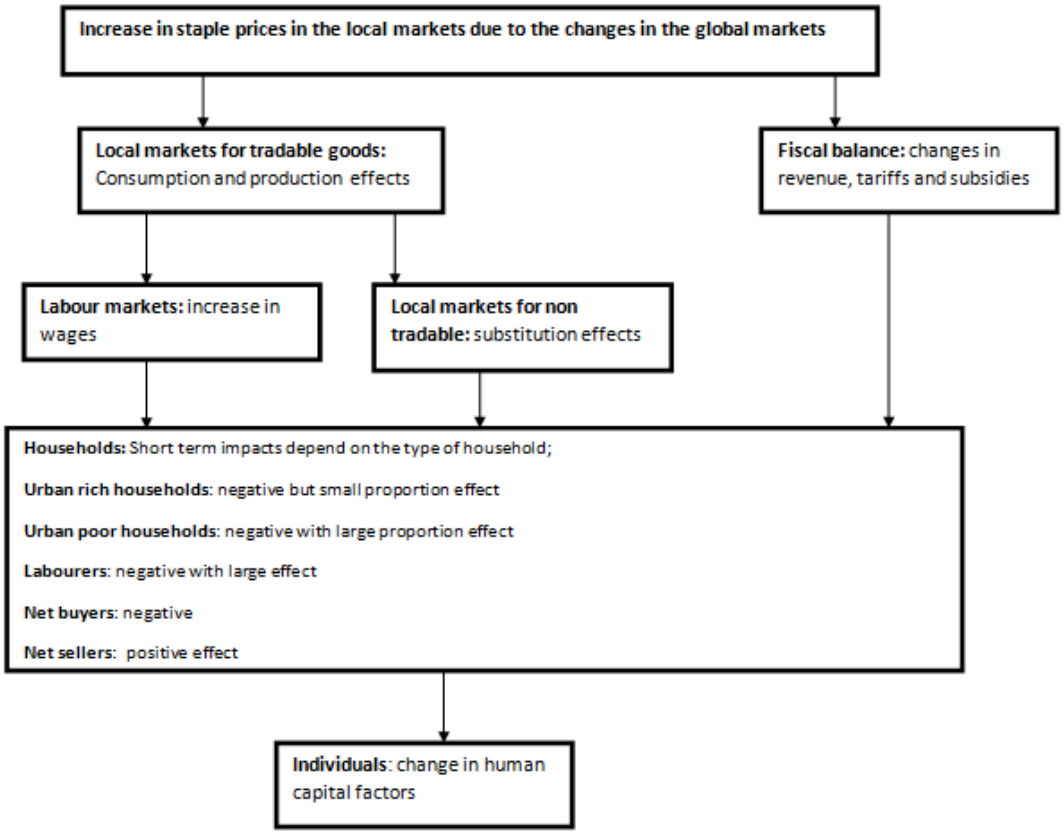

Figure 2: Effects of increasing food prices on developing economies

Source: Benson, *et al.*, 2012

Since most developing countries are net food importers, it is perceptible that price changes and patterns experienced in international food markets are also transmitted to domestic markets. Studies show that the local markets and the international food markets are integrated to up to sixty percent (Jayne 2010, Cornia, *et al*, 2012). This means that sixty percent of the change in price bahaviour on the international market will be transmitted to the local market.

Increasing global food prices tend to adversely affect the fiscal balance of net importing and developing economies by reducing the forex reserves. This reduces the overall government investment expenditure to other productive sectors like mining and industrialization to focus on providing food thus meeting the social obligations. In order to attain the social responsibility and political motives placed on the shoulders of the government (Minot, 2011; Benson, *et al*, 2012).

Increasing global staple food prices create a foremost source of risk and uncertainty in developing countries due to the high dependence on agriculture directly and indirectly as a source of livelihood (Minot, 2013). In most developing countries over 70 percent of the total population resides in the rural areas and derive their

livelihood directly or indirectly from agriculture. Prices play a vital role in their production, consumption, and marketing decisions. The risk and uncertainty augments due to the fact that most households in developing countries apportion over 60% of their income to food purchases. Increasing food prices therefore diminishes their overall purchasing power, thus leading to food insecurity and poverty (Benson, *et al*, 2012; Jayne, 2012 ; Lahiani, *et al*, 2013; Bellemare, 2014). Increasing food prices will cause demand for an increase in wages to compensate the diminished purchasing power. Due to the uncertainty that arises due increasing food prices employers resort to laying off some labour to minimise wage costs thus reducing output (Benson, *et al*, 2012).

Changes in production and consumption caused by increasing global food prices, will result in high volatile and unstable food prices on the local markets. This effect is apparent in the malawian maize market, where prices increase immensely above import parity levels in 2007/ 2008, 2009/2010 growing seasons and mid 2012 in Malawi (Tschirley and Jayne, 2010; Minot, 2011).

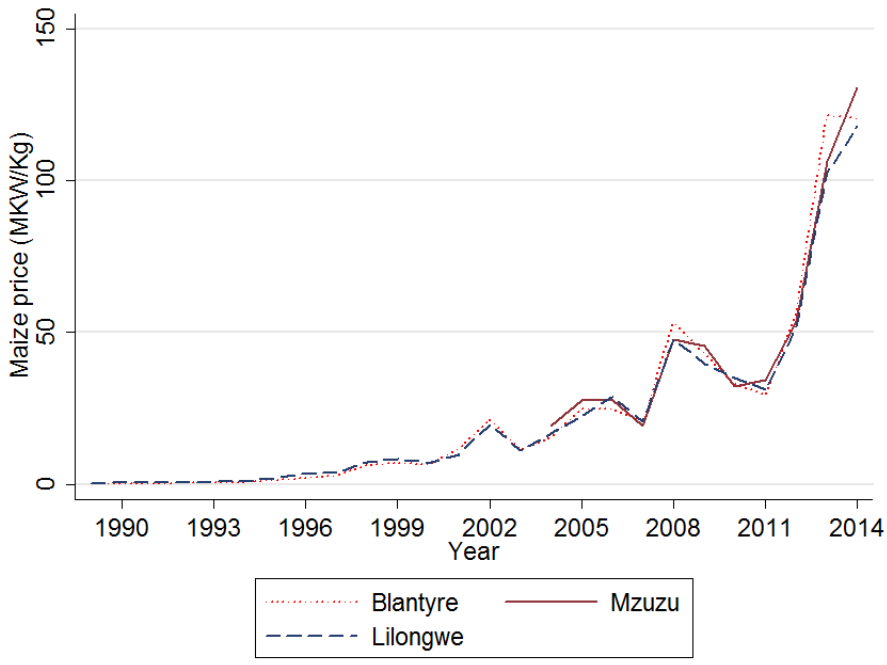

Figure 3: Maize price trend in Malawi since 1990 to 2014

Source: Agricultural Marketing Information Survey (AMIS) [1]

Despite policies and strategies implemented by the Malawian government since 2001 to keep food prices from rising beyond tolerable levels maize prices in Malawi have remained unstable and relatively high in comparison to its neighbouring countries (Tschirley and Jayne, 2010; Minot, 2011). Measuring price

[1] Agricultural Marketing Information Survey: this is a national survey which is conducted by the Ministry of Agriculture and Food security monthly on the prices of various agricultural commodities in the main markets of all the districts in Malawi.

variations using the coefficient of variation of annual producer maize prices ($standard\ deviation\ /\ mean\ price\ over\ period$) of prices, the Malawian maize prices score above 45 percent in comparison to the neighbouring countries like Tanzania and Mozambique in the same region who score ranges of 30 to 35 (Jayne,*et al*, 2010; Christopher, 2010).

Poverty levels remain high particularly among small holder farmers in Malawi who depend solely on rain fed agriculture for subsistence production. According to the third Integrated Household Survey by the National Statistical Office of Malawi in 2010, it is estimated that 51 percent of the total population in Malawi reside under the poverty line. Poverty can be caused by many factors, lack of well developed markets which leads to low market participation being one of them (Adenegan, *et al.*, 2012). The argument lies behind the fact markets, improved market access, and market participation are prerequisites for increasing rural incomes (Oparinde & Daramola, 2014). Participation in agricultural markets by resource constrained households (who are both producers and consumers of maize) living in the rural areas is vital for poverty eradication and enhancement of food and livelihood security.

On the other hand increasing food prices might create an opportunity for small holder farmers to enhance their livelihoods by increasing their farm incomes by participating in food markets. The new price environment could inspire farmers to heighten their contributions to economic growth and development by producing for local consumption and for international trade through market participation of food markets (Martuscelli, 2012; Minot, 2013). Market participation can be defined as the involvement in any form of market or any market related activity which promotes the sale of produce by an individual or household in terms of cash or in kind (Adetola, *et al.*, 2014).

Following the structural adjustment programs in the early 1980s there was a shift in agricultural policies which led to the recognition of markets as an engine of economic growth and development. This gave rise to a market led rural economic growth and development paradigm. This shift was referred to as agricultural transformation. The policies aimed to transition smallholder agriculture from subsistence agriculture to more productive market oriented agriculture to ensure economic diversification and economic growth in the rural areas (Barrett, 2007).

However since the implementation of these policies two decades ago, market participation in Malawi has remained relatively low (Jayne, *et al.*,2010; Shephard,*et al.*, 2011). Survey findings by Jayne (2012) indicate that only 6.9% of the total smallholder farmers are net sellers, 44.9% are net buyers the remaining 48.2 are autarckic households. This simply means that half of the rural farm households are only buyers of food (a minority of these are net buyers who sell and then buy in the same year). Therefore by increasing

smallholder farmers' market participation in staple crop markets presents them the opportunity to improve their livilihoods and incomes and thus eradicating extreme povery and hunger (Mather, *et al.*, 2013).

The coherent vindication for poor agricultural commercialization transformation among small holder farmers is that in as much market participation is a consequence it is also a cause and catalyst for economic growth and development (Barrett, 2007). The importance of market participation in regards to economic growth and development dates way back to the trade theories hypothesized by Ricardo and Adam Smith. Households seek to maximise their utility by consuming what they produce and selling the surplus to consume other tradable goods and services in which they do not have comparative advantage over. Trade therefore offers households the opportunity to specialize in accordance to their comparative advantage (Duncan, *et al.*,2007; Gebremedhin and Jaleta, 2010; Onoja, *et al.*, 2012). Specialization in smallholder farmers encourages the growing of other cash crops with higher comparative advantage than the food crop.

In addition to specialization, market participation increases households' agricultural income which in return enhances the rural livelihoods. This also encourages improved technology adoption like fertilizer application, the use of improved seeds in order to ensure maximum output for profit maximization (Lawrence and Adebiyi, 2014). For poor resource constrained farmers market participation can be a tool for increasing their welfare measured through the proxy of household income (Bernard, *et al.*, 2010). Evidence suggests that improved market participation in a high price environment can provide households with the necessary incentives to invest in improved agricultural technologies and put more effort in increasing agricultural productivity (Benson, *et al*, 2012; Benfica, *et al*, 2014).

The major challenge faced by Malawi that has led to poor market participation is the lack of effective policies that address the various marketing problems faced by smallholder farmers. These challenges include, price uncertainty, access to markets, weak coordination on the various stages in the supply chain (Jayne *et al.*, 2005)**.** The existing trade policies have failed to intensify commercialization of agriculture to raise living standards and exterminate poverty and hunger (Phiko and Phiri, 2014).

Ineffective policies are implemented due to lack of empirically evidence based formulated agricultural trade and price policies which do not prompt vigorous market participation in staple crop markets (Barrett, 2007; Benson, *et al*, 2012). Policy makers and governments can only formulate and implement effective polices that stimulate the desired level of market participation, on the basis of solid empirical foundations on how smallholder farmers respond to changes in the macro economy like prices (Jayne, 2012).

Literature on staple market participation in a high and increasing price environment remains measly in Malawi. To the knowledge of the author not study on the response of smallholder farmers to the new price

environment has been done. The study therefore seeks to contribute to literature as a basis for dialogue to policy makers on interventions to stimulate market participation in the face of increasing food prices.

Maize remains the staple food in Malawi which is grown by 90 percent of the total farming households. Maize alone account up to 55 percent of the total caloric intake of the households (Jayne, *et al,* 2010). Despite maize being the main staple crop most of its production is undertaken by smallholder farmers and is mainly for consumption (Fafchamps & Gabre, 2006). This makes maize a vital policy target crop for policy interventions.

Policy makers and advocates need to pay particular attention to price fluctuations and instabilities as they will not only cause irregularities in agricultural markets and inflation threats, but also induce higher costs for importers, exporters, and final consumers (Lahiani, Nguyen, & Vo, 2013). Following the food price hike scenarios, FAO conducted a summit in 2011 to discuss the impact of global food price crisis in Developing countries. During which a call was made for research on effects of increasing global food prices to serve as a backbone for policy formulation, implementation, and evaluation in addressing the impasses food producers face to stabilize global food price prices in the future. To the knowledge of the writer no study has been done on the effects of increasing food price on market participation in Malawi. This paper there seeks to add to the knowledge bank on how increasing affects market participation in the maize markets (Bellemare, 2014; Minot, 2013;).

In order to combat the adverse effects that come with the rising prices there is need to identify and implement effective policies that aim to incite agricultural investment and enhance agricultural markets to stimulate both productivity and the growth of smallholder farmers (to transform them from subsistence to commercial farmers). Effective policies and incentives can be fomulated by observing how farmers' respond in terms of supply to changes in the macro economic environment like increase in food prices for example (Jayne, 2005).

A rich strand opf literature in regards to effects of increasing global staple food prices in Africa has been available by Jayne, *et al* 2010; Benson,*et al* 2012; Jayne 2012; Minot, 2013; Tschirley, 2012. These studies primarly focus on the consumers' welfare and various policies and concepts to mitigate against sadverse impacts on developmnets in situation of staple price hikes and no empahsis on farmers' response to high food prices after the first global price hike. The paper therefore seeks to fill the knowledge gap on how farmers' market participation and intensity responds to changes in food prices.

1.2 Objectives

The main objective of the study was to determine how increasing maize prices affect maize market participation and the intensity of participation among smallholder farmers in Malawi. Specifically the study sought to assess smallholder farmers' behaviour in the new price environment in terms of their decision to participate in markets and the quantity of maize sold.

The paper sought to answer the following research question, how do increasing food prices affect smallholder farmers' marketing decisions to participate, and the intensity of participation in maize markets.

1.3 Conceptual framework

Smallholder farmers make marketing decisions in two stages. The first stage invloves deciding wether to sell maize or not. The second stage involves deciding the quantity of maize to sell. These two stages of decision making are influeinced by factors that affect farmers as indicidual entities. These factors include household characteristics, market and infrastructures, farmers' expected and observed maize prices, production and technology and demand for maize on the market. The figure below shows the various factors and how they influence farmers decison to particpate in maize markets and the outcomes of market participation. The diagram below shows the various factors affecting agricultural marketing decision of small holder farmers.

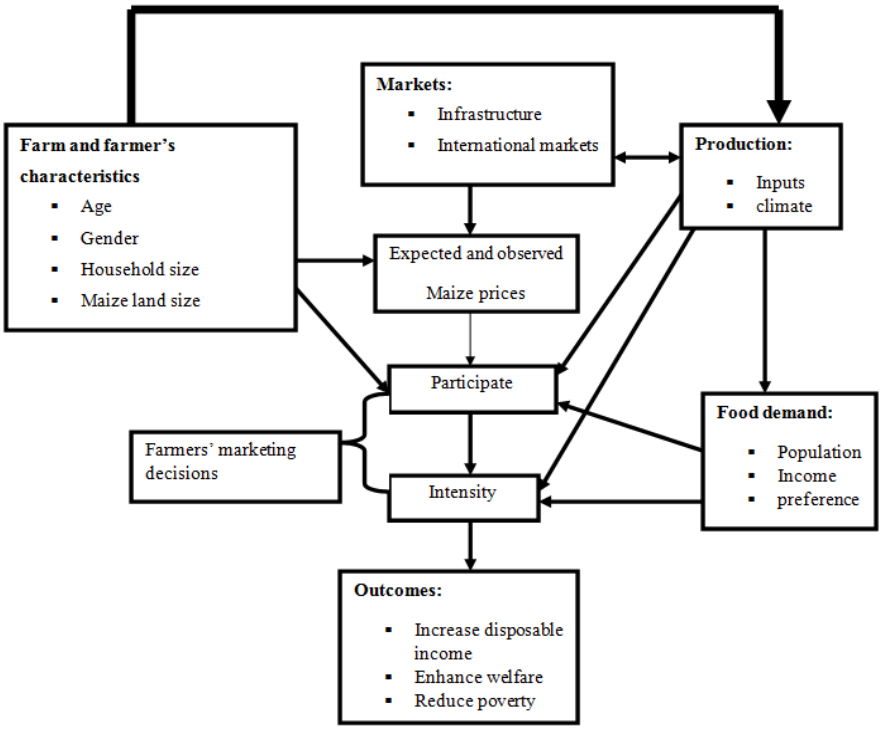

Figure 4: Conceptual framework on factors influencing farmers' agricultural marketing decisions

Source: adapted from Minot, 2013

2 LITERATURE REVIEW

This chapter reviews various studies in regards to market participation in an effort to explore the determinants of market participation among small holder maize farmers in the face of increasing global staple food prices. The first section 2.1 discusses the effects of increasing trend in global staple food prices on smallholder farmers in regards to staple crop marketing. The second section presents some relevant empirical literatures on factors affecting smallholder market participation. Specifically the section reviews factors explaining the constraints to market participation such as household endowments and transaction costs from previous studies. Generally smallholder farmers in Malawi lack incentives to produce and participate in agricultural markets due to the various challenges they face. These challenges include poor access to markets and market information, poor prices and price uncertainty which in result affects the farmers marketing and intensity decisions.

2.1 Impact of increasing staple food prices

As stated earlier there has been a significant increase in food prices since 2008 after the global food crisis. A wide range of researchers have tried to identify the culprit of the global food price hikes and their adverse impacts in developing countries (Jayne *et al.,* 2010; FAO, 2011; Benson *et al.,* 2012; Minot, 2013). The major causes include climate change, economic collapse of major economies and increase in energy costs and increase in demand for meat and meat products. The literature on the effects of increasing food prices and their impacts on developing countries mostly by Ivanic & Martin, 2008; Jayne *et al.,* 2010; FAO, 2011; Benson *et al.,* 2012 and Minot, 2013 to mention a few have focused mainly on policies on welfare of consumers as food prices increase.

The argument of focusing on consumers lies on the rationale that high food prices pose a challenge to the poor households who are net food buyers in most developing countries and increasing food prices will therefore decrease the purchasing power thus promoting hunger. A study by Jayne in 2012 found that on average 44 percent of the households in Malawi are food net buyers with only 7 percent of the total households classified as net sellers the rest are autarkic households who only produce for subsistence purposes, other might argue that these households' net purchases are equal to net sales, so in computing net sales they are likely to have zero sales. This means that increasing food prices have an adverse impact on net buying households due to the decreased purchasing power and considering the fact the net buying households are more numerous that net selling households there is need to combat the adverse effects of high and increasing food prices (Aksoy & Dikmelik, 2008;).

However the effects of increasing food prices at smallholder farmer levels depends on a household's net sales (or net purchases) of food relative to household income; the level of a household's income and assets,

which influences its food security and vulnerability to shocks; and the existence and effectiveness of government programs and policies to protect vulnerable households in a community. Within households, members are likely to be affected by a crisis to varying degrees, with the nutritionally vulnerable members include the elderly, women of childbearing age and young children being most at risk (Benson *et al*, 2008; Benson, *et al*, 2012).

Recently a study on effects of high food price on marketing was conducted in Mozambique by Benfica, *et al*, 2014, however the study focused on agricultural intensification and productivity in high price envronments. In malawi a study on the economic implications of increasing food prices demeanoured by Ularo, 2010. All these studies found that increasing food prices adversely affect low velnurable households who are characteristiesd as uneffectient, unproductive agricultural households trapped in the visicious poverty cycle. However there is aknowledge gap in determing how farmers supply responds to increasing food prices to enhance their livelihoods so they can benefit from oncreasing food prices.

On the other handother agricultural economists argued that higher staple food prices tend to transfer income from poorer rural households who are net buyers and from urban consumers to a relatively small segment of wealthier capitalized farmers who account for the lion's share of marketed grain output (Jayne *et al*, 2010). This becomes a rationale as to why we need to focus on smallholder farmers' supply response to increase in food prices.

2.2 Previous studies on Agricultural Market Participation

The primary strand of literature on the determinants of market participation in agrarian economies focuses mainly on the role of transaction costs, household resources, and endowments, policies to enhance market participation and econometric measures to combat sample selection biasness in testing market participation hypotheses. The fundamental theoretical contributions towards farmer's market participation and supply response behaviour in the presence of market failures were made by von Braun *et al.*, (1989), de Janvry *et al.*, (1991), and Fafchamps (1992). The household models formulated by de Janvry *et al.*, (1991), and Fafchamps (1992) explain explicitly is that low productivity in staple crops, transaction costs and various market failures not only hinder food crop market participation but also cash crop market participation.

Barrett (2008) presented an overview of the literature on smallholder participation in Eastern and southern African food grain markets. The major impediments to staple food markets in eastern and southern African markets include high transaction costs and are heightened by imperfect finial markets and poor infrastructures. A study in Ethiopia by Holloway *et al*, (2000) on livestock farmers and market participation, found out that farmers with lower transaction cost participated in markets and sold more because they were

likely to recover their production and marketing costs. Thus the recognition of the importance of transaction costs in market participation.

However farmers with well endowed households with both productive and non productive assets and resources like land livestock and other non agricultural income sources influence market participation. These results tally with the results from a market participation study in Mozambique by Boughton *et al.*, (2007) households with diversified assets are more likely to participate in agricultural markets.

Literature on the smallholder farmers' response to increasing staple food prices remains scanty (Benfica and Tschirley, 2012). The rationale lies on the fact that most people in developing countries are classified as net food buyers. For instance in Malawi according to Jayne (2012), only 11 percent of the total farming households are considered as maize net sellers and only 7 percent of the net selling households are large sellers (having net maize sales of more than 100kg of grain per adult equivalent). Increasing food prices adversely affect the rural poverty stricken households and the net consumers. Therefore, research and policies on staple crop price increased has mainly focused on the consumer welfare to enhance food security and control poverty (Aksoy and Dikmelik, 2008; Benfica and Tschirley, 2012).

Economic theory of demand supply states that increasing prices on the market increases supply in the long run. However in the African agriculture there is little empirical evidence to support the above agreement that increasing staple food prices will also stimulate both participation and intensity of smallholder farmers in maize markets (Jayne *et al.,* 2001; Jayne 2012; Minot, 2013). A study by Arega, *et al*, (2007) in Kenya on the effects of transaction costs on market participation and found that output prices have no significant effect on market partiction. However this study was conducted right before the global economic crisis and thus the output markets were not as volatile as they became after the global food crisis. However in our analysis we expect to see negative supply response as other studies in developing countries found that supply responses to price changes were limited and mostly up to 62 percent of the 103 countries studied, the supply elasticities where less than 0.50 percent and about 27 percent registered negative elasticities (Mather, *et al.*, 2013).

Bellemare and Barrett (2006) and Jayne, *et al.,* 2012 argued that staple food market participation is affected by numerous factors which can be categorised as socio economic factors such as household characteristics, institutional factors such as polices, transaction costs which include transportation and prices. Literature has shown that smallholder farmers are heterogeneous with great differences in terms of size, access to markets, agro-ecological conditions, and other characteristics, including their capacity to innovate in markets. Therefore policies formed tend to affect them differently.

The different types of households classified in agricultural marketing namely net sellers, net buyers or autarkic (Bellemare and Barrett, 2006; Barrett, 2008). Net sellers are those who sell in the market more than what they buy. Similarly, net buyers are those who buy from the market more than what they actually sell. On the other hand, autarkic are those who are self-sufficient or the amount they sell in the market is just equal to the amount they buy again from the market. Therefore the relative position of the households in these market regimes is bound to affect their welfare outcome in response to a given market policy instrument.

3 METHODOLOGY

This chapter aims to provide a more extensive explanation on the methods employed during the study to attain our study objectives. The first section explains on the study area followed by data sources and sampling techniques in section 3.2. The third section 3.3 to 3.4 explicitly explains and discusses the corresponding theories and econometric models that were used to perform the analyses in the study.

3.1 Study area

The study focuses on Malawi, a land locked country lying between 9° S and 17° S and longitudes 32–36° E in Southern Africa. The climate in Malawi changes from semi-arid in the Lower Shire Valley, semi-arid to sub-humid on the plateaux and sub-humid in the highlands. The average annual rainfall ranges between 763-1,143 mm per annum. There are five main land form areas namely; the Highlands, Escarpments, Plateaux, Lakeshore and Upper Shire Valley, and the Lower Shire Valley.

The highlands consist of isolated mountains between 1,320-3,000 meters above sea level. The escarpments are associated with major fault lines along the edge of the Rift Valley, running from the north to the south. The Plateaux make up quarters of Malawi consists of plateaux at elevations of 750-1300 meters above sea level. The lake shore Upper Shire Valley occupies 8% of the total land area, at 465-600 meters above sea level. The Lower Shire Valley is mostly at less than 180 meters above sea level. The figure below shows the map of Malawi.

Figure 5: map of Malawi

3.2 Data sources and sampling techniques

The study draws from two different nationally representative surveys. The first survey is commonly known the second Integrated Household Survey (IHS2) covering 2004 /2005 growing seasons. The survey was carried by the National statistical office of Malawi (NSO) implemented with financial help from the World Bank and technical support from the International Food Policy Research Institute (IFPRI). The main objective of the survey was to monitor and evaluate the changing conditions of Malawian households since the first integrated household survey which was carried out in 1997/1998 growing season[2]. The data collected provides insights on poverty and vulnerability indicators for evidence based policy formulation and monitor the progress of meeting the Millennium Development Goals (MDGs) as well as the goals listed as part of the MGDS. The study was conducted in all expect one district in Malawi. The Likoma Islands were excluded from the sampling frame, as the total population only represents about 0.1% of the population of Malawi, and the corresponding cost of enumeration would have been relatively high.

A two stage stratified sampling was applied to draw the sample frame for IHS2 using the Population Census Enumeration Areas (EAs). The primary sampling units (PSU) were the EAs. These were selected for each stratum on the basis of probability proportional to size (PPS). The household population figures used for the EAs are those from the 1998 Population and housing census[3]. The second stage involved randomly selecting 20 households in each EA. Every listed household in an EA had an equal chance of being selected to be enumerated. There was no systematic method imposed on the selection of the sample as it was randomly selected. Determination of the sample size was calculated based on the distribution of the household welfare indicator from the Integrated Household Survey 1 poverty analysis. To provide district level estimates of the mean household welfare indicator with a 15% level of tolerable error would require a national sample size of just fewer than 7,000 households. In addition to reduce sampling errors the sample selected an equal number of households from each primary sampling unit (EA). In total **11,280** households were interviewed in this survey (Malawi Governmet, 2005).

The second survey used in the study is commonly known as the Agricultural Input Subsidy Survey (AISS2) two. This survey covers the 2008/2009 growing season. The survey was implemented by the NSO in conjunction with Wadonda Consulting. The main purpose of the survey was to evaluate the implementation procedures and impacts of the farm input subsidy program. The survey was built using the sampling techniques and principles as the IHS2 making it a panel survey as well as a nationally representative survey.

[2] Other household integrated household surveys were conducted in 2010 and 2014. The later surveys could not be used as they do not form a panel survey. The study preferred using panel data to cross section data.

[3] These are population and housing counts are conducted by the National Statistical Office of Malawi every five years in Malawi with the aim of knowing the total population, population growth rate and the urbanization rate.

However due to budget constraints the sample size in this survey was reduced. The sample consists of **1,982** households (Mason and Gilbert, 2013).

Using the district, traditional authority, enumeration area and the unique household identifier recorded in each of the surveys above, a household identification was created by the author to identify panel households. The two data sets were then appended. To maintain the panel attribution, households that had the same household head over the years were kept. This was to ensure that the study examined the same households in the different price regimes (before the global food price hike and after the global food price hike). In total used 1,209 households from each survey. Table 1 below shows the composition of the households in the data set and the number of households used in the analysis.

Groups of households in the data set	**Number of households**
Households found in IHS2 only	9,899
Households found in AISS only	601
Panel Households with consistent house heads	1,209
Panel household with different heads 2004	172
Panel Households with consistent house heads	1,209
Panel households with inconsistent household heads 2004	172
Total Number of observations	**13,262**
Total number of households used in the analysis	**2418**

Table 1: Summary of types households found in the data set

3.3 Theoretical Framework

Theory about household participation in agricultural marketing can be linked to the theory of trade hypothesized by Ricardo. The theory suggests that farmers are prompted to partake in agricultural markets if they will be able to maximise their utility given that they will enjoy a diverse consumption bundle. Smallholder farmers tend to utilize welfare gains from trade by concentrating in the production of goods they have comparative advantage, and exchange for those they have no comparative advantage, these good in most developing countries are mostly manufactures. The trade theory primary explains the main intention for farmers to participate in markets that is profit maximization. However the theory does not meticulously recognize determinants of market participation let alone how farmers are likely to behave in high food price environments (Siziba, *et al.*, 2011)

The theory of market participation has evolved massively since the early 1970s to late 1985. The oldest literature on the theory before 1985 hypothesized that smallholder farmers' decisions on production and consumption are non separable. In agricultural marketing this meant that households cannot be viewed as

separately or independently from maximizing profits as a producer and utility as a consumer. The non separable theory was based on the risk averse nature of small holder farmers (as their first priority for production is to ensure consumption needs are met). Other arguments proposing the model include transaction costs and missing markets which lead to market failures. This model has important policy implications especially when modelling market failures. However depending on the nature of the market imperfections, there may be verge effects whereby policy changes have no effect on household behaviour until the change is outsized in some measure. In this environment, policy analysis assuming the existence of perfect markets may badly misstate the impact of policy changes on producer behaviour and household welfare (de Janvry *et al.*, 1991).

A further theory hypothesized by de Janvry *et al* (1991), entails agricultural household decision making in regards to market participation and explains why some farmers participate and why others eschew from participating in agricultural markets. From the results, it was made apparent that smallholder farming households in developing countries face a wedge between selling price and purchasing price of a given commodity (Olwande, *et al*, 2015). This wedge arises from a combination of factors relating to production, consumption and marketing. Production is mainly affected by lack of access to finance for key inputs and low food crop productivity.

While consumption related factors include lack of insurance mechanisms (like credit for instance) against risks of fluctuating market prices especially in food. On the other hand marketing factors include transportation costs from to the market, poor access to price information, poor market infrastructures and the non competitive behaviour of local traders (Mather, *et al*, 2013). In this study to thoroughly understand farmers' responses to increasing food prices we use the separable model where we assume production, consumption and marketing decisions are made differently.

The separable model elaborates that production, consumption, and marketing decision are undertaken separately as prices are exogenously determined in perfect markets. Primary literature on smallholder farmer participation in staple food markets builds on theoretical results focusing on the role of transaction costs as a barrier to market participation (Barrett, 2007; Arega *et al*, 2007; Adenegan, *et al*, 2012). This has led to underinvestment in institutional and physically related marketing infrastructure and thus effects of prices have remained unheard off (Mather, *et al* 2013).

We assume that a typical agricultural household will face two hurdles when making marketing decisions; whether to consume the produce and secondly to sell the produce. If the household decides to sell part of their produce on the market they are represented by $\boldsymbol{M}_{it}^{cs}$ and where $\boldsymbol{M}_{it}^{cs} = 1$ means the household decided to sell their maize in a given year t or price environment, where $t = 1$ denotes high food price

environment and $t = 0$ denotes a lower food price environment before the price hikes. $\boldsymbol{M}_{it}^{cs} = 0$ Denotes the household did not sell maize.

According to the theory of the agricultural household as applied to the marketing decision of smallholder farmers in East and Southern African conditions by Barrett (2008), the decision to participate in agricultural marketing can be expressed in the reduced form as a function of exogenous variables ($\boldsymbol{M}, \boldsymbol{G}, \boldsymbol{Z}, \boldsymbol{A}, \boldsymbol{NS}$). The vectors of the variables include the household's decision to participate in the market in the given price environment, and is equal to one if the farmer participates in the maize market and zero if otherwise. G denotes public goods and services, where as Z denotes individual household characteristics that might influence cost like search costs. A represents the productive assets owned by the household and NS denotes the total volume of agricultural net sales.

Barret (2008) argues further that farmers will make price decisions based on the vectors of the variables stated above and influence transaction costs which decline with quantities. He further differentiates the costs as household, location, and commodity specific and other costs emerge from linkages in the local, regional, and international markets (Olwande, *et al*, 2015). These transaction costs create wedges which result in price bands. If the wedge between sales and purchases prices is large, entails greater width of price band in which costs of selling exceeds the households' willingness to sell and the purchasing cost is greater than the households' willingness to pay for the commodity. A household whose internal or shadow price for the commodity falls within this price band or wedge will thus chose to not participate in the market, as either a seller or buyer. This condition is sometimes referred to as a missing market or as a market failure. In this context, market failure is household- and not commodity specific (Mather, *et al*, 2013). The reduced equation of maize market participation can be expressed as:

$$\boldsymbol{M}_{it}^{cs} = \boldsymbol{M}_{it}^{cs}(\boldsymbol{M}, \boldsymbol{Z}, \boldsymbol{A}, \boldsymbol{NS},)$$

Where;

$\boldsymbol{M}_{it}^{cs}$ Denotes the vector of quantity of maize sold in each price regime by the $\boldsymbol{i^{th}}$ household and

$\boldsymbol{M}$ Is the decision to participate in the market or not in the given price environment. The next explains how this model is laid out implicitly in application to our objectives stated above.

3.4 Empirical framework

3.4.1 The Double Hurdle Model

A rich strand of literature on determinants of market participation have used the Heckman's (1976) sample selection model and its variants which include the double hurdle, triple hurdle model and the switching

regression model Alene, *et al*, 2007; Adenegan, *et al* 2012; Mather, *et al*, 2013 Olwande, *et al*, 2015, Burke, *et al* , 2015 to mention a few. These models seem ideal to modelling market participation with the understanding that agricultural marketing undergoes through two hurdels firstly, wether to sell and secondly how much to supply on the market.

The Heckman's sample selection model involves using the tobit model in the first stage to model factors affecting the probability to sell maize and uses the mills inverse ration to determine factors affecting the quantity of maize supplied on the market. The main concern for modeling small holder market participation is that there is low market participation in staple food markets. Given the dependent variable in the first stage is binary in nature ($y = 1$ if the household sold maize at year t and $y = 0$ if the household did not sell any maize). We threfore expect alot of zeros in the first stage since most smallholder farmers do not participate in agricultural markets.

When using tobit to in the first stage, zeros are regarded as missing, censored or unobserved characteristics which is not feasible in marketing studies. When determining various factors affecting the market participation and intensity of staples by farming households, the value zero entails a valid economic choice (i.e. a rationale corner solution model) that can be explained rather than a missing value or observation. The second drawback of the Tobit model is the model assumes that factors affecting the decision to participate on the first stage and the factors affecting intensity on the second stage have the same sign. This might not be the case especially in developing countries famers might experience different hurdles in the first stage and different hurdles in the second stage like transaction costs for instance might affect sales but not the decision to participate in the market.

As explained earlier, the main objective of the study is to assess the impact high staple food prices on the households' decision to participate in maize market as sellers. We therefore added a dummy variable which indicates the different price environments, ($t = 1$, if $year = 2009$ denoting the period after prices increase and $t = 0$ if $year = 2004$ denoting the period before prices increased. This is so because we expect a positive impact on market participation and intensity). The marketing decision undergoes two stages. First, the household decides whether to sell maize or not. The second stage involves only those households that sold maize in the first stage and has to do with deciding o the quantity of maize to sell. This two-step process can be modelled as:

$$M_{vit}^{sc} = M_{vit} \times q_{vit}^{*} \quad \textbf{...Equation 1}$$

where M_{vit}^{sc} is the quantity of maize sold by household i living in village v at time period t, M_{vit} is a binary variable – that takes two possible values (zero and one) – determining whether the quantity of maize sold is

zero or strictly positive; q_{vit}^{*} is a continuous latent random variable. When a household does not participate in the maize market then $M_{vit}=0$ and q_{vit}^{*} is unobservable. Furthermore when the household participates in the market then $M_{vit}^{*}=1$ and $M_{vit}^{sc}=q_{vit}^{*}$ (note that q_{vit}^{*} is only observed when $M_{vit}=1$). The first stage can be estimated using probability distribution to determine the conditional probability of participating in maize markets. The conditional probability of participating in maize markets can therefore be modelled as:

$$\Pr\left(M_{vit}=1\middle|\mathbf{X}_{vit},t,\mathbf{D}_{v}\right)=\Pr\left(M_{vit}^{sc}>0\middle|\mathbf{X}_{vit},t,\mathbf{D}_{v}\right)=\Phi\left(\mathbf{X}_{vit}\boldsymbol{\alpha}+\beta t+\mathbf{D}_{v}\boldsymbol{\gamma}\right)\ \textbf{...Equation 2}$$

where $\Phi(\square)$ is the cumulative distribution function (cdf) for the standard normal variable; $\mathbf{X}_{vit}$ represents household characteristics that influence the decision to participate in the maize market; t is a year dummy variable ($t=1$ if $year=2009$ after the prices increased, and $t=0$ if $year=2004$ before the prices increased); $\mathbf{D}_{v}$ denotes district dummy variables capturing all unobservable factors that are constant at district level but influence market participation decisions; ε_{vit} is the independently and normally distributed error term; and $\boldsymbol{\alpha}$, β and $\boldsymbol{\gamma}$ are unknown parameters to be estimated using the Probit estimator. The district dummy variables were added to control for all the fixed effects at district level that might be correlated with the decision to participate in the market. For the sake of simplify in notation, the conditional probability could be compactly written as

$$\Pr\left(M_{vit}=1\middle|\mathbf{Z}_{vit}\right)=\Phi\left(\mathbf{Z}_{vit}\boldsymbol{\eta}\right)\textbf{...Equation 3}$$

Where $\mathbf{Z}_{vit}$ represents the set all explanatory variable explicitly presented above, and $\boldsymbol{\eta}$ denotes the set of all unknown parameters. After estimation of the unknown parameters, partial effect for continuous variable, Z_j, is given by

$$\frac{\partial\Pr\left(M_{vit}=1\middle|\mathbf{Z}_{vit}\right)}{\partial Z_{j}}=\eta_{j}\times\phi\left(\mathbf{Z}_{vit}\boldsymbol{\eta}\right)\ \textbf{... Equation 4}$$

Where $\phi(\square)$ denotes the probability density function for the standard normal variable. This last expression suggests that the estimated parameter, η_j for instance, cannot directly be translated into changes in the conditional probability resulting from changes in a given variable Z_j. The signs of the estimated parameters are, however, important in determining whether the variable will affect the conditional probability positively or negatively. To compute the average partial effect APE_j, the total number of observations N is used. The APE_j, is then computed as;

$$APE_j = \eta_j \times \left[N^{-1} \sum_{i=1}^{N} \phi\left(\mathbf{Z}_{ivt}\boldsymbol{\eta}\right) \right] \text{ … Equation 5}$$

Equation five gives the magnitude by which the conditional probability increases or decreases due to an increase in a given independent variable Z_j.

The second stage which involves market intensity decision can be modelled using two possible alternative modelling approaches as suggested by Cragg (1971): either by truncated normal hurdle model or lognormal hurdle model. If we assume truncated normal hurdle model as the one that best fits the data, then the second stage is specified as:

$$M_{vit}^{sc} = q_{vit}^{*} = \mathbf{X}_{vit}\boldsymbol{\delta} + \varphi t + \mathbf{D}_v\boldsymbol{\omega} + \varepsilon_{vit} \quad \text{... Equation 6}$$

where $\boldsymbol{\delta}$, φ and ω are unknown parameters to be estimated; and ε_{vit} denotes a truncated normally distributed error term with variance σ^2. As in the first stage, the last expression could be written succinctly as

$$M_{vit}^{sc} = q_{vit}^{*} = \mathbf{Z}_{vit}\boldsymbol{\psi} + \varepsilon_{vit} \quad \text{... Equation 7}$$

As shown by Wooldridge (2010), because $M_{vit}^{sc} = q_{vit}^{*}$ when $M_{vit}^{sc} > 0$, the conditional and unconditional expectation of maize sales are, respectively, given by

$$E\left(M_{vit}^{sc} \middle| \mathbf{Z}_{vit}, M_{vit}^{sc} > 0\right) = \mathbf{Z}_{vit}\boldsymbol{\psi} + \sigma\lambda\left(\mathbf{Z}_{vit}\boldsymbol{\psi}/\sigma\right) \text{ ...Equation 8}$$

$$E\left(M_{vit}^{sc} \middle| \mathbf{Z}_{vit}\right) = \Phi\left(\mathbf{Z}_{vit}\boldsymbol{\eta}\right) \times \left[\mathbf{Z}_{vit}\boldsymbol{\psi} + \sigma\lambda\left(\mathbf{Z}_{vit}\boldsymbol{\psi}/\sigma\right)\right] \text{ ...Equation 9}$$

Where $\lambda(p) = \phi(p)/\Phi(p)$ denotes the inverse Mills ratio. From the last expression, the partial effect is then computed as

$$\frac{\partial E\left(M_{vit}^{sc} \middle| \mathbf{Z}_{vit}\right)}{\partial Z_j} = \eta_j \times \phi\left(\mathbf{Z}_{vit}\boldsymbol{\eta}\right) \times \left[\mathbf{Z}_{vit}\boldsymbol{\psi} + \sigma\lambda\left(\mathbf{Z}_{vit}\boldsymbol{\psi}/\sigma\right)\right] + \Phi\left(\mathbf{Z}_{vit}\boldsymbol{\eta}\right) \times \psi_j \times \theta\left(\mathbf{Z}_{vit}\boldsymbol{\psi}/\sigma\right) \text{ ... Equation 10}$$

where $\theta(p) = 1 - \lambda(p)\left[p + \lambda(p)\right]$. In the last stage, average partial effects can therefore be computed from equation 10. Given our second option, the lognormal hurdle model, the intensity of participation (quantity of maize sold) can be compactly written as:

$$M_{vit}^{sc} = q_{vit}^{*} = \exp\left(\mathbf{Z}_{vit}\boldsymbol{\pi} + \varepsilon_{vit}\right) \text{... Equation 11}$$

Where exp denotes exponential function and ε_{vit} follows normal distribution with zero mean and constant variance σ^2. As in the case of truncated hurdle model, both conditional and unconditional expectations of maize sales and the corresponding average partial effects can be computed similarly. The unknown parameters for both truncated normal and lognormal hurdle models are estimated using maximum likelihood estimator.

A prior criterion for choosing between truncated normal and lognormal hurdle models is not available. Hence, the study used the Vuong test – proposed by Vuong (1989) to choose the model that best fits the data used, to model factors affecting the intensity of participation in the maize market. The Vuong test suggests a selection test to choose the best fitting model for non-nested models. Essentially, the test uses the log likelihood values of both models to test whether one model has significantly higher log likelihood than the other (Wooldridge, 2005). The null hypothesis for the Vuong test is specified as

$$H_0 : E\left[\ell_{vit}(\boldsymbol{\psi})\right] = E\left[\ell_{vit}(\boldsymbol{\pi})\right] \quad \textbf{...Equation 12}$$

Where $\ell_{vit}(\boldsymbol{\psi})$ and $\ell_{vit}(\boldsymbol{\pi})$ are, respectively, the log likelihood for the truncated normal and lognormal hurdle models. The Vuong statistic is given by

$$V = \frac{N^{-1/2}\sum_{i=1}^{N}\left[\ell_{vit}(\boldsymbol{\psi}) - \ell_{vit}(\boldsymbol{\pi})\right]}{\left\{N^{-1}\sum_{i=1}^{N}\left[\ell_{vit}(\boldsymbol{\psi}) - \ell_{vit}(\boldsymbol{\pi})\right]^2\right\}^{1/2}} \quad \textbf{...Equation 13}$$

3.4.2 Variable definition and expected signs

Dependent variables

The first stage of the analysis employs the probit model to identify factors influencing the probability of making non-zero sales. The dependent variable in this stage takes a dichotomous form. If the response is equal to one it means a household sold maize in that particular price environment and zero otherwise. In the second stage, the dependent variable takes a logarithm form of the amount of maize sold. The table below describes and defines the explanatory variables used in the analysis;

variable	Variable definition	Expected sign
Explanatory variables		
Land cultivated	Land allocated to maize cultivation (hectares)	Positive

Applied fertilizer	Whether the household applied fertilizer or not (1 = yes, 0 = otherwise)	Positive
Hired labour	Hired extra labour (1 = yes , 0 =otherwise)	Positive
Hybrid maize	Whether the household grew hybrid maize	Positive
Age	Age of household head (years)	Negative
Household size	Number of people living in the household (persons)	Negative
Gender	Gender of the household head	Positive
bicycle	Whether the household owns a bicycle (1 = yes , 0 =otherwise)	Positive
Motor vehicle	Whether the household owns a motor vehicle (1 = yes , 0 =otherwise)	Positive
Radio	Whether a household owns a radio (1 = yes , 0 =otherwise)	Positive
Log(total income (MKW))	Log (Total house hold annual income (MKW))	Positive
Northern region	Northern region (1= yes, 0 = otherwise)	Positive
Central region	Central region (1= yes, 0 = otherwise)	
Year	Year representing the various prices regimes (1= 2009,0 = 2004)	Positive
Market distance	Distance to the nearest weekly market (km)	Negative
Subsidy	Whether the household received improved	Positive

Table 2: Variable definitions and expected signs

From literature explanatory variables that have been used by various scholars to explain market participation can be classified into three categories these are: agro ecological conditions, production technologies used, market characteristics (e.g. prices and market access), and household characteristics.

Agro ecological zones

To control for spatial variation in agro ecological potential in the study, dummy variables were included for each region namely, northern, central and southern region. The variation in the agro ecological zones may arise from rainfall patterns which tend to affect maize yields. A study on market participation Olwande, *et al.*, (2015) in Kenya also included variables to account for agro ecological zone variations. To control for unobserved location specific effects the study used district dummy variables in each of the stages. Studies have used this technique for instance Boughton, *et al.,* (2007) and Mather *et al., (*2013) to control for

correlation between the the variables that might arise due to location specific variations. Examples of location specific variatios rainfall recieved and maize prices observed at district levels.

Household characteristics

We categorize household assets into the following categories namely productive assets, physical assets human and human capital. Household productive assets include physical assets such as total land size allocated to maize production. Another productive asset was the log of annual household income from both agricultural and non agricultural sources. The values were recorded in real terms using 2009 as a base year. The age of the house hold head is used in this case as a proxy for life cycle wealth effects and may also measure human capital in terms of farming and marketing experience.

We expect log of annual household income to have a postive relationship with the probability to sell maize and the amount os maize sold. Households with high icomes are more likely to partipate in maize markets as they will be able to purchase inputs to increase their production (Boughton, *et al.,* 2007; Olwande, *et al.*, 2015). We expect a negative relationship between the age of the household head and maize market participation and the amount of maize supplied on the market. Young house heads are more likely to adopt improved technologies and venture into agricultural businesses as they are more vibrant flexible than older house heads (Mather *et al.*, 2013).

In order to test for gender disparities in maize marketing a binary variable was included which is one when the household head is male and zero if otherwise. We expect a positive sign association between a male house head and market participation as men are more advantaged in terms of production resource ownership and ease of access to marketing services. Females on the other hand have huge responsibilities to cater for their households' needs and chores and thus marketing can a challenge their divided time availability.

Another household characteristic proposed to affect maize marketing is the household size which in turn affects the amount of maize required for the whole year. Large households decrease the propensity to participate in staple crop markets due to the increase in demand for food (Omiti, *et al.,* 2009). Since maize is the staple crop in Malawi we expect household size to have a negative influence on market participation and the quantity of maize sold.

Input use and improved technologies

The ability of farmers to produce marketable surplus depends on among other things the use of improved technologies to enhance their productivity. To measure the use of improved technology during maize production variable measuring hybrid seed use and fertilizer applications were used. Both variables take a

binary form in which the value one entails the household used a hybrid seed. The same applies for the fertilizer variable, equals one if the household applied fertilizer to the maize.

In addition to fertilizer use another variable called which is a subsidy proxy variable was added. This is to measure the effects of subsidized inputs on both market participation and intensity. The farm input subsidy program started in 2007/2008 growing so for the 2004/2005 farming season we used whether the household received a starter packs[4] from the government as a proxy for subsidized inputs for that particular year.

Market Characteristics

Distance to the nearest big weekly market was used as a proxy for transportation costs. The distance to the nearest big weekly market determines the specific transaction costs due to transportation. We expect a positive relationship between market distance and probability and intensity of maize supplied on the market as this would reduce the total transaction costs that arise due to transportation. Another viable reason could be the ease of price information. Households that live close to the market are more likely to observe price behaviours and thus make informed marketing decisions than households living further from market (Barrett, 2007) .

In villages with missing market distance, the average distance for the whole traditional authority area was recorded. Districts with missing market distance (in our case only one district had a missing distance market, which was not recorded) the average the average market distance for the whole region was recorded for such districts.

We included the ownership of transportation assets like bicycles and a motor vehicle to measure the impact of reducing transaction costs that arise when searching for markets and transporting maize to the market. The variables took a binary form where one indicated the household owned the particular asset and zero otherwise. Ownership of a radio was used as a proxy for market and price information. The variable takes form of a binary response where one signifies a household owns a radio and zero otherwise. Information on markets and prices can be dispersed easily to smallholder farmers through radios. Access to market price information through radios may help reduce price risk and improve farmer returns through bargaining power (Boughton, *et al.,* 2007; Mather *et al.,* 2013; Olwande *et al.,* 2015). We therefore expect radio ownership to have a positive impact on market participation and the quantity of maize supplied.

[4] The input starter packs program was implemented from 2003/2004 to 2005/2006. This involved giving 5kg of seed and 20 kg of fertilizer to smallholder farmers to boost production and household food security. The program was stopped in 2007 and the farm input subsidy programme was introduced. In this program smallholder farmers are given a coupon to purchase hybrid maize seed, legume seed, and 50 kg of both top dressing and basal fertilizer at subsidized prices.

4 RESULTS AND DISCUSSION

This chapter aims to discuss the study findings. In the first descriptive and statistical analysis of demographic, production and marketing characteristics of households present in the data set. The latter section discusses on the econometric (empirical) analyses of factors affecting the probability to participate I maize markets and the amount of maize supplied in the particular price regime.

4.1 Descriptive statistics

This section aims to describe the data based o the characteristics such as, demographics, production and marketing characteristics. This is to also examine if there has been any statistical significant change in the variables over time.

Household and demographic characteristics

The study conducted a t test on the difference in means between the demographic variables to examine if there was a statistically significant difference in the means of the following demographic variable in two price regimes. The table below shows the demographic household characteristics and the p value tested against the null hypothesis that there is no significant difference between in the household's characteristics over the period of time.

Households characteristic	2004	2009	Total	P value
Male headed households (1= male, 0 = otherwise)	.85	.85	.85	1.0000
Average household head age (years)	45	50	48	0.2214
economically active household head (1= yes, 0 =otherwise)	.88	0.76	.82	0.2090
Average household size	5	6.6	5.8	0.0023
Radio (1= owns, 0= otherwise)	0.76	0.88	0.82	0.2090
Bicycle (1= owns, 0= otherwise)	0.71	0.68	0.69	0.7967
Motor Vehicle (1= owns, 0= otherwise)	.04	.03	.04	0.5617
Log (total annual household income (MKW))	10.72	10.56	10.65	0.6475

Table 3: Household demographics characteristics

The number of households headed by males has remained constant in this study because we maintained the panel attrition by keeping the households that had the same household head over the years. On average 85 percent of the households in the study reported to have a male household head. These results match with results from National statistical office of Malawi, (2015); using data from Integrated Household Surveys conducted in 2010 and 2014 that found that over 75 percent of the total households in Malawi have a male household head.

The increase in the average age of the household head 45 years to 50 years is consistent with the panel nature of the sample. The average ages entails that these farmers are in the economically active age groups (that ranges from 19 years to 65 years in Malawi). Household heads in the economically active age category are more likely to participate in markets than other counterparts. This can be due to the creation of social networks, easy understanding, and exposure to market and new technologies and are more likely to make extra income to purchase inputs i.e. through working or piece works from other farms (Oluwatoyin, 2013).

On average 88 percent of the household heads are in the economically age group. There has been a significant increase in household size from 5 persons in per household in 2004 to 7 people per household in 2009. This increase can be due to new births coming in of new household members from extended families. However since the household size on average is relatively small, implying that the demand for food will not be as much and farmers can be able to produce enough for both consumption and marketing.

Production characteristics

The total number of households growing maize increased significantly from 2004 to 2009 by five percent. Since maize is a staple crop in Malawi, households are more likely to produce maize for subsistence purposes. Other reasons for the increase in maize production could be due o increase in maize prices. Some farmers will tend to shun away from buying maize at high prices and opt to produce maize for their own household consumption needs. The table below shows the summary statistics of production variables.

Production characteristic	2004	2009	Total	P value
Households growing maize (1 = yes, 0= otherwise)	.92	.97	.94	0.0000
Land size (Ha)	.80	.77	.78	0.4751
Whether the household received inputs from the government (1 = yes, 0= otherwise)	.64	.69	.66	0.0076
Fertilizer application (1 = yes, 0= otherwise)	.60	.77	.69	0.0000
hybrid seed (1= yes, 0 = no)	.54	.46	.50	0.0002
Hired labour (1 = yes, 0= otherwise)	.20	.20	0.20	0.9506
Maize harvested (kg)	571.27	421.82	496.81	0.0000

Table 4: Production characteristics

Land is the prime production resource for small holder farmers as it vital in enhancing production and production decisions. Land is expected to positively affect market participation as when land increases productivity increases and thus market surplus. The average land allocated to maize has remained stagnant in the panel households over the years. On average the land allocated to maize production was 0.78hactres. Similar results were found by a study by Tchale (2009) and Phiko and Phiri (2014). Smallholder farmers in

Malawi produce on less than a hactre of land. This shows stagnation in maize farming over the years, as maize remained more of a staple crop rather than a commercial crop.

The use of inorganic fertilizer has increased significantly by 16 percent. The increase could be accredited to the farm input subsidy program implemented in 2007/2008 growing seasons. On average 69 percent of the total households in the study received a form of subsidy from the government in form of coupon or free starter pack. Despite the increase in the number of households using inorganic fertilizers, the number of households using hybrid varieties decreased significantly by 7 percent.

The low use of improved varieties in Malawi could be due farmers' preferences. Local maize, which has a flint grain texture, has always been favoured by smallholder subsistence farmers due to the high proportion of hard starch granules. Another preference for local varieties due to their ease in storage management and high flour to grain extraction thus making them more preferred flavourful refined flour for cooking nsima, the traditional food (Chirwa, 2005). The low use of improved varities denote inefficiet production and entails that farmers produce mainly for subsuistence purposes than comercial objectives.

On average only 20 percent of the households admitted to use hired labour during their production activities. Hiring extra farm labour indicates large production and mostly for both subsistence and commercial purposes as family labour can sometimes be unproductive. The low use of hired labour denotes slow low maize production for consumption purposes only (Chirwa, 2005).

The amount of maize harvested despite the implementation of the farm input subsidy program has decline significantly. The average yield was 496.81 kg; this means the productivity (average yield in tons divided by the average land in hectares) on average was 0.701 tons per hactre which low in comparison to the potential yield of 100 tons per hactre. The low yields could be due to the decrease in the use of improved hybrids and other harsh weather conditions experienced in 2008/2009 growing seasons ((Mapila, *et al.*, 2013; Phiko & Phiri, 2014)

Marketing characteristics

This chapter seeks to explain and describe on the marketing characteristics of the households in the data set. The table below shows the marketing characteristics of households over the years.

Marketing characteristics	2004	2009	Total	P value
Market participators (1= sold, 0 = otherwise)	.18	.26	.22	0.0000
Log (Maize sold (Kg))	5.13	5.03	5.07	0.3563
Share of output taken to the market	.04	.20	.12	0.0019
Distance to the nearest weekly market	8.86	7.34	8.21	0.0001

Table 5: Marketing characteristics

The number of households on average selling maize has increased significantly by 8 percent. However on only 22 percent of the households sold maize. The new price environment of increasing staple food prices might have created an incentive for smallholder farmers to sell maize to increase their household income. Another reason could be increasing food prices motivated farmers to grow maize to shun from buying food at high prices and thus sold off the surplus thus increase in the number of participants. Other studies by Mather, *et al.*, (2013) and Olwande, *et al.*, (2015) noted that farmers decisions to sell maize are more responsive to chages in maize prices and are likely to sell maize whe maize prices increase.

Despite the increase in the number of households selling, there is no significant difference the quantity of maize supplied on the market. However comparing the share of output taken to the market from the harvest (*maize sold / maize harvested*) it therefore become evident that farmers are supplying more maize at the market in the new price regime than before, However due to the decrease in harvest, the amount is relatively small. Previously farmers supplied 4 percent of their produce to the market; give the new price environment farmers are supplying up to 20 percent of their produce. The increase in the crop share could be farmers' response to increasing maize prices.

There has been a significant decrease in the distance from the households or villages to the nearest big weekly market. The significant decrease in the distance to the nearest weekly market could be due to the construction of roads and new community markets in most districts during the panel period.

4.2 Multivariate analysis

It is rather common for households to shift from their net marketing position (i.e. from net buyers to net sellers annually depending on yields, shocks, and prices. For instance urban households would be expected to mostly be net buyers with little opportunity to shift to net sellers unless they are also directly engaged in agricultural production. Using point estimates like means above might not explicitly capture these dynamic

effects. There is therefore need to conduct a multivariate analysis to determine various factors affecting decision to participate and intensity in maize markets.

Firstly the market participation model is estimated as a dichotomous variable (1 when a farmer sold maize and 0 if otherwise) as the dependent variable on other explanatory variables that are believed to be correlated with the probability to participate in the maize market. Secondly we estimate the dependent variable log of maize sold on other explanatory variables that affect the quantity or intensity of maize market participation.

4.2.1 Probit results

After running the Probit model the immediate coefficient results are only useful in determining whether the variable will increase or decrease the probability of households selling maize. The table below shows the coefficients from the probit regression.

Explanatory Variable	Coefficients	Standard errors	Z value
Year (1= 2009, 0 = 2004)	0.327***	0.0717	4.56
Log(Annual household income (MKW))	0.0217	0.0267	0.81
Whether the household received inputs from government (1= yes, 0 = otherwise)	-0.0198	0.0786	-0.25
Radio (1 = owns, 0= no)	0.209***	0.0774	2.7
Market distance (km)	0.000526	0.00649	0.08
Household size	-0.0501***	0.0144	-3.48
Age of household head (years)	0.00291	0.00204	1.42
Hybrid maize seed (1= yes , 0 = no)	0.0646	0.0677	0.95
Applied fertilizer (1= yes , 0 = no)	0.264***	0.0877	3.01
Hired labour (1= yes , 0 = no)	0.529***	0.0801	6.6
Maize land size (Ha)	0.102**	0.0450	2.27
Household head gender (1= male, 0 = female)	-0.0183	0.0876	-0.21
Bicycle (1 = owns, 0= no)	0.162**	0.0741	2.19
Motor vehicle (1 = owns, 0= no)	-0.928*	0.532	-1.74
Northern region	0.730***	0.179	4.09
Central region	-0.136	0.187	-0.73
Constant	-1.770***	0.303	-5.84

Observations	2,095

*Indicates that corresponding coefficients are statistically significant at the 10%. **Indicates that corresponding coefficients are statistically significant at the 5%. ***Indicates that corresponding coefficients are statistically significant at the 1%.

Table 6: Signs of factors affecting the probability to sell maize

From the coefficients above we computed the average marginal effects (also known as average partial effects see table 8 below). The results show that holding all factors affecting households' decision to participate in maize markets, we are 99 percent confident farmers are not likely to participate in markets and thus the variables explained in the model are essential in determining factors affecting maize market participation. From the results we find that holding all factors affecting market participation constant, we are 99 percent confident that the new price regime of increasing food prices increases the probability of household selling maize by 8.4 percent. Other studies by Mather *et al*. (2013) and Olwande, *et al*, (2015) found that farmers' market participation decisions are higly responsive to changes in food prices prices. High maize prices act like incentives motivating smallholder farmers to sell maize for profit maximazation. Increased particpation might come in due to the fact that small holder farmers' might increase their productio to avoid buying maize at high prices, and might sell their maize due to realised surplus or immediate money needs that might arise due to increasing food prices.

In terms of technology and input use, we found a positive relationship between fertilizer use and the probability of a household to sell maize. Holding all factors affecting the probability to participate in maize markets in the model, a one percentage increase in fertilizer usage will increase the probability of market participation by 6.8 percent. Holding all factors affecting market participation constant, a one percent increase in hired labour to will increase the probability of household selling maize by 13.67 percent.

Holding all factors affecting market participation constant, a one percent increase in land allocated to maize production will lead to an increase in households' probability to sell maize by 2.63 percent. Households with larger households are more likely to harvest surplus production above their household subsistence needs and thus enabling them to sell. A study conducted by Demeke & Haji (2014) in Ethiopia found a postive relationship between land and the probability to sell maize.

In terms of household assets, we find a positive association between owning transportation assets that play vital roles in market information dissemination like radio and bicycle. The study found that holding all factors constant increasing the ownership of a bicycle by one percent increases the probability if household selling maize by 4.1 percent. A study by Key *et al.*, 2000; Bwalya *et al.*, 2013, found that owning transportation assets like bicycle increase the probability of a household selling as they help reducing

transport expenditure during searching and negotiating. This reduces transaction costs and thus increasing the probability of market participation in markets.

The study however the ownership of a motor vehicle negatively affects the probability of selling maize according to the study results. This could be due to the fact that a motor vehicle is not a common household asset among farming households in Malawi. Households owning motor vehicles are usually urban households who do not engage much in farming and might their vehicles for other purposes rather than agricultural purposes.

Holding all other factors affecting market participation constant, increasing the ownership of a radio by one percent increases the probability to participate in maize markets by 5.4 percent. This is so because owning a radio enables households to acquire market information at lower cost, thus reducing searching and screening costs thus increasing the probability to participate in maize markets. A study conducted by Bwalya *et al.*, 2013 in Zambia on maize market participation also found a positive relationship between radio ownership and the probability to participate in maize markets. In Malawi most radio stations have farmers programs which help in disseminating agricultural and marketing messages

The results show that household size was negatively associated with the probability of household to participate in maize markets. In the study that holding all factors affecting the probability to participate in maize markets constant we found that one percentage increase in household size reduces the probability of household to participate in maize markets by 1.3 percent. Despite being a source of family labour, huge household sizes affect maize marketing in Malawi since maize is the staple food crop, thus huge households have an increased demand for food at household level, and might find it hard to produce beyond their consumption needs and produce marketable surplus. The results on household size and probability to participate in maize market tally with other study findings by Siziba *et al.* (2011) and Oluwatoyin, (2013) on the determinants of cereal market participation in sub-Saharan Africa and Nigeria respectively.

On agro ecological characteristics, there is a positive relationship between smallholders from the northern region and the probability to participate in maize markets. Holding all factors affecting market participation constant a farmer from the northern region has a probability of 19 percent in selling maize than the other counter parts. This was significant at 99 percent confidence level. Due to the climatic conditions of the northern region maize tends to mature latter than the other regions but more likely to have bumper harvests due to rainfall patterns. Therefore farmers from the north are more likely to sell maize due to the favourable weather conditions. Stress due to dry spells and rainfall shortages will negatively affect the probability to participate in maize markets (Olwande, *et al.*, 2015)

Explanatory Variable	Average Marginal effects	Standard error	Z-value
Year (1= 2009, 0 = 2004)	0.084475***	0.018354	4.60
Log(Annual household income (MKW))	0.005611	0.00689	0.81
Whether the household received inputs from government (1= yes, 0 = otherwise)	-0.00511	0.0203	-0.25
Radio (1 = owns, 0= no)	0.053947***	0.019903	2.71
Market distance (km)	0.000136	0.001678	0.08
Household size	-0.01295***	0.003699	-3.50
Age of household head (years)	0.000752	0.000527	1.43
Hybrid maize seed (1= yes , 0 = no)	0.016699	0.017513	0.95
Applied fertilizer (1= yes , 0 = no)	0.068179***	0.022542	3.02
Hired labour (1= yes , 0 = no)	0.136741***	0.020187	6.77
Maize land size (Ha)	0.026372	0.011602	2.27
Household head gender (1= male, 0 = female)	-0.00472	0.022641	-0.21
Bicycle (1 = owns, 0= no)	0.041828**	0.019114	2.19
Motor vehicle (1 = owns, 0= no)	-0.23976	0.137432	-1.74
Northern region	0.188635***	0.045677	4.13
Central region	-0.03525	0.048375	-0.73
Constant	-1.770 ***	.3033518	-5.84

*Indicates that corresponding AMEs are statistically significant at the 10%. **Indicates that corresponding AMEs are statistically significant at the 5%. ***Indicates that corresponding AMEs are statistically significant at the 1%. To control for zone fixed effects at district levels in all the years the model included district variable in the model

Table 7: Factors affecting the probability to participate in maize markets

4.2.2 Vuong test

The study used a Vuong test to test for the best fit model between the truncated regression and the log normal regression models. As stated in chapter three, we tested the null hypothesis that there is no significant difference between the log likelihood ratios of the truncated and the log normal regression models. There after the log likelihoods of both models were then computed after running both models in stata. The difference between the log likelihoods of the models was then regressed. The regression coefficient was equivalent to – 0.0831 which was significant at 99 percent confidence level. Since the coefficient id negative and small in absolute term, this entails that the lognormal model has a higher value in absolute terms.

Remembering that log likelihoods are negative, in real terms, the truncated regression has a higher log likelihood value. We therefore reject the null hypothesis and conclude that we are 99 percent confident that there is a significant difference in the log likelihood of both models and that the lognormal model best fits the data set.

4.2.3 Lognormal regression model results

The dependent variable in this second stage takes a logarithmic form of maize sold, therefore to compute the average marginal effects of the coefficients would involve transforming the explanatory variables to semi elasticises (for variables in logarithmic form) and elasticises (for variables in a non logarithmic). However due to the scope of the study in this stage we shall only interpret the signs of the coefficient on the impact of maize sold.

Holding all factors affecting market intensity in the model constant, we are 99 percent confident that about 8.56kilograms of maize on average quantity of maize will be sold by smallholder farmers. Farmers will still sell maize regardless of prices, if they have produced surplus in a good year, with good rainfall they will sell the surplus maize. Another reason for selling maize regardless is due to immediate financial constraints and needs.

From the results above it is apparent the log of maize sold has a positive association with the log of total household income. The total household income has an effect on the amount of maize sold. This could be due to the fact that households with more income whether farm or non farm incomes are more likely to finance their production and purchase improved technologies like hybrid seed and fertilize to produce marketable surplus. These results are similar to results found by Siziba, *et al.*, 2011, also found a postive relationship between maize sold and total household income.

Hiring extra labour has a strong and positive impact on the log of maize sold and the probability to participate in maize markets. This is so because hiring extra labour increases productivity and insinuates commercial farming. Hired labour is more productive than family labour thus increasing production and yield and increasing the amount of surplus realised after harvest for sell. Similiar results were also found by Adenegan, *et al.*, 2012.

The amount of land allocated to maize production has a strong positive association with the quantity of maize supplied on the market. Land is an essential resource needed for production. The more land allocated to maize for production the more yield a farmer is likely to realise from the production thus an increase in the surplus a household will produce thus sell maize at the market in large quantities (Oluwatoyin, 2013). Several studies by Olwande *et al.*, (2015) and Lawrence & Adebiyi, (2014) to mention a few also found that increasing land for production will also increase the amount of maize supplied at the market.

Explanatory Variable	Coefficient	Standard error	Z - Value
Year (1= 2009, 0 = 2004)	-0.1637	0.10899	-1.5
Log(Annual household income (MKW))	0.08251**	0.03979	2.07
Whether the household received inputs from government (1= yes, 0 = otherwise)	-0.2347*	0.12336	-1.9
Radio (1 = owns, 0= no)	0.2636**	0.11717	2.25
Market distance (km)	-0.0097	0.0083	-1.16
Household size	0.05673**	0.02215	2.56
Age of household head (years)	0.00758**	0.00334	2.27
Hybrid maize seed (1= yes , 0 = no)	0.20554**	0.10129	2.03
Applied fertilizer (1= yes , 0 = no)	-0.1434	0.1415	-1.01
Hired labour (1= yes , 0 = no)	0.56879***	0.10873	5.23
Maize land size (Ha)	0.30028***	0.0959	3.13
Household head gender (1= male, 0 = female)	-0.1025	0.13326	-0.77
Bicycle (1 = owns, 0= no)	0.24032**	0.1077	2.23
Motor vehicle (1 = owns, 0= no)	1.37061	0.99873	1.37
Northern region	0.13694	0.28328	0.48
Central region	-0.109	0.31393	-0.35
Constant	3.156315**	.4841227	6.52

*Indicates that corresponding AMEs are statistically significant at the 10%. **Indicates that corresponding AMEs are statistically significant at the 5%. ***Indicates that corresponding AMEs are statistically significant at the 1%. To control for zone fixed effects at district levels in all the years the model included districts in the model

Table 8: Factors influencing the quantities of maize sold by households

The use of hybrid maize seed has a positive relationship with the quantity of maize sold. These results are similar to other study results by Mather *et al,* 2013. Hybrid varieties have been developed and disseminated depending on the agro ecological zones and rainfall patterns areas of specific areas to attain maximum yield. For instance in Malawi according to the zones, varieties are distributed accordingly, the southern region early maturing varieties which are drought resistant varieties, the central region medium maturing varieties, and in the northern late maturing varieties, therefore this has improved maize production and enhanced marketed surpluses in low potential zones (Mapila, *et a*l,. 2013).

Even though we expected a positive relationship between receiving subsidised farm inputs from the government to have a positive association with quantity of maize sold, the variable has a negative influence on the quantity of maize sold. The elucidation for this lies in the aims of the starter pack distribution and farm input subsidy programs. The main objective for the implementation of the input support programs was to achieve self sufficiency at household level. This discourages farmers to supply maize on the market as farm gate prices tend to be low at the beginning of the season. Large commercial farmers tend to with hold their grain in anticipation for better prices in the hunger seasons. Another reason could be that beneficiaries are not certain on the receipt of improved inputs in the next year, therefore they will dread on selling their surplus maize in order to consume the following year than to buy maize at high prices. A policy brief by Pauw & Edelman (2015) also highlighted similiar negative impacts of the subsidy program on maize marketing in Malawi.

Household size in the second tier has a positive relationship on the intensity of participation. As the household increase the amount of maize supplied on the market also increases. Even though household size has two opposing effects, where in the first stage due to food demand it reduces the probability of selling maize, increasing household size implies increasing family labour. Other studies on maize market participation Makhura *et al.,* 2001; Bwalya *et al.,* 2013 also found similar results on the relationship between household size and intensity of participation. The coherent explanation could be due to the fact that most of the households in the data set do not hire labour for maize production, the role of family labour becomes apparent, the more labour a household has, the more they are likely to produce and produce more thus increase in the quantity of maize sold.

The age of the household head has a positive relation with log of maize sold on the market. Age was used a proxy in this study for experience (both maize marketing and maize production). The positive relationship could be due to the reduced transaction costs of searching for marketing information due to the established social networks. Similar results were also found by Goetz, 1992; Mathura et al., 2001; Bwalya *et al.,* 2013, the age of the household head had a significant positive relationship with the quantity of maize supplied on the market.

In terms of household assets, ownership of transportation assets like bicycle has a positive impact on the log of maize sold on the market. This is so because in most maize Malawi, farmers bear the cost of delivering their produce at the market. Therefore owning a bicycle means reducing the amount of transaction costs of on transportation. Studies on market participation also found a positive relationship between ownership of at least on transportation asset and the intensity of participation (Makhura *et al.,* 2001; Omitti *et al,,* 2009).

5 POLICY RECOMMENDATION AND CONCLUSION

Due to increasing global food prices, food prices in the Malawian markets are also following the strong upward trend. This creates a barrier to eradicating extreme poverty and hunger as high food prices lower the purchasing power of households and negatively affects social capital thus stunting the economic growth ad development. Increasing food prices however have a strong influence on the farmers' decisions to participate in maize markets rather than o the quantities of maize supplied. This could be due to the fact that harvests are declining. The study therefore recommends the following.

Policies that stimulate maize productivity should be implemented in Malawi. In particular policies that encourage farmers to use improved varieties. This is so because the use of improved maize varieties particularly influences both marketing and intensity. Therefore, policies that enhance the use of improved varieties should be up scaled and implemented in Malawi. In the formulation of the improved varieties is important to consider farmers' preferences and the various agro ecological zones. This will increase the use of improved varieties ad the effectiveness of improved varieties.

Other productivity enhancing policies include land reformation policies. Land should be easily accessible to smallholder farmers for them to enhance their production. Acquiring land will easily transform smallholder farmers from subsistence oriented to commercial oriented farmers. Policies and programs that increase incomes should also intensified jointly to increase the households' total incomes and asset base such as transportation assets. Examples of these actions could be work for asset programmes, provision of small agricultural loans to enable them to acquire improved inputs to increase their productivity.

The use of hired labour is important for both market participation and intensity of participation in maize markets. The study therefore recommends the use of more cost effective labour, which involves using animal tract. Human labour could be more expensive and less efficient than animal tract the study therefore recommends the use of animal tract to enhance extra labour thus increasing productivity (Olwande, *et al.*, 2015). There is need for more research on the effects of the subsidy program in regards to maize crop marketing in Malawi given the regime of increasing food prices. Thorough research should be done further on the topic in regards to subsidies. This will help in highlighting the shortfall of the program and create strategies on how improve the program to stimulate more market participation and intensity in the new price environment.

To create an incentive for farmers to sell more produce the government should not intervene in the maize price formulation. However to protect both consumers and encourage farmers to sell maize government through channels like ADMARC might purchase maize from smallholder farmers from their very own location thus minimising their transaction costs that arise from transporting their produce to the nearest

market. Private maize buyers like ADMARC, processing industries and other intermediary players along the maize value chain should announce their maize prices through channels like radios earlier on before maize productions to enable farmers to make informed decisions to participate in maize markets.

5.1 Limitations of the study

The study sought to assess the impact of increasing food prices on maize market participation, however due to lack of data from the previous years before prices increased the study used data from 2004/2005 growing as a baseline and 2008/2009 as data after the food prices had increased. Since the food prices increased in 2007, it seems too consecutive to measure the impact of food price using data from 2008/2009 as some households might take time to adjust to price changes. However for a rational household, it is possible to adjust to changes on the market and prices within two year to make informed marketing decisions.

The study used data from different surveys; IHS2 and the AISS2. The surveys had different objectives, for instance the main objective of the IHS2 is to monitor living conditions and see how they have changed over time. On the other hand the AISS2 is to monitor the implementation of the farm input subsidy program in Malawi and its impact on households. It was impossible to gather some important variables that would have been relevant in explaining market participation and intensity in our study. Finding variables that were consistent in both surveys was a challenge as a result the study observed very few variables. Other important variables that were not observed but could have been relevant in explaining market participation include marital status, education status, extension visits, data on household consumption and credit accessibility.

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