EFFECT OF BUYER TYPE ON MARKET PARTICIPATION OF SMALLHOLDER FARMERS IN NORTHERN GHANA

by

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Abstract

Transaction costs, one of the most significant barriers to market participation, may vary by buyer type. Depending on who a farmer sells their produce to, they may alter their potential transaction costs consequently influencing their market participation. This study examines the effect of buyer type on smallholder market participation in Northern Ghana where poverty is still endemic and often exacerbated by fewer opportunities for commercialization such as limited access to markets. The analysis is based on data from the agriculture production survey conducted in 2013 and 2014 and the Population based Survey conducted in 2012 in northern Ghana. Analysis is performed using the Double Hurdle approach to control for self-selection bias, ensure more flexibility on the variables affecting the decision to sell and how much to sell as well as to provide unconditional effects of the variables on market participation.

The results reveal greater market participation of cash crop producing farmers than those producing a lower value food crop - Maize. The results also show that farmers selling to aggregator-type middlemen and other buyers have a propensity to sell more. The aggregators and 'other buyers' buy in bulky, offer lower prices and are associated with lower transport, loading and offloading costs than consumers. Farm output, access to information and price also have a significant positive impact on intensity of market participation. These findings support policy initiatives such as supporting aggregator-type middlemen, increasing the provision of information, promotion of cash crops as well as supporting more interventions focusing on increasing production and yields.

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Dedication

This thesis is dedicated to my first born son, Chansa Ufya Chishimba III.

Chapter 1 - Introduction

1.1 Importance of Agriculture in sub Saharan Africa

At least half of the world's food insecure are poor smallholder farmers living in low-income countries cultivating on marginal lands without access to productivity-enhancing technologies or markets to engage in commercial agriculture (Shetty 2006). Africa has the highest proportion of rural poor and the greatest potential for smallholder agricultural led poverty reduction (Livingstone, Schonberger and Delaney 2011). Over three-quarters of the poor in Sub-Saharan Africa (SSA) live in rural areas and more than 80% of rural households are engaged in farming activities to generate income and/or to meet their own food requirements (International Fund for Agricultural Development 2011). In SSA, agriculture accounts for 70% of employment and 17.2% of GDP (World Bank 2000, 2015). Agriculture, particularly smallholder agriculture, is the main source of livelihood for people in SSA and it is vital for the economic development of SSA countries.

Given the importance of agriculture on livelihoods and economic development, many African countries have placed a high priority on strengthening smallholder agricultural competitiveness as a strategy to reduce national poverty (Hammouda et al. 2006). The World Bank (2007) has emphasized the role of agriculture in developing countries stating that GDP growth originating in agriculture is about four times more effective in reducing poverty than GDP growth originating outside the sector.

Currently, the agricultural sector in Africa consists mainly of rain-fed, low-technology, low-input, non-mechanized smallholder farming (International Fund for Agricultural Development 2011). Smallholder farming is the dominant mode of agriculture in SSA with 80% of its farms comprising of 2 hectares or less (Fanzo 2012). Barrett (2008) refers to this state of agriculture as "low-level equilibrium – a poverty trap" from which farmers must be broken out of and shifted towards productivity and commercialization partly through increased smallholder market participation. Interventions aimed at facilitating smallholder organization, reducing the costs of intermarket commerce, and improving poorer households' access to improved technologies and productive

assets are central to stimulating smallholder market participation and escape from semi-subsistence poverty traps in the region (Barrett 2008).

1.2 The Role of Market Participation in Smallholder Agriculture

Deliberate efforts to encourage smallholder market participation have not always been a necessity. Before the 1980s, marketing was the responsibility of the government which in some cases collected market produce from the farmer's household. Beginning in the early 1980s, however, most SSA countries adopted agricultural market reforms in an effort to liberalize the markets (Kherallah et al. 2002) and eliminate many of the inefficiencies brought about by government involvement in the marketing process (Williams 2009). These World Bank and International Monetary Fund (IMF) inspired reforms transferred the responsibility of marketing agricultural produce from the government, through agricultural marketing boards, to the farmers and private sector. Since then, farmers have had to largely find/select their own buyers but have also been faced with a number of challenges in trying to access the markets.

Alene et al. (2008) assert that although market reforms have been introduced in many countries in SSA since 1980s with a view of enhancing the efficiency of input and output markets, transactions costs in production and marketing may have actually increased. Market access for most smallholder farmers in SSA countries has remained low post market reforms largely due to numerous barriers to market access and participation faced by the farmers such as significant distance to market, poor road infrastructure, limited access to resources and information, and associated high transaction costs for selling products in the market (Alene et al. 2008). Some of the smallholder farmers in Africa are essentially stuck in a poverty trap—too poor to achieve robust and high levels of economic growth, and in many places, simply too poor to grow at all due to high transport costs and small markets, low productivity agriculture, high disease and malnutrition burden, adverse geopolitics and slow adoption of technology from abroad (United Nations Millennium Project 2005)

Stimulating smallholder market participation is one way of breaking the rural poor free from their poverty trap (Barrett 2008). Market participation is important because of its potential for creating economic opportunities, improving production systems and enhancing incomes for smallholder

farmers (Omiti et al. 2009; Alene et al. 2008; Jagwe, Machethe, and Ouma, 2010). Research conducted in Kenya and South Africa found a positive relationship between the share of households' agricultural output sold in the market and the level of production efficiency and yields (Omiti et al. 2009; Barrett, 2008). However, the potential of markets as an engine of agricultural growth and a pathway to exit poverty for the majority of the poor smallholder farmers in the region remains not fully exploited by most SSA countries (Siziba et al. 2011).

1.3 The Case of Ghana

Ghana is located on the West Coast of Africa sharing borders with Burkina Faso, Cote d'Ivoire and Togo (World Atlas 2015). It is the 82nd largest nation in the world with a total area of 238,533 square kilometers (World Atlas 2015). Formerly known as the Gold Coast, Ghana was the first SSA nation to gain its independence in 1957 (BBC News 2016). Its capital city is Accra, its major languages are English, Akan and Ewe while its major religions are Christianity, Indigenous beliefs and Islam (BBC News 2016). Its population is estimated at 26.8 million with a life expectancy of about 61 years at birth (World Bank 2016). Ghana is a lower middle income country with an estimated gross domestic product (GDP) of $38.62 billion, an annual GDP growth rate of 5.7 and a national poverty ratio of 24.2% of the total population (World Bank 2016). Its principal exports include cocoa, timber, horticultural products, fish/sea foods, game and wildlife and its major mineral resources are petroleum, gold, bauxite, manganese and diamond (Ghana Ministry of Food and Agriculture 2013)

Similar to other SSA countries, agriculture is a key sector of Ghana's economy. It is the mainstay of the economy accounting for about 23% of the national GDP (Food and Agriculture Organization 2015) and is the largest source of employment; employing more than half of the total labor force approximately 49% of men and 51% of women (Feed the Future 2011). Development of the agriculture sector is, therefore, a declared priority for the Ghanaian government (Food and Agriculture Organization 2015).

The largest contributor to Ghana's agriculture's GDP are crops (not including cocoa) estimated at 61.3%, followed by cocoa (13.3%), forestry and logging (11.1%), livestock (7.5%) and fishing (6.9%) (Ghana Ministry of Food and Agriculture 2013). Ghana's main agricultural commodities

include cocoa, cassava, yam, banana and maize, as well as fruits and other cereals (e.g. millet, sorghum, rice) (Food and Agriculture Organization 2015). Its staples include maize and rice (Wood 2013). The country is also promoting the production of soybean because of its potential to increase income and enhance the nutritional status of households (Mbanya 2011). Table 1 shows the major cereal crops grown in Ghana. Although food secure in most staple crops, Ghana has a significant deficit of nearly 70 percent of its rice needs and 15 percent of its maize needs (Feed the Future 2011).

Table 1: Ghana's Major Cereal Crops

	Maize	Millet	Sorghum	Rice
Average Annual Production (000 MT	1835	194	297	479
Average Yield (MT/Ha)	1.9	1	1.2	2.5
Per Capita Consumption (kg/head/year)	45	5	5	24

Source: Ghana Ministry of Food and Agriculture 2013

Ghana is the first country in SSA to meet the Millennium Development Goal (MDG) target of halving extreme poverty by 2015 (United Nations Development Programme 2012). Its economy has maintained a commendable growth trajectory with an average annual growth of about 6.0% between 2008 and 2014 and is expected to continue having a robust growth rate of around 8% in the medium term (1-4 years) (Okudzeto et al. 2014). Its growth is bolstered by improved oil and gas production, increased private-sector investment, improved public infrastructure development and sustained political stability (Okudzeto et al. 2014).

Despite Ghana's impressive economic progress, poverty is still quite endemic in the northern regions of the country. More than half of the country's population living in extreme poverty lives in the northern part of the country (Savannah Accelerated Development Authority 2010). While the country has recorded an overall reduction in poverty from 52% to 28% between 2000 and 2010, the northern part of the country has poverty rates that are nearly twice that of the south (Feed the Future 2011). Similarly, the World Bank (2012) reports that while the number of poor in southern Ghana declined by 2.5 million between 1992 and 2006, it increased by nearly 1 million in northern Ghana. Further, while only 5% of Ghana's population is considered food insecure, the proportion of residents in the northern part of the country that are food insecure has been estimated to be anywhere from double to seven times the national average (USAID|Ghana 2012, Feed the Future

2011). Although there has been an 11.7% reduction in people living on less than $1.25 a day in northern Ghana between 2012 and 2015 (Zereyesus et al. 2014, 2016), households in northern Ghana still remain more vulnerable than the rest of the country.

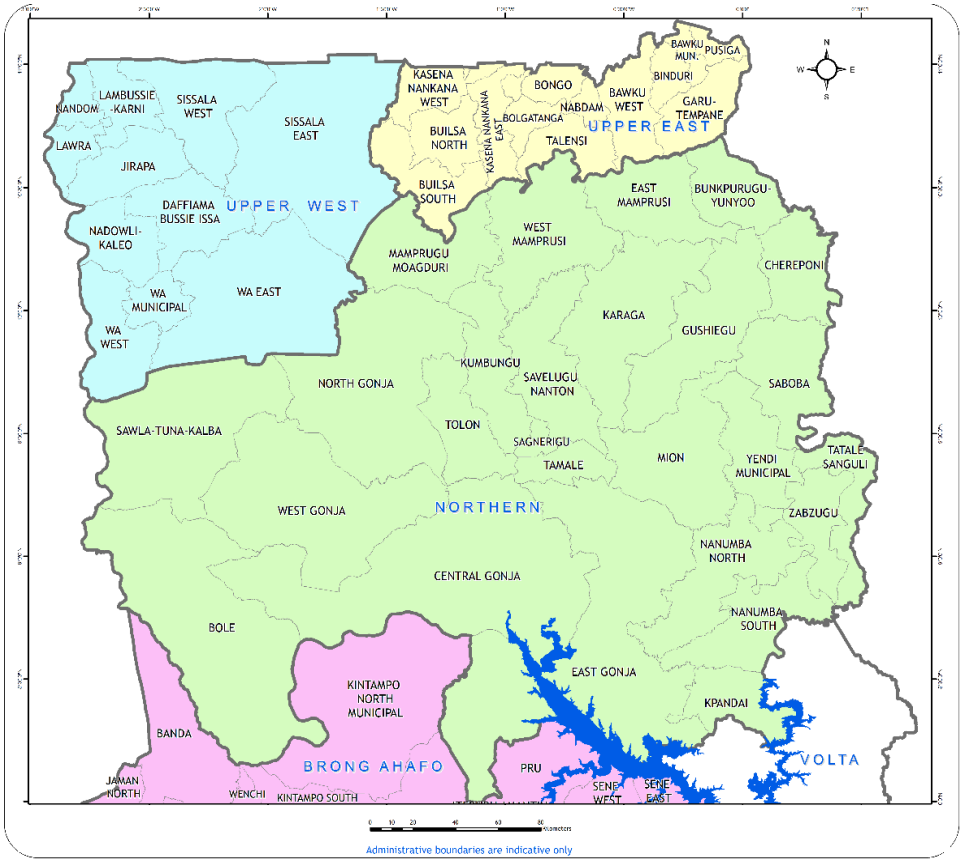
According to Chamberlin et al. (2007), the higher rates of rural poverty in the northern regions of Ghana are likely exacerbated by factors linked to fewer opportunities for intensifying and commercializing agriculture, such as poorer access to input and output markets. The marketed share of farm products and the percentage of farmers who sell their produce tend to be lowest in northern Ghana (Chamberlin et al. 2007). Because more than 70% of the economically active population in northern Ghana is engaged in agriculture, forestry and fishing activities (Ghana Statistical Service 2012), improving market access for farmers in this region is likely to have a significant impact on poverty reduction.

1.4 Feed the Future Initiative

Feed the Future is the U.S. Government's global hunger and food security initiative that supports country-driven approaches to address the root causes of hunger and poverty (Feed the Future 2012). It aims to reduce the prevalence of poverty by 20% and the prevalence of stunted children under five years of age by 20% in the areas where the initiative is implemented (USAID 2015). This initiative has been established on the belief that agriculture is key to reducing hunger and extreme poverty.

In Ghana, the Feed the Future - initiative is focused on achieving a substantial increase in key staple food production and intra-regional staple food exports (Feed the Future 2011). The approach focuses on closing the yield gaps and reducing pre- and post-harvest losses of the country's major staple crops (e.g maize, rice), improving the efficiency of their value chains, and strengthening the regulatory system and policy frameworks to support regional trade (Feed the Future 2011). Due to the aforementioned disparities between the northern and southern regions of Ghana, the Feed the Future initiative in Ghana has concentrated its intervention activities in the northern part of the country (USAID|Ghana 2014) i.e., Northern, Upper East, Upper West and some parts of Brong Ahafo Region.

Figure 1: Zone of Influence for the Feed the Future Initiative in Northern Ghana



Source: USAID-METSS, 2015

Targeting northern Ghana ensures that the initiative maximizes its impact by directing efforts to the region with the greatest need and taking advantage of the clear understanding of the poverty challenge and opportunities in that region. The specific objectives of the Feed the Future initiative in Ghana's northern regions are to increase resilience of vulnerable households and maintain food security throughout the year by diversifying household income, encouraging the production of nutritious foods for household consumption and income generation, supporting communities to develop plans for storage, food safety, and food security, and improving nutrition-related behaviors (Feed the Future 2011).

1.5 Motivation: Transaction Costs and Buyer-type

Transaction costs are said to be the most significant barrier to market participation for subsistence agricultural producers in SSA (Alene et al. 2008; Jagwe, Machethe and Ouma 2010). A multitude of studies have shown that transaction costs determine households' decisions to either participate in the market or not (Goetz 1992; Key, Sadoulet, and Janvry, 2000; Randela 2008; Alene et al.

2008). The economic literature defines transaction costs as the combination of the observable (e.g., transport, loading/offloading costs) and non-observable costs (e.g., cost of negotiating, cost of enforcing contracts etc) associated with the exchange of goods and services (Coase 1937).

While some operational costs (e.g., licenses and certifications, vehicles, buildings) are common among all marketing channels, each channel has additional costs (e.g., transport costs) and requirements that are specific to that channel (LeRoux et al. 2010). Since transaction costs across different marketing channels may vary widely, in some industries, the selection of marketing channel (i.e., buyer) may be a prime opportunity for cost reduction (Payne and Frow 2013). In fact, some literature has identified marketing channels as the new avenue for cost control in the twenty-first century (Moriarty and Moran 1990; Kotler and Keller 2009). By choosing buyers who are associated with lower acquisition costs, sellers may attain an overall transaction cost saving (Bharadwaj and Matsuno 2006). For example, the decision to sell to buyers who are in close proximity to the farmer may result in lower transport costs compared to selling to buyers who are further from the farmer.

Numerous studies have confirmed the strong negative relationship between market participation and transaction costs (Shepherd 1997; Heltber and Tarp 2002; Alene et al. 2008; Ouma et al. 2010; Azam, Imai, and Gaiha 2012 and; Hlongwane, Ledwaba and Belete 2014). Depending on the choice of buyer-type, farmers may alter their potential transaction costs thereby influencing their market participation. Supply chain management research has shown that well-functioning buyer-seller relationships facilitate exchange and reduce transaction costs (Stem and Reve 1980; Joseph and Perreault 1999; Shawnee et al. 2003; Ik-Whan 2005). By choosing buyers who provide lower acquisition costs, sellers may attain an overall transaction cost saving (Bharadwaj and Matsuno 2006).

The marketing channel/buyer type and price are two of the four elements of marketing (the other being product and trade promotion) that a manager (i.e., farmer) can control (Rao 2009). Although literature has typically assumed that transaction costs are exogenously determined (Fafchamp and Hill 2005), farmers have the ability to choose the marketing channels (i.e., buyer types) to sell to which renders transaction costs endogenous (Barrett 2008). Therefore, focusing on the effect of

buyer-type on market participation has the advantage of bringing transaction costs, the most significant barrier to market participation, under the control of the farmer. More importantly, marketing channel data is easier to capture and more exhaustive than transaction cost data which includes both observable and unobservable costs. There is however a dearth in knowledge on the effect of these marketing channels (i.e., buyer-types) on market participation in general and even more so for smallholder farmers in SSA. It is not clear if, and to what extent, buyer-type affects market participation of smallholder farmers in rural SSA where the impact of high transaction costs paralyzes much of the smallholder market participation.

1.6 Thesis Objectives

The main objective of this thesis is to determine the effect of buyer-type on market participation of smallholder farmers in northern Ghana. The question being addressed is whether the level of market participation either improves or deteriorates depending on the buyer-type that the farmer sells to.

The marketed share of farm products and the percentage of farmers who sell their produce tend to be lowest in northern Ghana compared to the rest of the country (Chamberlin et al. 2007). In northern Ghana, production of grain crops such as maize, rice and soybean is overwhelmingly dominated by smallholder farmers in areas that are considerably remote where barriers to market access are more pronounced. For example, transaction costs along the maize chains may be equivalent to 80% of the farm gate price (Chamberlin et al. 2007). Market-driven assistance programs that link smallholder producers to markets can therefore serve as important avenues for increasing incomes and reducing food insecurity in northern Ghana. A better understanding of the effect of buyer-type on market participation, which is directly linked to transaction costs, is critical in understanding why some farmers opt to participate as sellers while others choose not to. Having a better understanding of factors influencing a smallholder farmer's decision to participate in the market would help agribusinesses and policy makers to develop appropriate intervention measures that would enable the rural populations to actively participate in the market thereby increasing their incomes.

To achieve this objective, data from the USAID|Ghana's 2013-2014 Agriculture Production Survey and the 2012 Population based Survey are used. The analysis is performed using the Double Hurdle approach to control for self-selection bias, to ensure more flexibility on the variables affecting the decision to sell and how much to sell as well as to provide unconditional effects of the variables on market participation.

1.7 Thesis Outline

Literature on market participation will be reviewed in this thesis. Studies that have looked at market participation, transaction costs and middlemen in agricultural marketing, both in SSA and other areas will be presented. After the literature review section, the data and methods employed in this study will be explained. This will involve a discussion of the conceptual framework, the data used and empirical model. The results section will capture the output of the model used, report results and a discussion of results. The final section covers the implications and conclusion of the study.

Chapter 2 - Literature Review

This Chapter looks at literature on market participation, transaction costs, buyer-types literature for Sub Saharan Africa and other areas. Firstly, literature looking at the sequential and simultaneous nature of marketing decisions is reviewed, then the relationship between transaction costs and market participation is carefully appraised. Since transaction costs may vary by buyer type, the types of buyers in SSA markets are identified. The debate on middlemen (all buyer types between the seller and the final consumer) is explored. The section ends by reviewing findings on the factors affecting probability of participation and intensity of market decision. The factors affecting these decisions may be different and may affect the decisions in different ways.

2.1 Market participation decisions: Simultaneous or sequentially made

Market participation implies produce offered for sale and use of purchased inputs (Berhanu et al. 2010; Omiti 2009). In this study, market participation infers only to produce offered for sale and not the use of purchased inputs. Intensity of market participation is measured as the quantity of total output that is sold. Market participation is, therefore, simply concerned with the decision to sell while intensity of participation is particularly concerned with how much output to sell.

It is important to determine if the decision to sell and the decision of how much to sell are made simultaneously or sequentially. If farmers make these decisions simultaneously, they pre-commit to a volume before receiving information available to them at the time of the sale. This simultaneous decision making by the farmer gives their buyers more market power by rendering their supply inelastic with respect to new market information (Bellemare and Barrett 2006). If the decisions are made sequentially, however, the farmer makes the decision on how much to sell after receiving new information discovered at the market at time of sale. This reduces the buyer's capacity to enjoy all gains from trade (Bellemare and Barrett 2006).

Goetz (1992) modeled the agricultural household's discrete decision of whether to participate in markets separately from the continuous decision of how much to trade, conditional on market participation. He modeled the household as making the discrete market participation choice simultaneously with the continuous decision of how much to trade. He used this model to

separately identify the effect of proportional and fixed transaction costs on supply response. Similarly, Key, Sadoulet and Janvry (2000) model the market participation decisions as simultaneous decisions implying that farmers pre-commit to a quantity to sell before getting to the market hence giving the buyer more power. That is, the farmer's supply is inelastic to new information and prices.

Randela (2008) and Boughton et al. (2007) agree that marketing behavior is a two-step decision process in which the household first decides whether or not to participate in the market, and then establishes how much to sell. Bellemare and Barret (2006) developed a two-stage econometric method that allowed them to test whether rural households in developing countries make market participation and volume decisions simultaneously or sequentially. They found evidence in favor of sequential decision making, implying that households that make sequential marketing decisions are more price-responsive and less vulnerable to trader exploitation. This study assumed that marketing decisions are made sequentially. Therefore, the farmer's supply is assumed to be elastic to information and price, and in addition, the decisions may be affected by different factors and in different ways too.

2.2 Transaction costs and Market Participation

Economic literature defines transaction costs as the combination of the observable and non-observable costs associated with the exchange of goods and services (Coase 1937; Goetz 1992; Staal, Delgado, and Nicholson.1997). They include costs of discovering what the prices are, negotiating and closing a contract (Coase 1937). Past studies have separated transaction costs into fixed and proportional transaction costs. Fixed transaction costs (FTCs) are invariant to the volume of output traded and affect smallholder farmers' market participation decisions while proportional transaction costs (PTCs) are the per unit costs of accessing markets that vary with the volumes traded and may affect the decision to participate in the market as well as the quantity traded (Jagwe, Machethe and Ouma 2010). Distance to market is considered as a proxy for FTCs (Randela 2008) while PTCs include costs associated with transferring the output being traded, such as transport costs and time spent delivering the product to the market (Jagwe, Machethe and Ouma 2010).

A number of studies in the SSA context have been carried with a varying but closely related array of findings. Several studies have shown that there is a strong negative relationship between market participation and transaction costs (Shepherd 1997; Heltber and Tarp 2002; Alene et al. 2008; Ouma et al. 2010; Azam, Imai, and Gaiha, 2012; Hlongwane, Ledwaba and Belete 2014). Jagwe, Machethe and Ouma (2010) found that FTCs largely determine a farmer's decision to participate in the market while the extent of participation is affected mainly by PTCs.

2.3 Buyer Types in SSA

As earlier mentioned, transaction costs may vary by marketing channel (buyer type). There are many different buyer types to which smallholder farmers in rural SSA can sell their produce to. The seller (farmer) needs to identify the buyer types available to carry on his channel work (Kotler and Keller 2009). In traditional rural markets in developing countries, the main buyer types were classified as the itinerant village trader, the trader in the wholesale market and the trader in the final market (Galor 1990). The itinerant village trader is sometimes himself the producer and in other cases, the one who transports goods to and from the wholesale markets (Galor 1990). The trader in the wholesale market is the one who forms the link between the village level and the secondary (wholesale) market level while the trader in the final market represents more serious purchasing outfits, operates on a commission basis and takes care of cleaning up the produce, processing, weighing, packing as well as dispatching to centers of transportation (Galor 1990).

Presently, these market actors have been categorized slightly differently in different countries. For example, in Ethiopia, grain marketing participants consist of buyers like local assemblers/collectors, wholesalers, cooperatives, consumers, government agencies and processors (Muluneh 2010). In the Kenyan grain market however, Shiferaw et al. (2009) discovered that the major middlemen include rural wholesalers, brokers/assemblers, producer marketing groups and other local buyers. For Ghana, where crop production in its northern region is overwhelming dominated by smallholder farmers residing in areas that are considerably remote and barriers to market access are more pronounced (Chamberlin et al. 2007), the main buyers in the maize supply chain include the farmer/seller, local assembler, commission agent, long-distance wholesaler, market-based wholesaler and market-based retailer (Asante 2011). Chapoto et al. (2014) states that the updated market categorization of these buyers in Ghana's grain market consist of five major

ones: small scale traders, large scale traders/ wholesalers, retailers/ marketers, processors and other buyers which comprise of other households, National Food Buffer Stock Company (NAFCO), out growers, and others.

These buyer-types account for different proportions of the market in different countries. Shiferaw et al. (2009) analyzed the Kenyan grain market structure in terms of transactions during 2005. His findings show that rural wholesalers accounted for 45.0% of sales and 49.0% of the volume traded, while brokers/assemblers accounted for 38.0% of sales and 38.0% of volume. The nascent producer marketing groups accounted for only 4.0% of the sales and 2.0% of the volume, while the rest (10.0–12%) was handled by other local buyers. For the Ethiopian grain market, Muluneh (2010) shows that the market share of buyers is such that, wholesalers account for 31.0%, followed by assemblers at 29.0%, consumers at 16.0%, Cooperatives at 14.0% and others buyers at 10.0%. According to Gebremedhin and Hoekstra (2008), wholesalers and retailers are the main buyers in teff and wheat markets in the Ethiopian grain market with about 65.0% and 51.0% of teff and wheat producers, respectively, selling through wholesalers and retailers and only 2.0% and 6.0% of teff and wheat producers, respectively, selling directly to consumers. In the case of Ghana, Chapoto et al. (2014) found that the majority of maize and rice sales in 2013 were to small-scale traders and retailers, which represents 39.2% and 36.4% of maize and rice sales, respectively. Processors had the smallest proportion of maize sales of only 0.1%. Large scale wholesalers had 16.5%, while other buyers had 7.9% of maize sales. Similarly, the largest proportions of rice sales in Ghana were to retailers (44.9%), compared to small scale traders (33.9%), wholesaler (6.4%), processors (9.2%) and other buyers (5.7%).

These buyer-types also differ in proximity to farmers' location, prices they offer for the produce and how much produce they buy from the farmers. For example, Chapoto et al. (2014) show that maize farmers selling to retailers traveled the longest average distance of 8.2 km, followed by small scale traders (7.9 km) and large scale traders/wholesalers (5.8 km). Rice farmers selling to retailers also travelled the longest average distance of 7.4 km, followed by small scale traders (6.7 km) and wholesalers (3.1 km). In Kenya, Bekele et al. (2007) found that as the distance from the farm gate increased, the number of transactions and volumes traded by market participants

declined. This relationship could be attributed to the increasing transportation and transaction costs associated with marketing the small quantities as the distance increases.

Results of a study conducted by Muluneh (2010) in Ethiopia discovered that market share of market participants in terms of quantity of wheat and teff bought were the largest for wholesalers at 36,650 kg compared to local assemblers at 33,700 kg, cooperatives at 16,550 kg, consumers at 18,000 kg and other buyers at 11,650 kg. Price may likewise differ widely among different buyer types mostly in proportion to the distance between the buyer and the farmer. For example, Bekele (2007) found that urban buyers offered a price that was more than 20% of the rural price for grains in Kenya.

2.4 Middlemen: proponents and opponents

While buyer types include all persons or entities to whom the farmer sells their produce, middlemen are intermediaries involved in the physical flow of produce from the farmer to the ultimate consumer/ user (Segetlija, Mesarić and Dujak 2010; Johri and Leach 2002; Olsson, Gadde and Hulthén 2013). Therefore, unlike buyer type, middlemen excludes consumers/final users. These middlemen usually buy produce at a low price and sell at a higher price to cover transaction costs and make a margin. This has sometimes been viewed as making profits from the seller (farmer), thus an act of exploitation. A debate on the role of middlemen in the market has consequently ensued.

Critics of the role of middlemen in markets argue that the opportunistic behavior of middlemen is expected to raise transaction costs and create imperfections in the market (Woldie and Nuppenau 2011), and that their high margins distort the market by driving a wedge between the price paid to farmers and by final consumers (Mitchell 2011). Farmers' production and marketing decisions may be sub-optimal due to risk aversion or minimization interests because of price volatility due to high risk and uncertainty, which is partially attributed to middlemen participation (Getnet 2008). According to Davies (2012), middlemen are popularly viewed as "parasites", that is, they do not create wealth or value because they do not actually create anything real such as a physical product or a direct service.

Proponents of middlemen , on the other hand, reason that middlemen are responsible from moving products from producers to final consumers, as well as overcoming the time, place, and possession gaps that separate goods and services from those who need or want them (Kotler and Keller 2009). Mintz (1956) argue that "it is dangerous to assume that middlemen are "parasites" who interpose themselves between producer and consumer and levy a toll on both without rendering any service." Segetlija, Mesarić and Dujak (2010) say Middlemen are important as a component of value chains in the function of consumption, production and competition development. Rubinstein and Wolinsk (1987) and Yavas (1992, 1996) also say that the role of middlemen is to reduce the time-preference losses that occur when agents must search for a trading partner. (Biglaiser 1993) claims that middlemen use quality controls that would be too costly for individual consumers to use. Biglaiser and Friedman (1994) also assert that middlemen obtain goods from several competing sources and can therefore enforce quality standards. Watanabe (2006) shows that besides mitigating market frictions, the role of middlemen includes linking producers and consumers, setting price for competition as well as holding inventories to smooth trade imbalances among producers and consumers. Likewise, (Davies 2012) sees the role of middlemen as of value addition to both parties they transact with, making both better off and also that the connecting of willing buyers and sellers who do not know each other and would find it impossible or excessively costly to get to know each other is essential to a functioning economy.

This debate on the role of middlemen in markets has been on-going since the 1950s. Given the role that middlemen play, the question should not be whether these functions need to be performed, but rather who is to perform them (Kotler and Keller 2009). While selling directly to consumers may be sometimes seen as the most ideal, it may not always be the most economical or convenient on the part of the farmer. Different middlemen may present different advantages and disadvantages to sellers such that the choice of who to sell to may have a significant economic bearing.

2.5 Factors affecting Probability of Market Participation

The probability of market participation is concerned with the likelihood to sell or not. Previous studies have shown that market information has a positive impact on the likelihood of participating in the market (Gani and Adeoti 2011; Musah, Bonsu and Seini 2014; Zamasiya et al. 2014; Ohen, Etuk and Onoja 2013; Siziba et al. 2011; Hlongwane, Ledwaba and Belete 2014). Access to

information can help farmers link to potential buyers, which reduces search costs, and information can also reduce risk perceptions (Siziba, et al. 2011). The empirical evidence also shows that membership to a cooperative motivates market participation by giving farmers an opportunity to exchange ideas and experiences and also by affording the farmers access to sources of information regarding credit facilities, knowledge and skills (Gani and Adeoti 2011; Musah, Bonsu and Seini 2014; Ohen, Etuk and Onoja 2013; Jagwe, Machethe and Ouma 2010). Gani and Adeoti (2011) and Zamasiya et al. (2014) state that there is a positive relationship between receiving extension visits and the probability of participating in the market because these visits provide a good platform for exchanging information at a lower cost. In fact, Gani and Adeoti (2011) show that farmers who were visited by extension agents/officers were more than three times likely to take market participation more seriously than those who were not visited. Hlongwane, Ledwaba and Belete (2014) and Musah, Bonsu and Seini (2014) found that farmers with access to credit were more likely to participate in the market because credit gave the household economic power to produce more.

Family (household) size and education have also been found to have a positive significant effect on the probability of participating (Gani and Adeoti 2011; Reyes et al. 2012). The argument being that larger households are able to take advantage of their family labor to produce more output surplus. Williams (1985) and Akunbile (1999) support this argument with their findings that local farmers have large family sizes to support their labor intensive agricultural activities. In contrast, Siziba et al. (2011) discovered a negative relationship between household size and probability of participating in the market because larger households were more likely to fail to produce marketable surplus beyond their consumption needs. Education increases the farmer's ability to obtain and understand market information, which helps to lower transaction costs by reducing risk and negotiating better buyer-seller relationships. Moreover, an educated farmer tends to have stronger production and managerial skills which lead to increased likelihood of market participation (Makhura 2001; Randela 2008). Musah, Bonsu and Seini (2014), however, had a contradictory result in which they found a negative relationship between education and the probability of market participation which they attributed to the possibility that more educated farmers had full-time jobs and only farmed part-time for consumption purposes. Zamasiya et al. (2014) found that males were less likely to participate in the market while Reyes et al. (2012)

found them to be more likely to participate than their female counterparts possibly because of their ability to negotiate more effectively (Cunningham et al. 2008). Musah, Bonsu and Seini (2014) found that older farmers were less likely to participate in the market than younger ones because they are more concerned about food security and not willing to take on the risk of trading. Similarly, Randela (2008) observed that younger farmers were more progressive, more receptive to new ideas and better able to understand information and engage in market participation.

Findings by Ohen, Etuk and Onoja (2013), Siziba et al. (2011) and Jagwe, Machethe and Ouma (2010) reveal that total land size has a positive significant influence on the likelihood of market participation. Total land size is linked to the ability to produce a marketable surplus (Key 2000; Goetz 1992). Additionally, farmers with a larger size of farm output are more likely to participate in the market because this larger output implies an increased marketable output (Gani and Adeoti 2011; Musah, Bonsu and Seini 2014; Ohen, Etuk and Onoja 2013; Reyes et al. 2012). Distance to market has generally been found to be negatively and significantly related to the probability of market participation since transport costs increase with longer market distances (Gani and Adeoti 2011; Hlongwane, Ledwaba and Belete 2014; Siziba, et al. 2011). Ohen, Etuk and Onoja (2013) found that market infrastructure and use of improved seed have a positive effect on the likelihood of participating in the market by reducing transport costs and increasing output, respectively.

2.6 Factors affecting Intensity of market participation

While probability of participating is only concerned with the farmer's decision to either sell their produce or not, intensity of market participation implies the quantity of produce being offered for sale. The probability of participation and the intensity of participation, which are assumed to be two separate sequential decisions, may be affected by different variables and sometimes, the same variable may affect the two decisions in different ways. This section particularly reviews literature on factors affecting the second decision of how much to sell (intensity of participation decision).

Distance to market has been found to reduce the percentage of output marketed because it increases travel time and cost (Omiti et al. 2009; Musah, Bonsu and Seini 2014; Siziba et al. 2011). However, Zamasiya et al. (2014) found a positive significant relationship between distance and level of market participation, which implies that distant markets offered higher prices and hence larger

volumes were sold there than markets that were closer to the farmer. Randela (2008) also found a positive relationship between distance to market and market participation, which he attributed to the possibility that farmers faced with long distances to markets were more likely to be commercial farmers. Farmers who have their own means of transporting their output to the market incur lower PTCs and experience stronger incentives to sell more output (Jagwe, Machethe and Ouma 2010). Access to credit provides an alternative to cash from crop sales. Access to credit has been found to have a positive relationship with intensity of market participation for smallholder farmers because it can finance large scale production which implies a larger market output (Cadot, Dutoit, and Olarreaga, 2006; Alene et al 2008; Stephens and Barrett, 2011; Hlongwane, Ledwaba and Belete 2014; Randela 2008). However, Siziba et al. (2011), found an unexpected negative relationship between access to credit and quantity sold which they couldn't explain. The cost of obtaining information is actually also one of the fundamental transaction costs faced by farmers (Shepherd 1997). With access to information, e.g., ownership of radio, farmers can easily find useful market information that can enable them to sell more in the market (Hlongwane, Ledwaba and Belete 2014; Alene et al. 2008; Randela 2008; Omiti et al. 2009; Jagwe, Machethe and Ouma 2010; Musah, Bonsu and Seini 2014; Siziba et al. 2011). Access to extension services has equally shown to have a positive impact on participation as receivers of extension services have access to information, skills and knowledge (Siziba et al. 2011; Reyes et al. 2012). Equally, Kirsten and Vink (2005) argue that belonging to a group empowers farmers to bargain and negotiate for better trading terms and as such enables farmers to sell more output. Alene et al. (2008) support this argument with the finding that maize farmers who belonged to a maize marketing movement sold 56% more maize than participants who did not belong to the group

Among the farmer demographic characteristics, (Omiti et al. 2009) found that being a male head of a household significantly increased the marketed output. This is supported by the argument given by Cunningham et al (2008) that men have a better acumen in negotiating, bargaining and enforcing contracts. However, (Musah, Bonsu and Seini 2014) found that females sold more than males although they could not clearly give the probable reason why. Household size has generally shown a positive impact on intensity of market participation (Jagwe, Machethe and Ouma 2010; Alene et al. 2008; Musah, Bonsu and Seini 2014). The reason for this is assumed to be that household size affects labor supply for production and that larger households produce more food

than they consume. Although household size has been found to have a positive relationship with market participation, Omiti et al. (2009) discovered a negative relationship between household size and quantity sold suggesting that larger households sell less because of consumption needs. Randela (2008) found a positive and significant relationship between the age of the respondents and quantity sold which he attributed to the fact that being older assists farmers to overcome fixed transaction costs since they have accumulated some experiences about the market overtime. Musah, Bonsu and Seini (2014) however found the relationship between age of household head and quantity of marketed output to be negative. They attributed this to the fact that characteristics of older farmers such as risk aversion and reluctance to adopt technology and hence inability to produce for the market far outweigh their ability to overcome fixed costs through experience. English literacy (ability to speak/understand English) has generally shown to positively impact quantity sold (Randela 2008; Omiti et al. 2009). This is because it enables resource-poor farmers to better engage in trade by improving the household's ability to process information, that is, understanding and interpretation of information thereby leading to the reduction of search, screening and information costs (Randela 2008).

Literature also shows that price is an incentive to sell. At higher selling prices, farmers sell more of their marketed output (Jagwe, Machethe and Ouma 2010; Musah, Bonsu and Seini 2014); this behavior is consistent with economic theory. In addition, there is evidence of a positive relationship between farm output and marketed output (Musah, Bonsu and Seini 2014; Omiti et al. 2009; Barrett 2008; Reyes, et al. 2012). Farmers with higher farm outputs have more marketable surplus than those with lower outputs, and are therefore able to sell more in the market. Ownership of livestock, a form of private assets, has shown to positively influence volumes of sales (Siziba, et al. 2011); however, Reyes et al. (2012) discovered contradictory findings. Lastly, non-farm income has been found to significantly reduce the amount of output sold when it is used to finance off-farm investments (Omiti et al. 2009; Musah, Bonsu and Seini 2014) but increases amounts sold if used to finance farm production (Siziba et al. (2011).

Chapter 3 - Methods

This chapter presents the methods and data used in this study. The conceptual and empirical frameworks are discussed in section 3.1 and section 3.2, respectively. Then the data used (section 3.3), variables selected and their description (section 3.4) and summary statistics (section 3.5) are presented.

3.1 Conceptual Framework

The theory underpinning this study is Barrett's household's non-separable market participation behavior model which is based on utility maximization. An alternative model used in similar studies is based on Fafchamp and Hill (2005) which models the farmer's decision to either sell at the farm gate or to travel to the market in which case the farmer incurs a certain level of transaction costs depending on a type of the buyer and the transaction. When deciding who to sell to, a farmer must identify an option with an optimal balance of price and transaction cost (Fafchamp and Hill 2005). One limitation of this model is that while it is useful for modeling the choice of a buyer, a marketing outlet, or a form of transaction, assuming the farmer has already decided to sell, it does not account for the factors affecting farmers' decision to participate in the marker. The advantage of the framework used in Barrett (2008) is that it accounts for both the farmer's decision to sell or not and the decision of how much to sell. In Barrett's model, the household's market access is not treated as uniform because it accounts for differences in marketing behavior driven by differences in transaction costs as well as spatial differences in cost of trade (Barrett 2008). These features induce households to rationally self-select out or participate in the market. The basic assumption of Barrett's model is that a farm household faces a decision to maximize utility either as a net buyer, net seller or autarkic, given a parametric market price for each crop and crop and household specific transaction costs per unit sold. The model uses two distinct layers of transaction costs, one that is household-specific and another that is crop and location-specific which allows market participation to vary by crop, household and location (Barrett, 2008).

For a single agricultural product, Barret's model is presented as below. Given an agricultural commodity x_1 and another tradable commodity x_2, a farm household's choice of whether to participate in the market as a buyer of the agricultural commodity is represented as M^{1b} while the choice to participate as a seller of the agricultural commodity is presented as M^{1s}. M^{1b} = 1 if the

household chooses to buy the crop and M^{1b} = 0 if the household chooses not to buy. Similarly, M^{1s} = 1 if the household chooses to sell the crop and M^{1s} = 0 if the household chooses not to sell. P_2 is the household- specific price for x_2 and P_1 is the household- specific price of x_1. Further, the household chooses quantities of x_1 and x_2 to sell or buy subject to an income constraint. $Q_1(A, G)$ is the output production function for x_1 as a function of A (household assets) and G (public goods and service e.g., extension, information and credit services). W is off-farm income.

The household optimization problem is:

$$Max\ U\ (x_1, x_2)$$
$$\{M^{1b}, M^{1s}, x_1, x_2\}$$

Subject to the following:

$$P_2 x_2 + M^{1b} P_1 x_1 = M^{1s} P_1\ Q_1(A, G) + W \quad (1)$$

$$(1 - M^{1b}) x_1 \leq Q_1(A, G) \quad (2)$$

Given P_m is the market price, the household-specific price for agricultural crop (x_1) either includes or excludes transaction costs (τ^1) or is autarkic as shown below. Transaction cost is a function of household characteristics (Z), household assets (A), public goods and service (G), off-farm income (W) and resulting net sales of the crop (NS^1).

$$P_1 = P_m + \tau^1(Z, A, G, W, NS^1) \text{ if } M^{1b} = 1 \quad (3)$$

$$P_1 = P_m - \tau^1(Z, A, G, W, NS^1) \text{ if } M^{1s} = 1 \quad (4)$$

$$P_1 = P_a\ if\ M^b = M^s = 0, where\ P_a \text{ is the autarkic shadow price} \quad (5)$$

For this study, transaction costs are anticipated to be also affected by buyer-type (B) such that,

$$\tau^c(Z, A, G, W, NS^c, B) \quad (6)$$

3.2 Empirical Model

In this study, in addition to estimating a participation model that describes whether the farmer sells or not, the intensity model which describes how much the farmer sells is estimated. The factors

affecting the participation and intensity decisions may be the same or different and the ones that are same may affect these two decisions in different ways. For example, distance to market can affect the decision to sell negatively (i.e. the further the market the less likely a farmer to sell because of expected high transaction costs), however if the farmer decides to sell then the distance can affect the amount sold positively (i.e., the further the farmer has to travel and the more transaction cost he has to incur, it is likely that he would want to sell more to cover the transaction costs)

One characteristic of the population of inference for this study is that a large proportion of farmers do not sell their produce. Because of the presence of different buyer options available for the farmers, it is plausible to assume that the observed zero amount of sales by a farmer reflect the farmer's optimal choice. This is in line with the assumptions in other studies in the context of Ghana's Upper West Region (Musah, Bonsu and Seini 2014). From the empirical modeling perspective, the zeros in the observed market participation variable imply a corner solution. A corner-solution applies to data where the dependent variables is truncated and "piles up" at some given value, but has a continuous distribution for positive values (Burke 2009). The Tobit model has been traditionally used for data characterized by a corner solution. However, its major limitation is that the participation decision and the amount decision are governed by the same process (Wooldridge 2009). That is, in the context of this study, it requires that the decision to sell a particular crop and the decision about how much of that crop to sell be determined by the same variables, which makes it fairly restrictive (Burke 2009; Wooldridge 2003; Ricker-Gilbert, Jayne, and Chirwa, 2011).

Alternatives to modeling market participation are the Heckman sample selection model (two step) used by (Goetz, 1992; Benfica, Tschirley, and Boughton, 2006; Boughton, et al., 2007), and the double-hurdle model originally proposed by Cragg (1971). The Heckman regression first estimates a probit model of market participation; then, in the second step, it uses ordinary least squares (OLS) to estimate the quantity traded conditional on market participation (Wooldridge 2003). It is designed for incidental truncation, where the zeros are unobserved values (Ricker-Gilbert, Jayne and Chirwa 2011). The double-hurdle model, on the other hand, allows for the participation and amount decision to be affected by different set of factors (Burke 2009; Reyes et al. 2012) and for

the same factors to have different effect on each decision (Ricker-Gilbert, Jayne and Chirwa 2011). The double hurdle model provides a more flexible alternative than the Tobit for the purposes of this study as it also allows to estimate the "unconditional" average partial effect (APE) of a particular variable on intensity of market participation (Reyes, et al. 2012) . The APE provide an estimated effect of a factor on the amount sold unconditional on participation. This may be useful in designing programs and policies for enhancing market participation. Consequently, the double hurdle model has been deemed more appropriate for this study.

In the double hurdle model, the first hurdle estimates the decision of whether or not to participate in the market then, conditional on market participation, the second hurdle estimates the quantity sold (Reyes, et al. 2012). Given y is the observed dependent variable (amount sold), the first hurdle, the participation decision, is estimated using the probit model and the second hurdle, the amount decision is estimated using truncated normal regression (Burke 2009; Wooldridge 2009). That is,

$$P_i = w_i\alpha + e_i \quad \text{Participation decision (i.e., to sell or not to sell)} \tag{7}$$

$$y_i^* = x_i\beta + v_i \quad \text{Amount decision (i.e., how much to sell)} \tag{8}$$

where P_i is a latent variable describing household's decision to either sell or not sell their crop. w_i denotes a vector of independent variables and α, the vector of coefficients explaining the participation decision. y^* is the latent variable for decision on how much to sell, x_i is the vector of explanatory variables and β is the vector of coefficients for the amount decision. e_i and v_i are the respective errors.

The observed dependant variable (amount sold) is censored at zero such that;

$$y = \begin{cases} y^* \; if \; y^* > 0 \\ 0 \; if \; y^* \leq 0 \end{cases} \tag{9}$$

Integrating the probit and truncated normal regression, Cragg's double hurdle model is specified as follows:

$$f(w, y|x_1, x_2) = \{1 - \Phi(x_1\boldsymbol{\Upsilon})\}^{1(w=0)} \left[\Phi(x_1\boldsymbol{\Upsilon})(2\pi)^{-\frac{1}{2}\sigma^{-1}} \exp\{-(y - x_2\boldsymbol{\beta})^2 / 2\sigma^2\}/\Phi(x_2\boldsymbol{\beta}/\sigma)\right]^{1(w=1)} \tag{10}$$

where w is a binary indicator equal to 1 if y is positive and 0 otherwise, the vectors $\boldsymbol{\Upsilon}$ and $\boldsymbol{\beta}$ are the coefficients associated with the explanatory variables in the probit and truncated regression model, respectively. x_1 and x_2 are the vectors of explanatory variables for probit and truncated regression model, respectively. The probability of $y > 0$ and the value of y, given $y > 0$, are determined by different mechanisms (the vectors $\boldsymbol{\Upsilon}$ and $\boldsymbol{\beta}$, respectively). Furthermore, there are no restrictions on the elements of x_1 and x_2, implying that each decision may even be determined by a different vector of explanatory variables altogether (Burke 2009).

For any given observation, the probit model for the probability of $y > 0$ is specified as:

$$P(y > 0 \,|x_1) = \Phi(x_1\boldsymbol{\Upsilon}) \tag{11}$$

where Φ is the standard normal cumulative distribution function.

The partial effect of an independent variable, x_j on the probability that $y > 0$ is given by:

$$\partial P(y > 0 \mid x_1)/\partial x_j = \gamma_j \emptyset(x_1\boldsymbol{\gamma}) \tag{12}$$

where γ_j is the element of $\boldsymbol{\gamma}$ representing the coefficient on x_j (Burke 2009).

In the truncated regression model, the expected value of y conditional on $y > 0$ is the same as the tobit model and is given by:

$$E(y|y > 0, x_2) = x_2\boldsymbol{\beta} + \sigma\lambda(x_2\boldsymbol{\beta}/\sigma) \tag{13}$$

where $\lambda(c)$, the Inverse Mills Ratio (IMR) $= \phi(c)/\Phi(c)$ and ϕ is the standard normal probability distribution function (Burke 2009; Wooldridge 2010). Then the "unconditional" expected value of y is given by:

$$E(\mathrm{y} \mid x_1, x_2) = \Phi(x_1\boldsymbol{\gamma})\,\{x_2\boldsymbol{\beta} + \sigma \times \lambda(x_2\boldsymbol{\beta}/\sigma)\}. \tag{14}$$

The partial effect of an independent x_j on the expected value of y, given $y > 0$, is given by:

$$\partial E(y \,|y > 0, x_2)/\partial x_j = \beta_j\,[1 - \lambda(x_2\boldsymbol{\beta}/\sigma)\,\{x_2\boldsymbol{\beta}/\sigma + \lambda(x_2\boldsymbol{\beta}/\sigma)\}] \tag{15}$$

where β_j is the element of $\boldsymbol{\beta}$ representing the coefficient on x_j (Burke 2009; Wooldridge 2010).

Based on Burke (2009) and Wooldridge (2010), the partial effect of an independent x_j on the "unconditional" expected value of *y*, if x_j is an element of both vectors is given by:

$$\partial E(y \mid x_1, x_2)/\partial x_j = \gamma_j \varphi(x_1\boldsymbol{\gamma}) \times \left\{x_2\boldsymbol{\beta} + \sigma \times \lambda\left(\frac{x_2\boldsymbol{\beta}}{\sigma}\right)\right\} + \Phi(x_1\boldsymbol{\gamma}) \times$$
$$\beta_j\,[1 - \lambda(x_2\boldsymbol{\beta}/\sigma)\,\{x_2\boldsymbol{\beta}/\sigma + \lambda(x_2\boldsymbol{\beta}/\sigma)\}] \text{ if } x_j \in x_1, x_2 \quad (16)$$

If x_j is only determining the probability of $y > 0$, then $\beta_j = 0$, and the second term on the right-hand side of (Equation 16) is canceled. On the other hand, if x_j is only determining the value of *y*, given that $y > 0$, then $\gamma_j = 0$, and the first right-hand side term in (Equation 16) is canceled (Burke 2009).

3.3 Data

The analysis is based on the data from the Agriculture Production Survey (APS) conducted in 2013 and 2014 in northern Ghana which was funded by the United States Agency for International Development (USAID). The sample of 527 includes farmers in 51 enumeration areas across 25 districts in the Zone of Influence of the USAID|Ghana's Feed the Future Initiative. The sample was constructed to be representative of the population in northern Ghana. The survey data were collected using a two-stage stratified random sampling approach and probability weights were developed to account for differential probabilities of selection and non-responses from the households. From the total sample size of 527, there were 377 farmers who mainly grew maize, rice and soybean. Because this study focused on only maize, rice and soybeans farmers, the 377 farmers were the ones used in this study. The other farmers who did not grow any of these three focus crops were excluded from the analysis.

The survey instrument was designed to collect detailed information on farmers' production and marketing characteristics and activities. The production data were collected over the entire 2013 cropping season in northern Ghana, from late June to mid-November. The marketing data were collected during follow-up visits in January, February, and March of 2014 to obtain data on crop sales at time of harvest and after being in storage. The crop production data section mainly looked at three crops: maize, rice, and soybeans which are the focus crops in the feed the future initiative in northern Ghana. This section included information on types of crop grown, area planted, types of inputs used, and total output for each crop, as well as management practices and production

costs. The marketing data included information on quantity sold, type of buyers, and price received for each crop, as well as detailed information on marketing and transportation costs. The survey also collected household demographic data.

The APS data is supplemented with additional data on relevant variables such as age of the respondent and credit access from the baseline Population Based Survey (PBS) conducted in northern Ghana in 2012. This survey was also funded by USAID|Ghana and is part of their Feed the Future Initiative. The baseline PBS survey was from a sample size of 4,600 drawn through a two-stage probability sampling approach. The respondents in the APS survey were also part of the respondents in the PBS survey such that triangulation of missing data from the APS onto the PBS was possible.

3.4 Description of Variables

The variables in the model are selected based on economic theory, previous literature in this area, and practical insight from the field observations. Past studies have modeled market participation as a function of household/demographic characteristics, resource endowment, access to market and roads, access to institutional services, household income (Berhanu, and Moti 2010; Randela 2008; Omiti et al. 2009; Sebbata et al. 2014; Hlongwane, Ledwaba and Belete 2014).

Similarly, in this study, explanatory variables used to model participation include demographic variables (i.e., age in years, marital status, literacy level, gender of the household head, and household size), access to institutional services (i.e., access to credit and information), production variables (i.e., farm output, type of crop produced) and market variables (i.e., price, buyer type, number of buyers). These variables are discussed below.

3.4.1 Household size

The size of the household represents the productive and consumption unit of the household (Makhura 2001). In line with Lapar, Holloway, and Ehui (2003) and Randela (2008), it is hypothesized that larger households have lower levels of market participation because they have higher consumption needs and hence use most of their produce for consumption rather than selling.

3.4.2 Age

Age can be associated with the farming experience of the farmer (Omiti et al. 2009). Older farmers are likely to have more experience than the younger ones. However, older farmers may engage in farming as a livelihood rather than as a business, may be less educated and less receptive to new ideas (Randela 2008). A negative relationship between age and market participation is therefore the *a priori* expectation in this study.

3.4.3 Marital Status

It is expected that married farmers may have more household resources and be less vulnerable such that they can be more willing to take on the risk of participating in the market compared to single/divorced/widowed or separated farmers. In this study, married farmers are therefore expected to participate more in the market.

3.4.4 Literacy

Literacy relates to the ability of household members (five years or older) to read or write a simple letter written in English or in a local Ghanaian language in which they are most proficient (Ghana Statistical Service 2008). In this study, literacy has been measured as English literacy since English is important for individuals' long-term economic wellbeing as it is Ghana's official language (Amanor-Boadu, Zereyesus and Ross 2015). While educational attainment can be used as a proxy for literacy, it is possible to have attended school without having acquired sustainable literacy skills in some poorer countries (Terryn 2003). Nevertheless, the two are closely related. Just as in previous studies (Omiti et al. 2009; Randela 2008), it is expected that English literacy/ education will enable smallholder farmers to better engage in trade by improving the household's ability to process information thereby leading to the reduction of search, screening and information costs.

3.4.5 Gender

International development agencies have reported that in Northern Ghana women face more constraints and receive fewer services and less support than men (World Bank 2007). These disadvantages reduce women's effectiveness as actors in value chains and therefore likely to reduce their overall market participation.

3.4.6 Access to credit

Limited access to credit has been shown to not only inhibit farmer's ability to make on-farm investments and improve productivity, but also limit farmers' ability to access input and output markets in the presence of high transaction costs (Randela 2008). Farmers with access to credit are likely to be better positioned to incur the transaction costs associated with market access. Farmers with access to credit are better able to finance the cost of selling their produce and may be more compelled to sell their produce in order to pay back their debt. Therefore, it is reasonable to expect that access to credit would have a positive relationship with the decision to sell and how much to sell.

3.4.7 Access to information

The cost of obtaining information has been confirmed to be one of the fundamental transaction costs faced by farmers (Shepherd 1997). Farmers can access useful information through the radio, extension services, farmer groups/cooperatives or even other farmers. Due to data limitations, only farmers who accessed information through farmer groups were measured in this study. Farmers who access information are expected to participate more in the market because they are more likely to acquire useful market information that can help them sell more.

3.4.8 Farm output

Based on the economic theory and the empirical evidence from previous literature, the total output has a positive effect on market participation (Musah, Bonsu and Seini 2014; Omiti et al. 2009; Barrett 2008; Reyes et al. 2012). This study also makes the *a priori* expectation that farmers with higher farm outputs have more marketable surplus than those with lower outputs, and are therefore more likely to participate in the market.

3.4.9 Major crop produced

This study focuses on three major crops grown in Northern Ghana: maize, soybeans, and rice. Maize is the most important staple crop in Ghana which also contributes significantly to consumer diets. Rice and soybean are cash crops mainly grown for sale. It is reasonable to expect that farmers who grow cash crops (rice or soybean) participate in the market more than those who grow maize, a staple food crop.

3.4.10 Type of major buyer

In this study, buyers are categorized into four types: aggregators, processors, consumers (other village households and urban end consumers) and others (NBSC, non-governmental organizations and school feeding programs). These buyer types are included as dummy variables in the analysis where selling to consumers is the variable left out in the model.

Each buyer type may be associated with different costs and requirements (LeRoux et al. 2010). For example, buyers located further from the farmer's location may involve higher transport costs compared to those located nearer. Farmers who sell to buyers associated with lower transaction costs are expected to participate more in the market.

3.4.11 Number of buyers

Although not included in previous studies, this study includes number of buyers, i.e., the number of buyers the farmer sold to, as one of the variables with a potential impact on market participation. It is hypothesized that farmers who sold to more buyers sold more than those who sold to a fewer number of buyers. This variable is particularly important in this study because the buyer type variable is only capturing the major buyer from among the different buyers that the farmer sold to.

3.4.12 Price

High output price is an incentive for sellers to supply more in the market (Alene et al., 2008). This is one of the basics of economic theory. The law of supply states that "when the price of a good rises, and everything else remains the same, the quantity of the good supplied will rise and vice versa." (Nicholson and Snyder 2008). It is unarguably expected, in this study, that price has a positive effect on participation.

3.5 Summary Statistics

3.5.1 Demographic Characteristics

Table 2 presents descriptive statistics for the variables used in this study. The average household size in the study was 10.7 members. According to Ghana Statistical Office the average household size for the three northern regions (Brong Ahafo, Northern and Upper East) was 6.6 in 2000 and 5.0 in 2005/2006 (Ghana Statistical Service 2008). In this study, the average age of the farmer was

44.5 years. This is slightly lower than the reported average age for the general population of Ghana which was estimated at 50 years (Ghana Statistical Service 2008). About 91% of the respondents in this study reported to be married while the remaining 9% who are not married are either divorced, separated, widowed or have never been married. This coincides with the findings from the Agricultural Production Survey Report which was based on the same sample as this study. The APS report shows that 91% of the farmers indicated being married (Amanor-Boadu, Zereyesus and Ross 2015).The Ghana Living Standards Survey Report however shows a much lower proportion of the married people of only 40% for the general population. Only 8.7% farmers in this study were found to be literate in English which is lower than the 22% of adults who are literate in rural savannah and the 51% literacy level for the general Ghanaian population as reported in the Ghana living standards survey report (Ghana Statistical Service 2008). The reason for this difference is that literacy in this study does not include those who are literate in a local Ghanaian language as was the case in the living standards survey. The proportion of male farmers (respondents/ farm managers) in this study is 89%. This is very close to the Agricultural Production Survey report findings which were based on the same data and in which, about 90% of respondents were male (Amanor-Boadu, Zereyesus and Ross 2015). The Ghana Living Standards Survey Report for 2005/2006 shows that proportion of households headed by males is 70.5% (Ghana Statistical Service 2008).

3.5.2 Access to Institutional services, Production Characteristics and Market Characteristics

Unavailability of credit inflates transaction costs in both input and output markets (Randela 2008). With access to credit, farmers are able to finance their transaction costs and participate in the market. Table 2 shows that only 14% of farmers in this study had access to information. This low proportion could be attributed to the fact that only farmers who accessed information through farmer groups were captured in this study. The average output for each household was 774 kg in this study. 84% of farmers grew maize as their major crop while 11% grew rice and 5% soybean.

In this study, buyer types include aggregators, processors, consumers (other village households and urban end consumers) and others buyers (National Buffer Stock Company (NAFCO), non-governmental organizations (NGOs) and school feeding programs). Among the farmers who participated in the market, 34.83% of farmers sold to aggregators while only 3.37% sold to

processors, 30.90% to consumers and 30.90% to other buyers as their major buyers. The average price of output sold in this study is 0.12GHS/kg which is approximately $0.32/kg at the prevailing exchange rate of 1USD = 2.68GHS in March, 2013 (Bank of Ghana 2014).

Table 2: Summary Statistics on Variables used in Study (n =377)

Variables	*Variable Description*	*Mean*	*SE*[1]	*Min*	*Max*
Dependent Variables					
Market participation	(1 if sold, 0 otherwise)	0.47	.499	0	1
Intensity of participation	Amount sold in kg	195.88	455.62	0	6000
Household Characteristics					
Household size	Number of people living in a household	10.65	5.64	2	53
Age (years)	Age of respondent in years	44.52	16.81	20	100
Married	(1 if married, 0 otherwise)	0.91		0	1
Literate	(1 if literate in English, 0 otherwise)	0.087		0	1
Male	(1 if respondent is male, 0 otherwise)	0.89		0	1
Access to Institutional services					
Access to credit	(1 if anyone in household got credit)	0.37		0	1
Access to information	(1 if anyone in household received information)	0.14		0	1
Production Characteristics					
Farm Output (kg)	Total quantity of produce in kg	773.74	772.31	0	6000
Rice	(1 if rice is main crop produced)	0.12		0	1
Soybeans	(1 if soybeans is main crop produced)	0.06		0	1
Marketing Characteristics					
Number of buyers	Number of buyers farmer sold to	0.53	0.908	0	4
Market distance	Average distance to market in km	0.4	3.41	0	65.25
Transport cost	Average transport cost to markets in GHS/tonne	0.13	0.53	0	6
Loading & offloading cost	Average loading and offloading costs to markets in GHS/tonne	0.03	0.28	0	5
Average Price (GHS/kg)	Average price of crop faced by household in GHS/kg	0.12	0.17	0	1.05
Sold to aggregators	(1 if aggregators is the major buyer)	0.17		0	1
Sold to processors	(1 if processors is the major buyer)	0.02		0	1
Other buyers	(1 if other buyers is major buyer)	0.145		0	1

[1] SE stands for Standard Error

The variables that are used in modeling the participation decision include all the household characteristics, access to institutional services and production characteristics. The variables in modeling the intensity of participation decision include the household characteristics, access to institutional services, production characteristics as well as marketing characteristics.

Chapter 4 - Results and Discussion

This chapter presents the results of study. The descriptive statistics are presented in section 4.1 while the results of the model are presented in section 4.2. The descriptive statistics include findings on quantity sold, price, transaction costs and total value by buyer type. The model results include estimated coefficients and their average partial effects.

4.1 Descriptive Statistics

4.1.1 Proportion of farmers selling to each Buyer-type

The buyer types in this study include consumers, processors, aggregators and other buyers. Consumers include two groups: consumers in the local village (e.g,. other households in the village) and consumers in the markets (e.g., urban or peri-urban markets) (Adams 2016). Aggregators are both small scale and large buyers who set up assembling/aggregation points/bases in villages (Adams 2016). Processors are those who buy for value addition purposes while Other buyers include NAFCO, NGOs and school feeding programmes who mostly buy directly from the farmer's "doorstep" (Adams 2016).

The results show that only 47% of farmers sold their produce. Figure 2 shows the proportion of farmers selling to each buyer type. Among the sellers, the proportion of farmers selling their produce mainly to aggregators, consumers and other buyers is almost equally divided. That is, 34.83% to aggregators, 30.90% to consumers and 30.90% to other buyers. Only 3.37% of farmers sold to processors as their major buyer type. This could be because few processors buy directly from farmers but instead buy through middlemen. Results of the study by Chapoto et al. (2014) also show that majority of maize and rice sales in Ghana in 2013 were to small scale traders (39.2%), wholesalers (16.5%) and retailers (36.4%) while processors purchased the least proportion of sales of only 0.1%.

Figure 4, Figure 5 and Figure 3 show the proportion of farmers selling to each buyer type, by crop. Generally, majority of farmers sold to aggregators and other buyers. For maize, the most popular buyers were consumers and aggregators, for rice, 60% of farmers sold to other buyers while for soybeans, aggregators and other buyers purchased from more than 80% of the farmers.

Figure 2: Proportion of Farmers Selling to Each Buyer-type (n = 178)

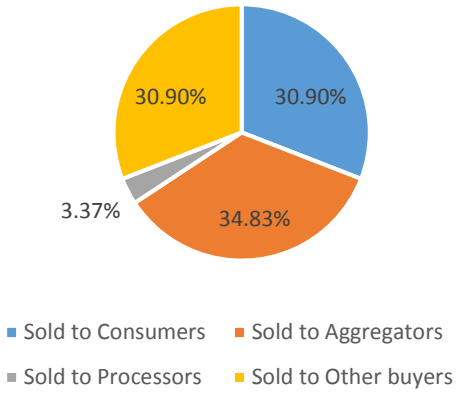


Figure 4: Proportion of Maize Farmers Selling to Each Buyer Type

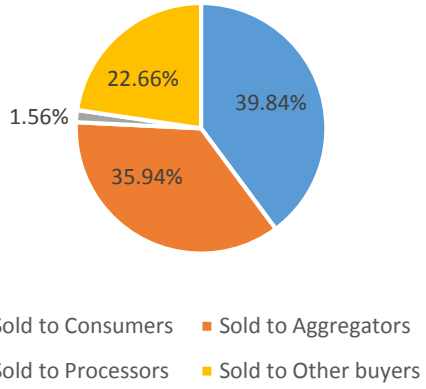


Figure 5: Proportion of Rice Farmers Selling to Each Buyer Type (n = 30)

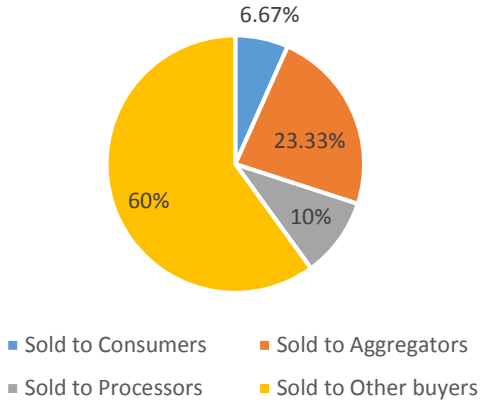
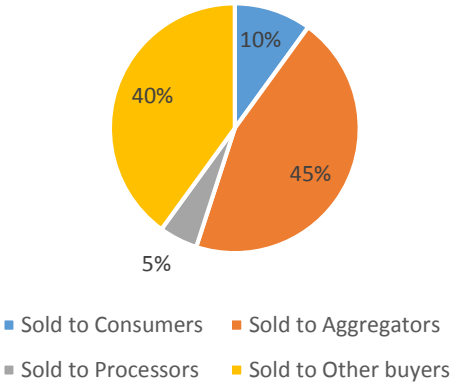


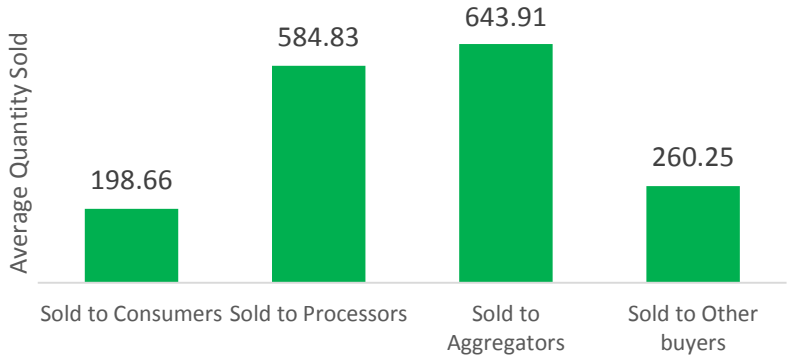
Figure 3: Proportion of Soybean Farmers Selling to Each Buyer Type (n = 20)



4.1.2 Average Quantity Sold by Buyer Type

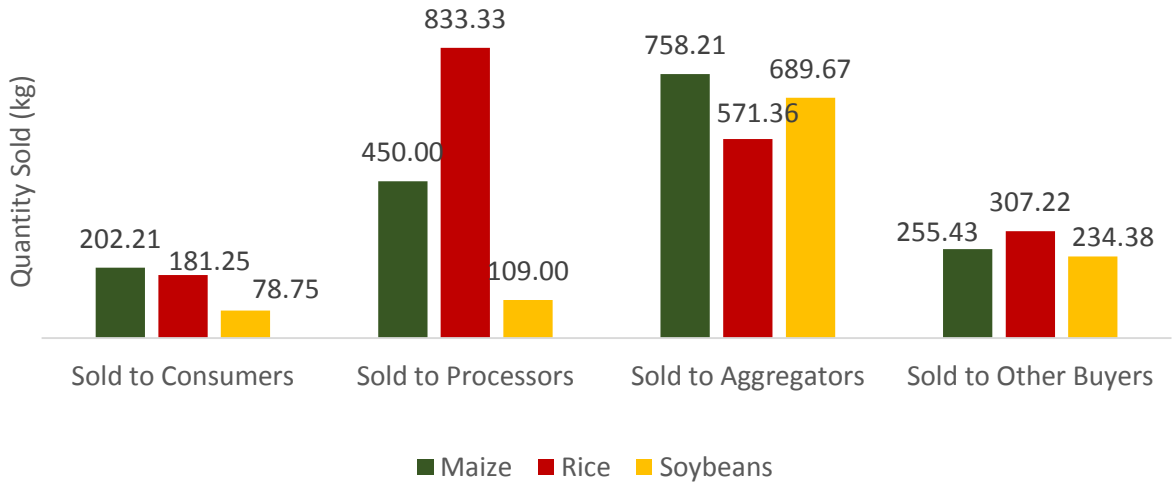
In terms of average quantity of produce sold, Figure 6 shows that farmers who sold to aggregators sold the largest average quantity of produce. Farmers who sold to consumers sold the lowest average quantity. This could be partially attributed to the fact that aggregators buy in bulk for resale whereas consumers buy small quantities sufficient for their own consumption. The multivariate test of means shows that average quantities of produce sold to each buyer type are statistically different from each other.

Figure 6: Average Quantity Sold by Buyer Type (n = 168)



With regards to specific crops Figure 7 shows that most of the maize was sold to aggregators (758.21 kg) while the lowest quantity was sold to consumers (202.21 kg). Similarly, rice farmers sold the lowest quantities to consumers. The highest average quantities of rice sales were to processors. For soybeans, aggregators bought the largest quantities at 689.67 kg on average.

Figure 7: Average Quantity Sold to Each Buyer Type, by Crop (n = 178)

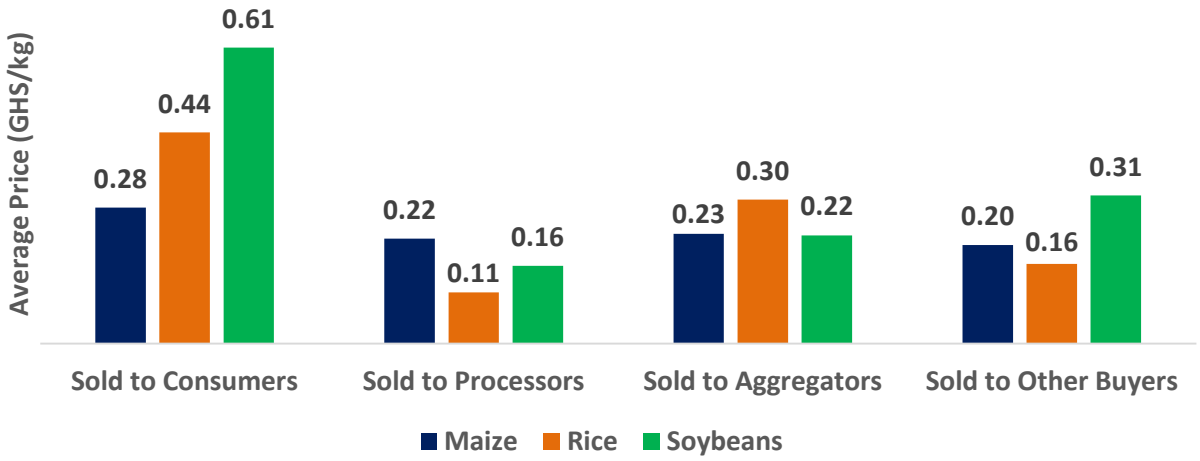


4.1.3 Average Price by Buyer Type for Each Crop

Figure 8 show the average price by buyer type for each crop. The average maize price was 0.22GHS/kg. This is close to the average rural wholesale price of 0.27GHS/kg reported by Ghana's Ministry of food and agriculture for the 2012 agricultural year (Ghana Ministry of Food and Agriculture 2013). With regards to maize sales only, the results show that selling to consumers

offered a premium price of 0.28GHS/kg. Aggregators and processors offered roughly equivalent prices of 0.23GHS/kg and 0.22GHS/kg while other buyers offered the least price of only 0.20GHS/kg. The average rice price of 0.25GHS/kg found in this study is slightly close to the average rural wholesale rice price of 0.45GHS/kg reported by the Ministry of Food and Agriculture for 2012 (Ghana Ministry of Food and Agriculture 2013).

Figure 8: Average Price by Buyer Type For Each Crop (n = 178)

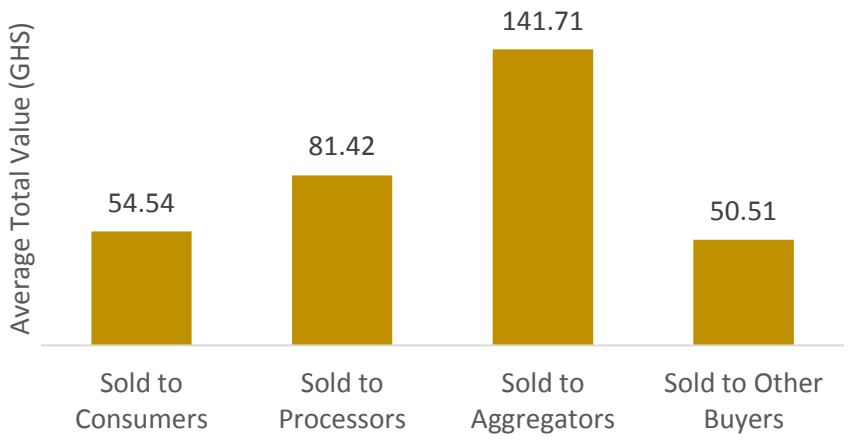


Similar to maize, consumers offered the highest average price of 0.44GHS/kg for rice. However, as opposed to maize in which other buyers offered the least price, in the case of rice, processors are the ones who offered the lowest price of 0.11GHS/kg. Consumers also offered the highest price for soybean (0.61GHS/kg). The lowest soybean prices were offered by processors (0.16GHS/kg) and aggregators (0.22GHS/kg). The multivariate test of means shows that average price among the different buyer types are statistically different.

4.1.4 Average Total Value by Buyer Type

In terms of total average value (i.e., average price multiplied by average quantity) by buyer type, Figure 9 shows that farmers selling to aggregators gained the most. This is because they sold more quantities compared to those who sold to the three other buyer types even though the aggregators did not offer the highest prices. The highest prices were offered by consumers who were however associated with one of the lowest average total value because they bought small quantities.

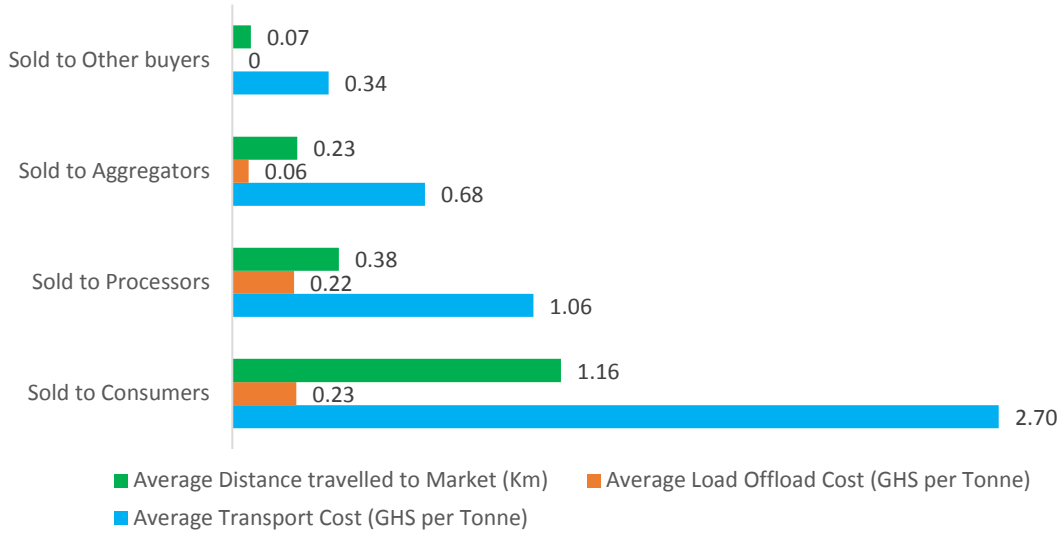
Figure 9: Average Total Value, by Buyer Type (n = 168)



4.1.5 Average costs by Buyer-type

Figure 10 shows the average transport, loading/offloading and market distance by buyer type. The results show that selling to consumers was associated with the highest transport and loading/unloading costs as well the as shown in table below. Selling to consumers involved the longest distance travelled to the market by farmers (an average distance of 1.16 km) compared to other buyer types. More than 55% of farmers selling to consumers had to travel between 3 km and 20 km. The high transport costs could be attributed to the longer distances being travelled by farmers to access the consumers. Chapoto et al. (2014) also show that selling to retailers who are usually located far in the urban market involved the longest distance to market travelled by maize and rice sellers. Selling to other buyers involved the lowest cost followed by selling to aggregators. The results suggest a positive correlation between transport cost and market distance.

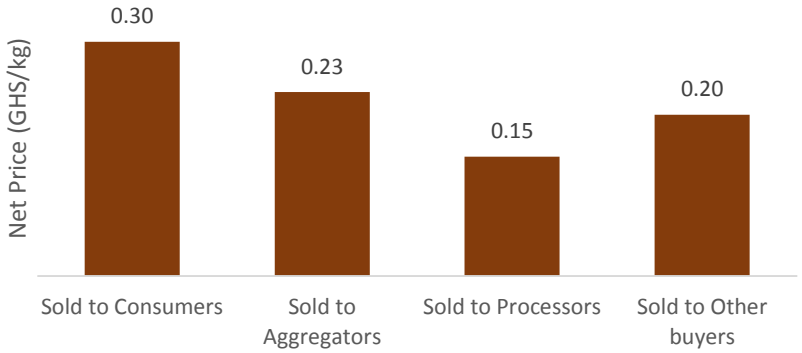
Figure 10: Average Costs and Market Distance by Buyer-type (n = 168)



4.1.6 Average Net Price by Buyer-type

Figure 11 shows the average net price (price less transport, loading and offloading costs) received by farmers selling to each buyer type. Similar to the findings by Bekele (2007) in which urban buyers offered a price that was over 20% of the rural prices for grains in Kenya, the results in this study show that on average, consumers offered the highest net price of 0.30GHS/kg. The second highest average price was offered by aggregators at 0.23GHS/kg.

Figure 11: Net Average Price Sold by Buyer-type (n = 178)



4.2 Empirical Results

Table 3: Double Hurdle Results - Estimated Coefficients (n=363)

Variables	Market Participation			Intensity of Participation		
	Decision to Sell or Not			*Decision on how much to sell*		
	Coefficient		Standard error	Coefficient		Standard error
Household size	-0.02	*	0.01	8.41		7
Age (years)	0.01		0	-1.93		4.01
Married	-0.07		0.28	-43.27		233.54
Literacy level	0.36		0.25	-269.22		235.18
Male	-0.03		0.26	324.7		391.28
Access to credit	0.24		0.15	-69.83		138.15
Access to information	0.74	***	0.21	252.74		154.72
Farm Output (100 kg)	0.04	***	0.01	46.5	***	12.8
Rice	0.74	***	0.24	115.94		178.87
Soybeans	5.7[2]	***	0.24	6.79		173.06
Sold to aggregators				1064.74	***	320.11
Sold to processors				458.67		316.83
Sold to Other buyers				1068.78	***	355.86
Multiple buyers				280.52	***	87.69
Average Price (GHS/kg)				921.33	*	487.26
sigma[1]				449.77	***	76.06
_Constant	-0.71	**	0.36	-2232.47	***	820.20

Note: Asterisks, *** = significant at 1%, ** = significant at 5% and * = significant at 10%
[1] The constant term in the section labeled sigma is the MLE of σ (Burke 2009)
The Collin test for multicollinearity for this model gave a VIF of 1.37 implying very low correlation among the predictor variables.

Table 3 shows the double hurdle results of factors influencing the decisions to sell and decisions on how much to sell. Among the demographic factors, only household size was found to be statistically significant. The results show that household size has a negative significant impact on market participation implying that larger households are less likely to participate in the market. This could be because larger households need larger consumption quantities making them less likely to sell their excess produce. Interestingly, results of the fifth Ghana Living Standards Survey show that the three northern regions, Upper West, Northern, and Upper East recorded high household sizes of 6.5, 5.5 and 5.3 respectively compared to the mean household size of 4.0 (Ghana Statistical Service 2008). These larger household sizes could partly explain the low levels of market participation in these northern regions. Randela (2008) also found a negative relationship

exists between market participation and household size, which he attributed to the possibility that members in large households tend to consume more than they contribute to the sales of the crop.

As expected, the findings show that farm output has a positive and significant impact on the decision to sell and how much to sell. Farmers who produced more output were more likely to participate in the market and also participated at a greater intensity. Findings by Omiti (2009) also show a positive significant relationship between total farm output and marketed produce. Consistent with other findings by Hlongwane, Ledwaba and Belete (2014) and Randela (2008), the results also show that access to information has a positive significant impact on market participation decision. Farmers who access information are better able to make informed decisions, take advantage of market opportunities, and therefore more likely to participate in the market.

With regards to major crop produced, the results suggest that farmers whose major crop produced is a cash crop (i.e rice or soybeans) are more likely to participate in the market than farmers whose major crop is a low value food crop (i.e maize). This makes intuitive sense, in that, cash crops are produced mainly for purposes of selling whereas, staple food crops like maize, which is one of Ghana's staples, are produced primarily for consumption and secondarily for sale. Statistics from Ghana Ministry of Food and Agriculture (2011) show that maize has the highest per capita consumption in Ghana. These results show that one way of improving farmer's market participation is the promotion of cash crop production among small holder farmers.

Results on major buyer type show that selling to aggregators and other buyers is significant in influencing intensity of participation. Farmers who mainly sold to aggregators sold more of their produce than those who sold to consumers. This could be because aggregators generally buy large quantities of produce for resale while consumers buy smaller quantities which are enough to satisfy their consumption needs. Farmers selling to other buyers sell more output than those who sold to consumers. The other buyers i.e NGOs, school feeding programmes, NAFCO are also bulky buyers. These results suggest that middlemen such as aggregators can play a role in improving farmer market participation. Another interesting finding was that farmers' intensity of participation increased as the number of buyer-types increased. Farmers with more buyer-types sold more. Additionally, and as expected, average price of produce was positive and significantly related to intensity of participation at 95% confidence interval.

Table 4: Double Hurdle Results - Average Partial Effects

	Probability of participating in the market			Amount of Produce sold in the market					
Variables	*Average Partial Effects*		*Std Error*	*Conditional Average Partial Effects*		*Std Error*	*Unconditional Average Partial Effects*		*Std Error*
Household size	-0.01	*	0.01	1.65	***	0.46	-0.65		0.99
Age (years)	0.00		0.00	-0.38		0.25	1.40	***	0.37
Married	-0.03		0.11	-8.50		14.18	-4.27		20.84
Literacy level	0.14		0.10	-52.90	***	16.35	26.58		21.68
Male	-0.01		0.10	63.80	**	24.95	-1.13		29.54
Access to credit	0.09		0.06	-13.72		8.58	31.12	**	13.29
Access to information	0.24	***	0.08	49.66	***	11.28	83.34	***	27.24
Farm Output (100 kg)	0.01	***	1.21	9.14	***	1.21	8.66	***	2.16
Rice	0.29	***	0.0001	22.78	*	11.27	66.54	**	25.62
Soybeans[1]				1.33		10.52	433.77	***	103.16
Sold to aggregators				209.21	***	30.10	130.25	***	30.10
Sold to processors				90.12	***	21.30	56.11	**	21.30
Sold to other buyers				210.00	***	31.02	130.75	***	31.02
Multiple buyers				55.12	***	7.12	34.32	***	7.12
Average Price (GHS/kg)				181.03	***	35.00	112.71	***	35.00

Note: Asterisks, *** = significant at 1%, ** = significant at 5% and * = significant at 10%

[1] There was not variation in soybeans to yield APEs for the participation decision because all soybean farmers sold their produce.

While the results in Table 3 show the significance and direction of impact of the variables on market participation and intensity of market participation, they do not show the magnitude of the impact. Table 4 below shows the Average Partial Effects (APE) of the different marketing variables on market participation and intensity of participation. The conditional APE show the magnitude of the impact of the variable on intensity of participation for farmers that participated in the market. The unconditional APE, on the other hand, show the magnitude of impact of the variable on intensity of participation for all farmers, whether they participated in the market or not. For farmers who did not participate, APE are computed by using the farmer's probability of participating to find the amount they would have been willing to sell. The elasticities for binary explanatory variables in the model are based on the discrete change in the variable and its proportionate effect on the dependent variable while for the continuous explanatory variables, the elasticities are based on the proportionate change in the variable and its proportionate effect on the dependent variable (Eakins 2014).

The results show that an additional household member would reduce the likelihood of selling produce by 0.01. A 100 kg increase in farm output would increase the likelihood of selling by an equivalent 0.01. Having access to information and producing rice would increase the probability of selling by 0.24 and 0.29, respectively.

Conditional on participating, an additional household member increases amount of produce sold by 1.65 kg. Similarly, conditional on participation, access to information increases amount sold by 49.66 kg and unconditional on participation, it increases amount sold by 83.34 kg. Conditional on participation, a 100 kg increase in output has a weaker effect of only 9.14 kg while unconditional on participation, it has an effect of 8.66k g on quantity sold. Production of rice has a conditional partial effect of only 22.78 kg on amount sold and an unconditional partial effect of 66.54 kg for all farmers regardless of participation.

Among the variables of interest, buyer-type (i.e, selling to aggregators and other buyers) have the greatest impact on intensity of participation. Selling to aggregators and selling to other buyers have the same conditional and unconditional effects on amount sold. That is, they have a conditional effect of about 210 kg and an unconditional effect of about 130 kg. Compared to aggregators and other buyers, selling to processors has weaker effects of only 90.12 kg conditional on participation and 56.11 kg unconditional on participation. The results also imply that conditional on participation, a unit increase in price is associated with a 181.03 kg increase in amount sold while unconditional on participation, it is associated with a 112.71 kg increase in amount sold. This is a stronger effect than a unit increase in number of buyer-types which, conditional on participation, increases amount sold by about 55.12 kg and unconditional on participation, by about 34.32 kg.

Chapter 5: Conclusion and Recommendations

The objective of this study was to determine the effect of buyer type on market participation of smallholder farmers in northern Ghana. Transaction costs, which are said to be the most significant barrier to market participation (Alene et al. 2008; Jagwe, Machethe and Ouma 2010), may vary across different buyer types (LeRoux et al. 2010). The choice of buyer type may therefore have an economic bearing on the farmer's market participation decisions. Besides, since transaction costs may be difficult to capture, buyer type could be used as an indirect means of capturing variation in transaction costs. Previous literature has not looked at the effect of transaction costs on market participation in this way.

This study was carried out with an objective to expand the understanding of factors driving or impeding the decisions of smallholder farmers in northern Ghana to sell their produce (the market participation decision), and how much to sell (the intensity of participation). Market participation is important in helping improve production systems and increasing incomes for smallholder farmers (Omiti et al. 2009; Alene et al. 2008; Jagwe, Machethe, and Ouma, 2010). The study particularly focuses on northern Ghana which is relatively "poorer" than the rest of the country (World Bank 2011) due to reasons partly related to low levels of market participation and high transaction costs for rural smallholder farmers (Chamberlin et al. 2007). Findings from this study are important in setting up appropriate interventions to enable rural smallholder farmers in northern Ghana actively participate in the market. The findings of this study this study will give policy makers an idea of which factors can have the greatest impact on market participation in northern Ghana for purposes of prioritization of interventions.

This study is based on Barrett's household's non-separable market participation behavior model. It employs the double hurdle model to estimate the farmer's probability of participating in the market and, conditional on market participation estimates the quantity traded. The data used is from the APS survey conducted in 2013 and 2014 funded by USAID. It had a sample size of 527 farmers and included information on the farmer's demographic, marketing and production characteristics.

The findings show that factors that significantly influence market participation include farm output (kg), access to information and type of major crop produced while factors that significantly influence the intensity of participation are farm output (kg), buyer type, having multiple buyers, crop produced and average price of produce.

These results reveal that farmers who sell to aggregator-type buyers sell more compared to those who sell to other consumers in the market. This implies that buyer-types who buy in bulk and close to the farmers' location can promote higher intensities of market participation. As expected, the findings show that price is an incentive for market participation and having multiple buyers also positively and significantly influences intensity of market participation. Access to information and farm output increase both the probability and intensity of market participation. This verifies the importance of provision of extension services and other avenues of information provision to farmers for market participation. The results also show that market participation is both a cause and consequence of increased production and productivity. Increased production boosts market participation.

5.1 Policy and Strategy Implications

Table 5: Key Findings and Policy Implications

Key Findings	Policy Implication
Selling to aggregators and other buyers increases quantity sold	Support aggregator-type middlemen
Access to information increases probability of selling and amount sold	Increase provision of information ➢ Strengthen extension services ➢ Support farmer groups
Farmers growing cash crops (rice, soybeans) are more likely to sell	Promote production of cash crops
Higher output increases probability of selling and amount sold	Support initiatives that focus on increasing yields

Table 5 shows the key findings of this study and their respective policy implications. The results show that farmers who mainly sell to aggregators and other buyers (e.g., school feeding programs, NGOs) sell more output compared to those who sell to consumers. In fact, selling to aggregators

and other buyers has the greatest impact on intensity of market participation suggesting that smallholder farmers probably value the convenience of having buyers pick up produce near their location. To improve market participation, middlemen such as aggregators can be promoted in rural markets until infrastructure in such areas is developed enough to substantially lower transport costs. The middlemen are able to reach remote smallholder farmers, buy from them in bulk and incur the cost of transporting the produce to urban consumers and other end users. Having a plethora of middlemen from which farmers can choose from will encourage competition among the middlemen causing them to offer better prices and support services as well as build strong relationships with the farmers. Price has the second highest impact on intensity of market participation after buyer type (aggregators and other buyers).

Another key finding was that access to information had a high impact on likelihood of participation and intensity of participation. Another alternative to improving market participation can therefore be increasing the provision of information to smallholder farmer, for example through strengthening of extension services and supporting farmer groups e.g., cooperatives. Farmer groups are also a good focal point for the dissemination of information and extension education and also a good platform for farmers to exchange information and experiences. Providing farmers with information can also be one way of protecting them from exploitation by buyers.

To encourage market participation, interventions in northern Ghana could also particularly focus on promoting the production of cash crops such as rice and soybeans. This is because, the findings show that farmers who grew cash crops were more likely to sell than those who grew maize, a lower value crop. One of the key findings was that farmers with higher output were more likely to participate in the market and to sell more than those with less output. Policy initiatives targeted at increasing production and yields can therefore also promote market participation.

5.2 Limitations and Further Research

The variables used in this study were largely based on previous literature. However, the data used in this study provided a limitation in that they did not capture all relevant variables. Other relevant variables such as access to credit and age of the farmer were triangulated from the PBS survey data. The PBS survey was conducted in 2012 and had the same target respondents as the APS.

However, variables such as off-farm income, ownership of means of transport and ownership of livestock were not captured in both surveys and suitable proxies couldn't be identified. These missing variables can potentially bias the reported parameters. Further research can include these variables.

This study also had four major buyer types. Further research could include more buyer-types. Among the categories of buyers in this study, other buyers was a category that included a number of different buyers. Further research can identify and separately categorize the main buyers in this group.

This study also focused on the major crop that the farmer produced, whether maize, rice or soybeans leaving out other crops that a farmer could have grown and sold in smaller quantities (minor crops). While it would add more value to also model each crop separately, the data used in this study had 306 observations for maize farmers, only 42 for rice farmers and only 20 for soybean farmers. The limited number of observations for rice and soybean farmers could not yield reliable estimates in the model. Further research can model the market participation for each crop separately to see how differently the factors would influence participation for each crop.

Lastly, most market participation studies have mainly focused on identifying the factors that affect the farmer's decision to either participate in the market or not and further determining the factors that affect their decision on how much they sell. It is not clear whether it is profitable for smallholder farmers to participate in the market and if they continue to participate or later drop out of the market. While it is important to get non-market participating farmers to join the market, it is equally important to keep the participating farmers selling and selling a larger share of output. Further research should aim at ascertaining the profitability of the market participants and were possible, a time series analysis of these participants can be done to assess if they continued selling, sold more or opted out of the market.

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Appendix

Table 6: Summary Statistics of Average Market Distance

Buyer type	Market Distance (km)	Standard Error	Frequency
Sold to Consumers	1.16	1.32	54
Sold to Processors	0.38	0.41	6
Sold to Aggregators	0.23	0.61	58
Sold to Other buyers	0.07	0.27	50
Total	0.48	0.96	168

Table 7: Summary Statistics of Average Transport Costs

Buyer Type	Transport Cost (GHS/Tonne)	Standard Error	Frequency
Sold to Consumers	2.70	3.87	54
Sold to Aggregators	0.68	1.99	58
Sold to Processors	1.06	2.30	6
Sold to other buyers	0.34	1.58	50
Total	1.24	2.83	168

Table 8: Summary Statistics of Average Loading and Offloading Costs

Buyer Type	Mean Load/Offload Cost (GHS/Tonne)	Standard. Error.	Frequency
Sold to Consumers	0.23	0.58	54
Sold to Aggregators	0.06	0.34	58
Sold to Processors	0.22	0.46	6
Sold to other buyers	0.00	0.00	50
Total	0.10	0.40	168

Table 9: Summary Statistics of Average Price

Buyer Type	Average Price (GHS/kg)	Std Dev.	Freq.
Sold to Consumers	0.29	0.18	54
Sold to Processors	0.15	0.06	6
Sold to Aggregators	0.22	0.13	58
Sold to Other buyers	0.20	0.14	50
Total	0.23	0.15	168

Table 10: Summary Statistics of Quantity Sold

Buyer Type	Average Quantity Sold (kg)	Std Dev	Freq
Sold to Consumers	198.66	157.20	54
Sold to Processors	584.83	419.45	6
Sold to Aggregators	643.91	544.10	58
Sold to Other buyers	260.25	283.77	50
Total	384.50	422.36	168