

EFFECTS OF COMMERCIALIZATION ON THE WELFARE OF SMALLHOLDER RICE
FARMERS IN THE BUILSA SOUTH DISTRICT OF GHANA

ADAJAGSA NATHANIEL

(10701430)

THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL
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DECLARATION

I, **ADAJAGSA NATHANIEL**, the author of this thesis titled, '**EFFECTS OF COMMERCIALIZATION ON THE WELFARE OF SMALLHOLDER RICE FARMERS IN THE BULSA SOUTH DISTRICT OF GHANA**' declare that with the exception of the references cited, this thesis was solely conducted by me in the Department of Agricultural Economics and Agribusiness, University of Ghana, Legon. I also declare that this thesis has never been presented either in part or whole for any degree in this University or elsewhere.


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16-11-2021
.....

Nathaniel Adajagsa

Date

(Student)

This thesis has been presented for examination with our approval as supervisors


.....

16-11-2021
.....

Prof. Akwasi Mensah Bonsu

Date

(Major supervisor)


.....

16/11/2021
.....

Dr. Freda Elikplim Asem

Date

(Co-supervisor)

DEDICATION

This work is dedicated to my parents Mr. Francis Adajagsa and Mrs. Francisca Abatori, my siblings Gifty Adoctalie Adajagsa and Mandela Adocta Adajagsa and my fiancée Portia Adom Azekumjigi and more especially our son Amaariba Abunab Andre Adajagsa.

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ABSTRACT

This study analyzed the level and determinants of rice commercialization among smallholder farmers in the Builsa South District of Ghana. The study also estimated the effect of rice commercialization on the welfare of the farmers in the study area. The study used primary data collected using a semi-structured questionnaire from a random sample of 384 smallholder rice farmers. The level of rice commercialization was calculated using the Household Commercialization index. The Double Hurdle Model was used to analyze the determinants of rice commercialization. Also, the effect of commercialization on the welfare of farmers (annual household expenditure and household income used as proxy) was analyzed using the Heckman Treatment Effect model. The mean Household Commercialization Index was 50.54%, showing a moderate level of rice commercialization in the study area. The study found that, farmer's decision to commercialize was significantly and positively influenced by access to market information, availability of buyers and size of rice farm, while negatively influenced by marital status and access to remittances. The intensity of commercialization was significantly and positively influenced by size of rice farm, ownership of means of transport and price of rice output, while negatively influenced by sex of household head and rice farming experience. Welfare of the household was found to be significantly and positively influenced by the level of commercialization of a household.

The study recommends that, farmers form a trade union that will facilitate their trade, protect their common interest and link them to more profitable and organized markets. Also, the study recommends that farmer groups should form a private/public partnership with government to establish a rice processing factory to add value to rice produced in the district for sale in high end markets. Again, MoFA should extend its current portfolio of services to include marketing services and timely dissemination of market information through the local media in the district.

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LIST OF ABBREVIATIONS

CCI	Crop Commercialization Index
DDA	District Department of Agriculture
GCAP	Ghana Commercial Agriculture Project
GDP	Gross Domestic Product
GIZ	Germany Agency for International Cooperation
GSS	Ghana Statistical Service
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IMR	Inverse Mills Ratio
LEAP	Livelihood Empowerment Against Poverty
MoFA	Ministry of Food and Agriculture
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
PFJ	Planting for Food and Jobs
SRID	Statistics Research and Information Directorate
SSA	Sub-Saharan Africa
WB	World Bank

CHAPTER ONE

INTRODUCTION

1.1 Background

Agriculture has traditionally dominated most African economies generating up to 50% of Gross Domestic Product, providing up to 50% of industrial raw materials and a great source of employment and income for majority of Africa's people (World Bank 2017). Due to the low level of formal education and employable skills of most rural dwellers, their livelihood options are often limited to agricultural activities (Guta 2017). In fact, most African economies rely on Agriculture for the most part of their growth (FAO 2016). This has made increasing productivity (i.e., increasing output per every unit of input such as land, seed, fertilizer etc. used in cultivation) which is key to agricultural growth a topical issue for most governments. Given population growth and the limits of area expansion as a means to increase crop production, productivity growth will increasingly entail the intensification and commercialization of smallholder agriculture, involving more intensive use of productivity enhancing inputs and more market-oriented patterns of crop production (Strasberg et al., 1999). Suggested as a strategy to increase productivity, commercialization entails the expansion of smallholder farmers' production orientation beyond just the traditional household consumption to market satisfaction through trade of a good portion of their output. However, most rural farmers who champion agriculture in most African countries predominantly practice consumption-oriented subsistence agriculture characterized with low productivity and quality which usually lead to their exclusion from formal market systems and other related income-mediated benefits (Olwande et al., 2015). Thus, contributing to the incidence of food insecurity and poverty among rural communities in Africa (Janssen 2017).

As reported by Geoffrey et al., (2015) the high incidence of food insecurity and poverty observed in most rural farming households have a direct linkage to the gradual dwindling of the performance

of the agricultural sector in developing countries. With projected increases in population, Africa is expected to reach two billion people by 2050, hence many have stressed on the need for African economies to advance agriculture to sustain food supply and achieve food security (FAO 2015). Developing agriculture is therefore considered an in-dispensable strategy to improve the livelihoods of many people in SSA. In fact, the OECD (2010) intimated that, growing the agricultural sector is a more viable option for rural development due to its potential to enhance growth nearly by thrice more than other sectors, for the very poor people in SSA. Often suggested as a great way to improve agriculture in SSA countries is the uptake of commercial farming among smallholder farmers (Olwande et al., 2015). Indeed, it is already observed that opportunities for livelihood improvement through agriculture are enormous in many rural areas in Africa due to comparative advantages that exist in the production of certain food commodities (Poole 2017).

In Ghana for instance, rice which is only second to maize in terms of national consumption, is observed to be an opportunistic crop for improving poverty in several rural communities due to their comparative advantage in its cultivation (SRID 2016). The production indices for major cereals in Ghana as estimated by (MoFA 2016), indicates rice production as the highest with a mean annual growth rate of 8.38% in the major rice producing regions of the country.

Counted among the poorest regions in Ghana, the Upper East Region (GSS 2015) comes third in total rice production in the country and has huge rice production potential in several communities that have not been fully exploited (MoFA 2016). Among many of these rural communities that have the opportunity for commercial rice production that could improve food security and welfare of farmers is the Builsa South District. This makes the prioritization of commercial cultivation of rice among the rural farmers a worthwhile strategy to improve the livelihoods of farmers in the district.

Policy makers have thus over the years prioritized agricultural commercialization in their agricultural development programs for rural communities across SSA countries (FAO 2014). There has been some progress recorded in this process over a couple of decades past. To begin with, agricultural commercialization as a catalyst for rural development was first widely propagated by the market liberalization policy in SSA (Geoffrey et al., 2015). This heightened in the period between 1980 and 1990 during the implementation of the structural adjustment programmes (SAPs). Also, policy makers have emphasized the sustainable deployment of local agricultural resources by channeling them into commercial activities with a focus on achieving market-driven growth (World Bank 2017). Being Ghana's main policy document navigating the country's agricultural progress, the Food and Agricultural Sector Development Policy (FASDEP) II captured agricultural commercialization among smallholder farmers as one of the approaches to transforming the sector. The policy hence prioritizes the increment of farmers' integration into both foreign and local markets. Again, Ghana's Commercial Agricultural Project (GCAP) reiterates the need to graduate from the current subsistence approach of smallholder farmers to a commercialized system through the creation of market linkages for productive smallholders. Quiet recently the Planting for Food and Jobs program have included the creation of market linkages for farmers as one of its five pillars. Similarly, interventions in other countries like Kenya and Ethiopia to transition smallholder subsistent farmers to commercial farming is evident.

In the light of these interventions, studies into the level of commercialization attained and the resulting effects in SSA have shown mixed results for different countries. Studies in Uganda and Tanzania on the adoption of smallholder farmer commercialization as a tool for eradicating poverty have showed similarly positive results (Janssen 2017; Tozooneyi 2017). Also, a finding by Geoffrey et al., (2015) in Kenya, revealed that commercialization of agricultural activities among

smallholder farmers reduced the incidence of insecurity of food supply and poverty quite significantly among commercialized households when compared with households that were not commercialized. In Ghana, IFAD-IFPRI (2011) found that, while there are significant differences in the level of commercialization for the regions in the country, being the least, the Upper East Region recorded an average marketed surplus ratio of 15%. For Abu (2013), transitioning of subsistent smallholder farmers to commercial farming remains an unsolved puzzle in Ghana, while its effect on livelihoods of rural farmers remains unclear. This study therefore seeks to contribute to the growing discussion on the determining factors of commercialization and to further inquire its effect on the welfare of smallholder farmers.

1.2 Problem Statement

Agricultural development in most SSA countries continue to stagnate due to relatively low investment into the sector by governments (World Bank 2017). Most SSA governments have yet to fulfil the Maputo declaration of at least a 10% dedication of government expenditure to investing in agriculture yearly. This has hence slowed the pace at which agriculture is transforming and also, lessened agricultures potential of eradicating the issues of poverty and insecurity of food supply among rural people in SSA countries (Geoffrey, et al., 2015).

In Ghana, Pauw (2018) finds that the average rate of growth in agriculture stands at 3.3% yearly with productivity for major food crops declining since 2010. An important crop like rice which has the highest growth rate among major cereals in Ghana has only achieved an average yield of 2.9mt/ha, out of its potential yield which is estimated at 6mt/ha (MoFA 2016). The reason for the low productivity recorded for major food crops which has affected agricultural growth is widely attributed to the dominance of subsistence farming (SRID 2016), which is characterized with low market orientation, low technology adaption, and low use of traded inputs like fertilizer and

improved seeds (Olwande et al., 2015). In fact, the FAO (2015) reported that, agriculture in Ghana is largely rain-fed and subsistence-based, with about 80% of production being done with rudimentary technologies. Even though the sector still employs the masses most of whom are subsistent farmers living in rural areas, the sectors' overall contribution to the country's GDP has been reducing since 2008 when it stood at 31% to its current 18.9% (World Bank 2017).

This situation has heightened suggestions for agricultural commercialization as a pathway to improve agriculture's potential to uplift rural people from poverty, improve their farm productivity and hence score significant welfare gains (Olwande and Mathenge, 2011). According to Wickramasinghe and Weinberger, (2013), addressing the declining rate of agricultural productivity that has significantly caused the high incidence of food insecurity and poverty among smallholder farmers living in rural areas will need a transitioning of rural smallholder farmers from subsistence agriculture to commercial agriculture. Again, the FAO (2013), reported that a deep understanding of the factors that influence smallholder farmers' ability to participate in agricultural commodity markets will be very useful for the successful formulation of measures and initiatives that facilitate farmer's adoption of new productivity enhancing technologies. Thus, attaining success in the attempt to increase smallholder farmers' productivity and reducing poverty will depend on the extent to which these farmers are linked to markets.

To explore these suggested benefits of commercialization, governments in SSA have tried to tailor several policy directions to help smallholder farmers who make up the huge part of the population of farmers to commercialize their farming activities (Geoffrey et al., 2015). Such a strategy is expected to increase productivity and reduce poverty especially among farmers who are comparatively advantageous in the production of economically viable food crops (Olwande et al., 2015).

Despite policy interventions aimed at enhancing productivity and commercialization among smallholder farmers, hinderances to market participation which include; market failures, transaction cost, lack of ability to meet standard requirements of some markets, poor access to credit facilities among others still persist (Abu 2013). This has led to low levels of commercialization especially among the rural poor who many a times have comparative advantage in the production of some marketable food crops. According to Siziba et al., (2011), the promotion of agricultural market-led development strategies including commercialization, have not yet yielded desired results due to persisting challenges encountered by smallholder farmers in Sub-Saharan Africa. Studies conducted in Nigeria and Ghana, shows a fairly low level of commercialization among rural farmers with most averaging only 30% commercialization level (Agwu et al., 2012; Abu 2013). IFAD-IFPRI (2011) also observed that the national average for level of commercialization is 33% and even worse in the Upper East Region which recorded the lowest commercialization level of 15% for the major food crops cultivated in the region especially rice.

Rice, which is predominantly produced in rural Ghana by smallholder farmers is fast becoming an economic crop in Ghana due to increasing demand emanating from population growth and urbanization (MoFA 2016). This has opened a window of opportunity for these subsistent farmers to commercialize their rice cultivation. According to the Builsa South District Department of Agriculture's 2019 annual report, despite the comparative advantage that exist in the production of rice due to the existence of huge high yielding rice valleys, commercialization among smallholder farmers is still low. Also, as noted by the Ghana Statistical Service in 2013, Builsa South which is among the few most recent districts to be created is rated as the poorest. Meanwhile, the District is touted by MoFA as one of the districts in Upper East region with great potential in

commercial rice production, explaining why several projects to enhance agriculture undertaken in the district have concentrated on the uptake of commercial rice production among smallholder farmers. It also observed that, most of the commercial rice farming in the district is increasingly being done by resourced farmers from other parts of the region, spewing a threat to the livelihoods of these rural farmers in the long run.

Studies on this subject of commercialization, have generally limited the scope to identifying the determinants of commercialization with just a few estimating the effects on various aspects the rural economic unit. Also, studies like (Geoffrey et al., 2015; Janssen, 2017) along this phenomenon have looked at agricultural commercialization in general, thus by estimating the degree of commercialization for several crops cultivated by farmers without focusing on specific crops that farmers are comparatively advantageous in its production. This study therefore wants to limit the scope of commercialization to farmers who have comparative advantage in producing a specific crop. Thus, it will investigate the, degree and extent of rice commercialization and estimate the trickle-down effect on welfare of households in the Builsa South District of Ghana.

1.3 Research Questions

The study raises these research questions:

1. What is the level of commercialization among smallholder rice farmers in the Builsa South District?
2. What factors influence decisions and the extent of commercialization among smallholder rice farmers in Builsa South District?
3. What is the effect of commercialization on the welfare of smallholder rice farmers in the Builsa South District?

1.4 Objectives

The main objective of the study is to assess the effects of commercialization on smallholder rice farmers in the Builsa South District. The specific objectives are:

1. To determine the level of commercialization among smallholder rice farmers in the Builsa South District through the calculation of a crop-specific index.
2. To examine the factors influencing decisions and the extent of commercialization among smallholder rice farmers in Builsa South District.
3. To estimate the effect of commercialization on the welfare of smallholder rice farmers in the Builsa South District.

1.5 Research Hypothesis

It is expected that, farmers with a high Crop Commercialization Index (CCI) for rice cultivation will have, better household welfare (proxied by household per capita expenditure and income) than farmers with a low CCI. Additionally, farmers decision and extent of commercialization is hypothesized to be limited as a result of market failures emanating from inherent high transaction costs in the markets.

1.6 Significance of Study

This thesis aims to contribute to the ongoing discussion on the impact of commercialization on agricultural development in rural areas. This will provide empirical evidence useful for identifying development pathways that stimulate agricultural commercialization in Ghana. Since agricultural commercialization has become a topical issue in growing Ghana's agrarian economy, knowledge on the level of commercialization, understanding its determining factors as well as its effects on welfare of rural farm families will be useful in navigating policy direction towards combating rural poverty. In doing this it will provide a fair understanding of the influencing socio-cultural and

economic factors and how they can be coerced through policy interventions to achieve high levels of commercialization among smallholder farmers.

This study will fill the gap in the literature on the trickle-down effect of commercialization on welfare at the household level. It will provide empirical evidence that serve as a measure of the performance of government interventions aimed at improving commercialization among smallholder farmers in the study area. The outcome on the effects of commercialization on rural livelihoods will be crucial for initiating policy and devising appropriate interventions that enhance commercialization among rural farmers. This study will thus contribute to a body of knowledge on this subject matter and form a basis for further studies by institutions and students.

1.7 Organization of Thesis

This thesis is organized in the following way. Chapter One introduces the study, stipulating the problem it seeks to address, the research questions raised by the study and the objectives to be addressed. It sums the chapter up with a justification and hypothesis on which the study is based. In Chapter Two, literature encompassing previous works by research institutions and individuals that have made valuable contributions to the subject of agricultural commercialization have been reviewed. Chapter Three details the entire research approach and various methods used for the study. Chapter Four presents the resulting findings of the study and their discussions. Finally, the last Chapter presents the major research findings, conclusions and the policy recommendations that are proposed by the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Similar works have been thoroughly perused to advice direction of this thesis and also to find and fill knowledge gaps relevant for policy advancement. The chapter presents a review of literature on the underlying concepts and empirical models upon which the study is based.

It starts with a discussion on the main concepts and categorizes them into three parts consisting of: definitions, measurements and findings of other studies on each concept. Finally, a summary of the theoretical and empirical literature is presented in the conclusion of this Chapter.

2.2 Theoretical Review of Conceptual definitions

2.2.1 The Concept of Smallholder Agricultural Household

The study adapts the GSS (2012) definition of an agricultural households which states that, a household is considered an agricultural household when at least an individual member of the household was engaged in at least one farming activity which may include; tree planting, cultivation of crops, rearing of livestock and fish farming.

Most authors who have tried to define smallholder farmers usually base their categorization on size of land under cultivation by the farmer. However, these farm sizes used in this categorization differ between regions, countries and agro-ecological zones. In their view, Wickramasinghe and Weinberger, (2013) stated that, in high dense areas, farmers who cultivate below 1 hectare of land are considered as smallholders, whiles in semi-arid areas, smallholders include those who cultivate about 10 hectares of land. MoFA (2011) whose view is considered by this study states that, farmers who cultivate at most 2 hectares of land are considered as smallholders.

However, works like Chamberlin (2007) on smallholder farmers in Ghana offer divergent opinions on the conceptualization to smallholder farmers by extending the base for categorizing beyond just the size of a farmers' land holding to the farmers' wealth, orientation to markets and the extent to which they are vulnerable to the risk involved in farming. Asuming-Brempong et al., (2004) also agrees that, the usage of farmers resource base and risk withstanding ability defines smallholder farmers more accurately than just the size of land holding of a farmer.

In the wake of all these divergent views, one key factor that is central to the definition of a smallholder is the size of the landholding of the farmer. This is probably because, the size of a farmer's landholding is an easy and more straight forward way of characterizing farmers for studies empirically. This study therefore defines a smallholder farmer based on the size of a farmer's landholding. Because MoFA is considered an authority in research in Ghana, its standard of at most 2 hectares of landholding size is adopted to categorize smallholder farmers for the study.

2.2.2 Agricultural Commercialization

The concept of agricultural commercialization has previously been defined and interpreted in different ways by several authors during different periods in time. This concept has traditionally been linked to the production of cash crops, but Moti et al., (2009), argues that, commercialization of agriculture is not limited only to the production and supply of cash crops to the market. Building on these assertions, Govereh et al., (1999) defines commercialization of agriculture as the portion of a farmers total output that is offered for sale in the market without restricting the product to only cash crops.

Agricultural commercialization according to (Braun 1995) therefore refers to a process that involves transforming agriculture from subsistence to a system that orients production decisions on market trends that impacts incomes, consumption and farm household's nutritional setup.

Essentially, the process transcends beyond merely yielding of excess output but also involves households' decision pattern regarding the choice of products and input usage while basing such decisions on the principle of maximizing profit (Pingali and Rosegrant, 1995). Thus, commercializing agriculture is more than the marketing of farm outputs but includes the replacement of farmers usage of own inputs for inputs traded in the input market and also the marketing of family labour available, hence increasing the strength of the link that exist between households and markets (Jaleta et al., 2009).

It is interesting to note that, in some instances market participation has been used to mean agricultural commercialization, however the usage of a proxy generated through farmers engagement in the market as sellers as a measure of commercialization has some observed inadequacies (Dawit et al., 2006; Moti et al., 2009). This argument suggests that, market participation be considered a subset of commercialization. Thus, when computing commercialization, it should be indicated clearly the exact aspect of market participation is being used to estimate commercialization.

Therefore, based on the literature, this study captures commercialization as a measure of a farmers' engagement in the output market as a seller and input market as a buyer. However, the computation will not include input market participation due to the government policy that provides inputs (seed and fertilizer) to farmers at hugely subsidized prices. Meanwhile not all farmers considered for this study benefited from this intervention. Therefore, the main indicator of commercialization adopted by the study is limited to the households' participation in the commodity market as a seller of its farm output.

2.2.3 Measurement of Commercialization

The divergent definitions and interpretations of the concept of agricultural households translates to the, different approaches used by different authors to compute household commercialization level (Braun & Kennedy, 1994) due to the difference in the definitions and interpretations of the concept. Most often, the ratio of sales to output is computed. This is done by calculating the value of sales in monetary terms as a proportion of the farmer's total farm output (Gebre-ab 2006). Randolph (1992) measured commercialization by taking the proportion of a farmer's crop sold of the total crops produced by the farmer.

The household commercialization index (HCI) initially introduced by Govereh et al., (1999) and Straberg et al., (1999) is computed as follows;

$$HCI_i = \left[\frac{\text{Gross value of crop sale}_{hhiyearj}}{\text{Gross value of all crop production}_{hhiyearj}} \right] * 100$$

Regardless of its own shortcomings, measuring only the output side is still able to estimate a household's commercialization status and is relatively easier to collect, while submitting itself well enough for empirical testing within a regression framework. The basic consideration of this measure is that, the agricultural commercialization process is usually represented in a continuum that ranges from an entire subsistence (**HCI_i = 0**) to a purely commercialized system (**HCI_i = 100**). However, Moti et al., (2009), identified a fundamental set back of the HCI, arguing on its failure to capture the livestock subsector, which is found in some instances to be more important than the traditional cropping systems. Gebreselassie and Kay, (2008) argues with an illustration that, the computation of such a concept may result in a misleading index value explaining that, when a farmer produces for instance only two bags of a crop and offers all on the market for sale, (HCI = 100) he/she will be seen as more commercial than another farmer who produces about 40 bags and sells 20 (HCI = 50).

Regardless of these setbacks, Govereh et al., (1999) maintains that, the HCI remains relevant for use in real practice, arguing that in countries that are yet developing, smallholder farmers have a relatively less likelihood to sell their entire output. Since this study focuses on only smallholder rice farmers in a rural community, the use of the HCI will be appropriate.

2.2.4 Determinants of Commercialization

As argued by Jaleta et al., (2009), the commercialization process is influenced by many internal and external factors that are interlinked to the household farming activity. The internal factors identified are essentially the households resource endowments which include land, labour and capital, while external factors on the other hand includes, technological changes, demography and market institutions close to the farm household.

The empirical investigation of the determinants of smallholder commercialization is based on the Sub-Saharan African context. The studies considered generally found a positive relationship between commercialization and (a) household assets and earnings, (b) accessibility of credit facilities (c) usage of input and extension services and (d) transaction cost items.

2.2.5 Impact of agricultural commercialization

There have been counter perceptions on the consequences of agricultural commercialization on the plight of rural poor households. The impact of this concept as categorized generally in theoretical literature consists three levels. The first level impacts are immediate household direct effects on income and employment while on the other hand health and nutrition are second level effects. These second level effects are mainly dependent on the income level of the household achieved through the current commercialization level. Lastly, the third level impacts are environmental and macro-economic impacts that are usually beyond the level of the household.

These impacts can be positive or negative though positive impacts generally outweigh the adverse consequences (Geoffrey et al., 2015).

Awotide et al., (2016), believes commercialization brings about exploitation of comparative advantages which promote efficiency and trade and eventually enhancing economic growth and household welfare improvement at both local and national levels. Also, majority of findings from IFPRI's country studies found positive levels of impact of agricultural commercialization on income and household caloric intake, with little impact on nutritional status of these households. (FAO 2014) affirms that, existence of commercially focused practices among some smallholder maize producers positively relates to economic outcomes. Strasberg et al., (1999) postulates that commercialization of an agricultural household generally influences significantly the household's food crop fertilizer use and productivity. The study specifically indicates that, on average a 10% increase in a household's commercialization level results in an increase in fertilizer use by 8kgs/acre and an additional 670Ksh/acre boost in productivity of food crops. In an opposing view, other authors have argued that commercialization does not always lead to positive outcomes. Taking a firm stand, Von Braun (1995), intimated that, amidst the instances and eventualities of inequality, risks and market failures, commercialization will only make poor households worse off. Also, Ouedraogo (2018) found that, commercialization would cause food insecurity to households who record low yields in their cultivation.

2.2.6 Effect of Commercialization on Welfare

Studies have shown that smallholder commercialization significantly influences the welfare status of farmers. Von Braun (1995) found commercialization to directly impact household's income levels and can either lead to betterment or worsening of the poverty status of rural people. Also, it is argued that, affording a quality of life depends on income growth which in most African

countries are raised through agriculture, implying that, improving a household's level of commercialization can impact greatly on the poverty status of farmers (Strasberg et al., 1999). Notably, agricultural commercialization involving integration of rural credit market contributes significantly to the growth process and transformation of agriculture (Mellor 1990). Studies in these countries (Rwanda, Malawi and Gambia) exhibited increased nutritional status of commercialized households compared to those not commercialized (Geoffrey et al., 2015). (Strasberg et al., 1999 and Govereh et al., 1999) also found consistent results indicating that agricultural commercialization positively and significantly affected use of fertilizer and productivity of food crops and thus overall farm incomes of farmers.

2.3 Models of Measurement and Analysis

A number of studies on smallholder commercialization have generally modelled both output and input market participation decisions as a two-stage decision process (Olewande and Matenge, 2012). This assumption is premised on the fact that an agricultural household makes two decisions; one entails the choice to engage in the market or not while the other involves the decision on the extent to which it participates in the market. Some studies have used the Heckman sample selection model (Boughton et al., 2007 and Alene et al., 2008) while others have used the double hurdle model (Geoffrey et al., 2015; Abu, 2013; Olwande and Mathenge, 2012). This study uses both the double hurdle model and the Heckman model to address two objectives which both involves a two-step decision process.

2.3.1 The Double Hurdle Models

Developed as a general form of the Tobit model by Craig, (1971), the Double Hurdle Model makes it possible for a factor to possess divergent influences on the household's probability to commercialize and the degree of commercialization as found by Lijia et al., (2011).

Olwande and Mathenge, (2012) also explain that, the double hurdle model offers a censored regression which is a type of a corner solution outcome. The model uses a dual stage approach for every study. The first stage usually involves a discrete probability of participation model, while the second stage focuses on the extent or intensity of participation (Olwande et al., 2015). The preceding stage of the two-tier model deals with an estimation of the Probit model. On the other hand, the second stage is able to take different functional distributions. The estimation of the Craig's double hurdle model usually assumes a normal truncated distribution allowing for the advantage of a normal truncated distribution over the Tobit model's lognormal distribution. This makes it possible to test for restrictions imbedded in the Tobit model (Olwande and Mathenge, 2012). The double hurdle model is hence, in theory more suitable than the other two-tier models.

2.3.2 The Heckman Model

Introduced by Heckman in 1979, this selection model is premised on a wage offer function given that some data on wages was missing because of the outcome of other variable e.g., labour force. The Heckman model employs two equations which are estimated in two steps. It rectifies this kind of sample selection problem by first computing a selection term from its initial equation and including it as a regressor to correct the self-selection issue in the second stage regression that involves observations from the selected sample. The first equation which is the selection model is calculated using the Probit model to predict the probability of the observed household participating or not participating in the market. Estimating an Inverse Mills Ratio (IMR), it accounts for the

sample selection to avoid any form of bias. The computation of the second equation is done using the using Ordinary Least Squares (OLS) including also an IMR as a regressor. Both models adapt same variables with the second including other variables which Wooldridge (2006) proposed as an exclusion restriction variable.

The Heckman selection model however has a weakness which is observed as, the exclusion restriction of the model identified only in assumptions that are distributional Sartori (2003) and as well as sensitive to the bivariate normality assumption (Winship and Mare, 1992).

2.4 Empirical Literature of Agricultural Commercialization

Following agricultural commercialization theoretical work, a series of empirical studies have been conducted to test the various arguments advanced in theory. Several empirical studies have been conducted on the subject with some showing similar findings while others also showing divergent views. Geoffrey et al., (2015), using a panel data obtained from Kenya, studied the impacts of agricultural commercialization on household poverty which was proxied by the household's per capita expenditure on food and non-food expenditure items. This study found that agricultural commercialization significantly increases household's annual per capita household expenditure among commercialized and non-commercialized households had they commercialized. Quite similarly, Strasberg et al., (1999) found that, the commercialization of cotton and groundnuts had positive spillover benefits for smallholder food production in Africa. However, the study also found a possible danger of commercialization that could emanate from the non-reliable and inefficient food markets in Africa that could expose smallholder households to major risks of food insecurity if they don't have the capacity to participate and/ or withstand shocks that may come with commercialization.

Kennedy and Cogill (1987) empirically measured the effects of agricultural commercialization on income and nutrition in Kenya using mainly descriptive statistics and OLS models. They used descriptive statistics to compare income and calorie intake between commercialized households (those contracted by sugar millers to grow sugarcane purely for commercial purposes) and non-commercialized household (not growing sugarcane). This static analysis was supported by OLS estimations of the determinants of total household incomes and total calorie intake with one of the explanatory variables in both models being income from sugar cane. Their results showed that more commercialized farmers (sugar cane growers) had higher household incomes which translated into higher levels of non-food expenditures. They did not however detect any significant differences in nutritional outcomes (calorie intake).

On the other hand, a study conducted by Gutu (2017) in Ethiopia, on the degree of commercialization and its contribution to farmers progress out of poverty, there were quite divergent results. First it found commercialization to be very low. Also, it found poverty to have an opposite relationship with commercialization, stating that poverty and welfare of farmers were better influenced by other factors other than degree of commercialization. Similarly, results from a comparative analysis of impacts of agricultural commercialization on health and nutrition of smallholder farm households across several countries in Asia, Latin America and Africa (including Kenya) by von Braun (1995) demonstrated that agricultural commercialization process had a significant positive effect on the wellbeing of rural smallholder farmers. Using descriptive statistics and fitting an OLS model to analyze the determinants of per capita income and the nutritional status of children in sampled households, von Braun (1995) incorporated share of cash crop income in total household income as an explanatory variable in the model. The econometric results showed that increased agricultural commercialization resulted into higher per capita

incomes that reduced household poverty significantly. Except for Kenya, the rest of the study countries (Guatemala, Philippines, Rwanda, Malawi and Gambia) exhibited increased nutritional status of commercialized households compared to those not commercialized. In the Kenyan case where there was limited improvement in child nutrition, this was attributed to factors like insecure land tenure, gender biases, market failures and policy biases against smallholder producers. However, this study did not empirically analyze the determinants of commercialization but instead concentrated on the impact of agricultural commercialization on household welfare. Also, the impact analysis framework adopted in this study was less rigorous i.e. used pooled data and assumed that commercialized and non-commercialized households had same characteristics with the only difference being agricultural output market participation (commercialization). This assumption is likely to be untrue because of the problem of households self-selecting themselves into commercialized and non-commercialized groups due to their unobserved characteristics.

2.5 Conclusion

The review shows that other studies have been done on the subject of smallholder agricultural commercialization. However, most of these studies focused mostly on identifying the determinants of agricultural commercialization with a few including the influence of commercialization on various aspects of farmers livelihood.

General methods used by current empirical studies on agricultural commercialization adopt a two-tier approach for analysis. The extensive use of the two-tier Heckman model and the Double Hurdle Model have been observed. For the purpose of achieving the objectives of this study, both of these models have been used.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the various research methods employed for this study. It includes; a conceptual framework guiding the study, the study area that details socio economic and environmental characteristics of the area under study, approach used to collect and analyze data, and the theory underlying the entire study.

3.2 Conceptual Framework of Commercialization

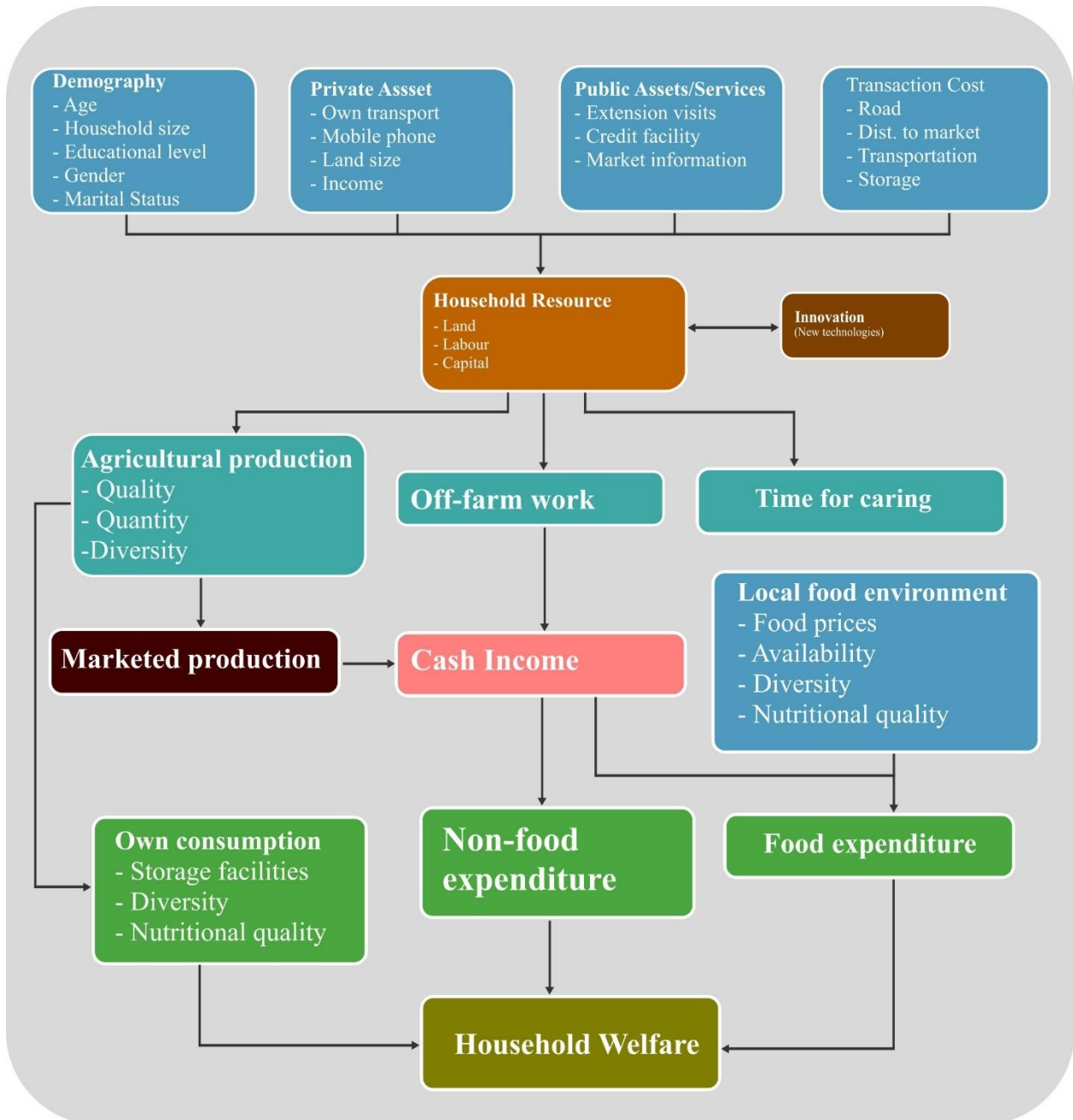
The conceptual premise for smallholder commercialization has been that markets provide increased incomes to participating households who in turn are able to enhance their overall consumption than it could have been under subsistence orientation (Pingali 1997; Timmer 1997). Thus, the study on commercialization of smallholder farmers is conceptualized in the framework presented in Figure 3.1. This presents the relationships existing between smallholder farmer's production, market participation and their welfare with some hypothesized covariates based on literature.

The framework suggests that the household which is a rational economic unit strives ultimately to satisfy its welfare needs with all resources at its disposal. However, in this quest, it is influenced by factors some of which are in its control and others not in its control. These factors invariably influence the household's decisions on how to use its resources for its welfare gains. In the first instance households' options for the use of their resources include; 1). Farm production 2). Off-farm activities and 3). Caring activities. The framework further suggests that when the households decide to engage in farm activities, they usually do so with two main reasons: home consumption and marketing. The household could either consume all output, market all or consume some and market the surplus depending on the commodity and quantity of output (Janssen 2017). In the

instance where the entire produce is consumed at home, it means that they are not market oriented but rather subsistent (i.e., they produce to satisfy what is required for home consumption alone). In the other instance where all produce is marketed, it means a market-oriented production or commercial farming. In the last instance some produce is consumed while the surplus is marketed to raise income for offsetting household expenditure while depending also on market for other food needs. Each of these situations have different implications on the farm holder's welfare and the development of the agricultural sector in general.

Households are usually faced with a decision-making problem on how to allocate their resources to derive the best possible utility from their farming activities. These decisions are influenced by their household needs and resource holdings. The output realized from their production resulting from their resource allocation decisions are either consumed entirely at home, sold entirely to the market or partially consumed with surplus sold at the market.

Figure 3.1: Conceptual Framework



Modified from (Janssen 2017).

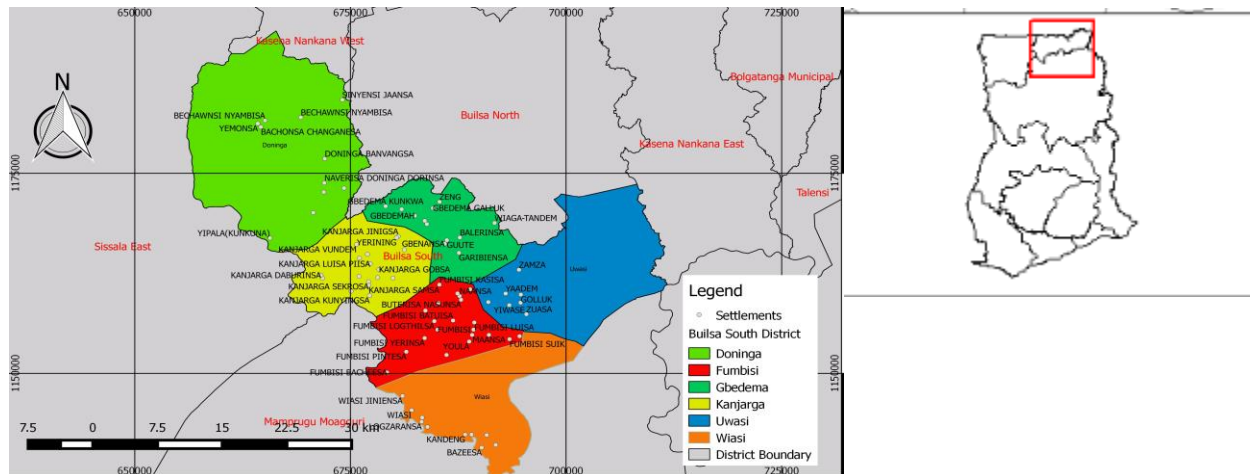
Commercialization is when a household sells a portion or all of its entire agricultural produce and is observed to be associated with many potentials. According to Jayne et al., (1995) commercial orientation leads to a decline in real food prices due to increased competition and lower costs in food marketing and processing.

Farmer's decision to commercialize (participate in the market) and their extent of commercialization (quantity of produce marketed) is influenced by several factors. In literature, the factors have been categorized as follows; socio economic characteristics of the household, assets privately owned by the household, public assets variables and cost involved in transaction variables. Siziba et al., (2011) suggests that commercialization have the potential to generate income for economic growth leading to welfare gains and development of smallholder farmers in rural areas. Thus, cash income gained from commercialization is used to finance household expenditure and thus improving their welfare. The framework thus focuses on the proportion of farmers' farm produce offered for sale in the market, the various factors that influence such proportions and how it finally affects the households' welfare.

3.3 The Study Area

The Builsa South was carved out of the then Builsa District by a Legislative Instrument (LI) 2014. The district is one of the four (4) that was created in the Upper East region in 2012. It has Fumbisi as its administrative capital. It lies between longitude 1° 05' West and 1° 35' West and latitude 10° 20' North and 10° 50' North of the equator. Builsa South is located in the South–West part of Upper East Region. It shares boundaries with Builsa North District to the North, Mamprugu Mogduri District in the Northern Region to the South, West Mamprusi District to the East, and Sisala East District in the Upper West Region to the West. The figure 3.2 represents the Map of Builsa South District.

Figure 3. 2: Map of the study Area



Source: Remote Sensing/GIS Laboratory, Department of Geography, University of Ghana, (2019)

The population of the people of Builsa South District, according to the 2010 Population and Housing Census, is 36,514 representing 3.5 percent of the region's total population. As expected of a rural locality, almost the whole district is engaged in agriculture as their main economic activity. Households engaged in agriculture constitute 92.7 percent of the total number of households in the district. Nearly 99 percent of the households are engaged in crop farming and 83.7 percent are also engaged in livestock rearing. Fish farming together with tree planting are relatively low in the district (GSS 2015). Total area of cultivable land is 1701 hectares. The people are predominantly smallholder farmers cultivating a range of rain-fed crops mainly for consumption. The main crops grown in the area are cereals (maize, rice, sorghum, millet) and also pulses (groundnut, cowpea, soya bean). Farmers along river bodies and dams also engage in vegetable and maize production during the dry season. The people are also engaged in livestock rearing (sheep, goats, cattle, pigs) and poultry production (local fowls, exotic fowls, guinea fowls, ducks).

The district is within the Guinea Savannah vegetation belt. There are mostly degraded soils with low content of organic matter and nutrients because of continuous cropping and other degradation activities such as rampant burning of bushes in the dry season, hunting and mining. The major implements used for crop farming activities include; hand hoe, animal traction and tractor, with the hand hoe being the most common. The district has a one maximum rainfall regime expanding over a period of 5 months. The annual total rainfall ranges from 700mm to 1000mm. The dry season which is the longest extends for 7 months and has a mean temperature of 25-30°C (Ghana Meteorological Dept. 2016).

Rice farming is comparatively high in the district due the existence of several rice valleys and has the potential to be a power house of rice production in Ghana (MOFA 2016). It is reported that, much of the farming activities among indigenes in and around the communities happens within these valleys offering direct jobs to about 3,500 people along the rice value chain in the district (SRID 2016). Current rice yield stands at an average of 2.5 mt/ha slightly above the regional average with potential yield estimated to be around 6 mt/ha (SRID 2016). Also shown in Table 3.1, production data from 2014-2018 shows that rice is the highest yielding crop in the district peaking at an average of 3.0 mt/ha in 2018.

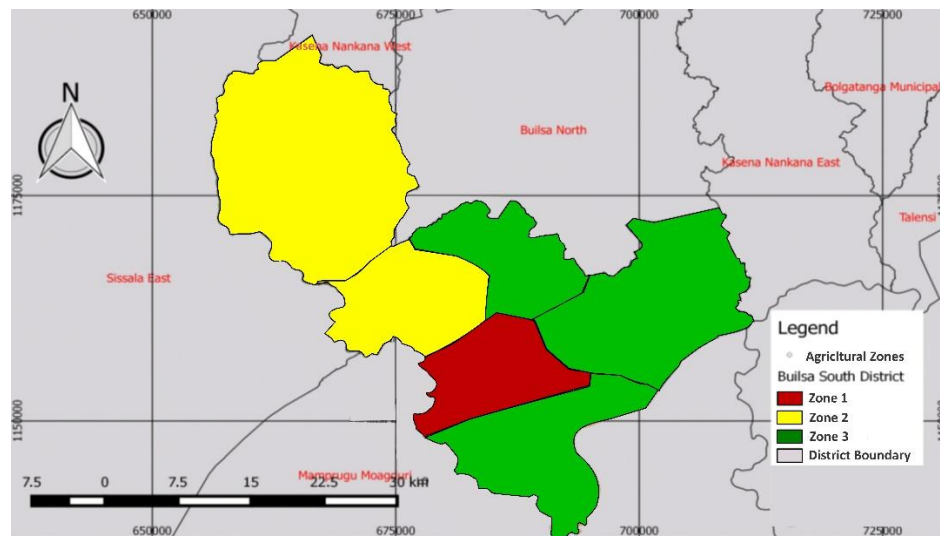
Table 3. 1: Output of crops in the Builsa South District

Crop	Estimated Production (MT)					Area Cropped (ha)					Average Yield (MT/Ha)				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Maize	600	1286	524	1610	3300	600	643	655	1150	1650	1	2	0.8	1.4	2
Rice (Paddy)	1260	2400	176.4	3100	5550	840	960	126	1240	1850	1.5	2.5	1.4	2.5	3
Millet	768	984	393	603	796.8	960	820	655	670	664	0.8	1.2	0.6	0.9	1.2
Sorghum	924	1014	407.5	512	953.7	840	845	815	640	867	1.1	1.2	0.5	0.8	1.1
Soyabean	167.2	279	285	145	200	152	186	190	290	200	1.1	1.5	1.5	0.5	1
Groundnut	680	1554	672	645	1440	680	740	560	860	1200	1	2.1	1.2	0.75	1.2
Cowpea	2910	4642	1581	738.75	1800	1940	2110	1054	985	1200	1.5	2.2	1.5	0.75	1.5

Source: District Department of Agriculture (2019).

For most indigenous dwellers, cultivation of rice in these valleys remain their main livelihood venture. The district is divided into three agricultural zones as shown in Fig 3.3 with each zone having about 6 operational areas each (OAs).

Figure 3.3: Map of Agricultural Zones



Source: Modified from Remote Sensing/GIS Laboratory, Department of Geography, University of Ghana, (2019).

3.4 Data Collection Approach

This section presents the sampling approach and how data for the study was sourced. It details the step-by-step scientific research sampling procedures used to arrive at the sample size for the study.

The conceptual frame work and theoretical framework of the study have also been outlined.

3.4.1 Sources of Data

Data for the study was mainly primary and some secondary data. The primary data was gathered through a household survey aided by a semi-structured questionnaire and using personal (one on one) interview of smallholder rice farmers. Secondary data was obtained from the District and Regional Department of Agriculture – MOFA, key informants, chief farmers and opinion leaders.

The questionnaire used was semi-structured and was designed to source data including; amounts of rice produced and the quantity offered for sale in the market, the demographic features of the household including; age of household head, gender of household head, marital status of household head, farming experience of head of household and the household size. Also, private assets owned by the household where enquired which included; size of household's farm, earnings from off-farm activities, ownership of means of transport and ownership of mobile phone. Public assets accessed by households such as access to credit facilities, contacts with extension agents, road network and transport system where also captured. Lastly transaction cost items like access to market information, distance to markets where also recorded.

3.4.2 Sample Size and Sampling Approach

Given the focus of the study, the sample included only smallholder agricultural households engaged in rice cultivation. The 2010 PHC defined an agricultural household as a household that has at least one person in the household engaged in any type of farming activity, namely crop farming, tree planting, livestock rearing and fish farming. Also, MoFA defines a smallholder

farmer as those who cultivate not more than 2 hectares of farmland in a season. Therefore, the population targeted for this study included smallholder rice farmers.

The data for the research was obtained from a survey of 384 smallholder farm households in the three agricultural zones of the districts. For statistical purpose, such a sample size is adequate for a true representation and generalization of the entire population. Also, considering resource constraints, this sample size is used to optimize resource use.

A multi stage random sampling technique was used to select the ultimate respondents. This multi-stage procedure was in three stages; cluster, purposive and randomized sampling approach in each respective stage. These three stages involved selection of Operational Areas (OA) earmarked by the District Department of Agriculture, Communities and rice farmers.

In the first stage, a cluster sampling was used to select ten operational areas from all the three agricultural zones of the district based on the proportional number of operational areas in each zone. Whereas five operational areas were selected from a total of ten OAs in zone one, two were selected from a total of four in zone two and three OAs were also selected from a total of six in zone three. These OAs formed the sample frame of the study. Using OAs as sampling units is advantageous given how they are approximately equal in size. This offers all farmers a relatively good opportunity to be selected, thus correcting for the unequal opportunity faced when using towns and villages which usually vary in a wide degree in sizes (Morris et al., 1990).

In the second stage, communities within each operational area were purposively selected based on their extensive production of rice, consequently, 30 communities were selected. This purposive sampling was done in consultation with all district AEAs in charge of each OA selected for the

study. Table 3.2 presents the distribution of OAs and communities selected in the three zones of the district.

In the last step or stage a random sampling was used to select the final respondents from the communities chosen in the previous stage. Due to the unavailability of a comprehensive list of rice farmers, an improvised list was generated with the help of the AEAs and community chief farmers. In each community, a community center where people usually converge was identified and used as a pivoting point for preparing a list of rice farmers in the community. Together with chief farmers, an AEA and a few other farmers who were available at the center, a list of rice farmers was generated. A lottery method was used to randomly select the sample from the list generated.

A semi-structured questionnaire was used to interview all the farmers engaged in the survey. Highlights of the data obtained from these farmers included; household characteristics, land size, resource ownership, access to extension services, access to credit, various crops cultivated, market participation, volume of output taken to the market, road access and other relevant information.

Table 3. 2: Summary of sample distribution per community

Agricultural Zones	Operational Areas Sampled	Number of Communities Sampled	Number of Households Sampled
Zone one	Baasa	3	32
	Batuisa	2	28
	Kasiesa	3	30
	Naadema	3	31
	Pintengsa	3	31
Zone two	Dogninga	3	42
	Kanjarga	3	37
Zone three	Wiesi	3	47
	Gbedembilisi	4	58
	Uwasi	3	48
Total		30	384

Source: Author’s compilation (2020).

This comprehensive sampling procedure, makes for a highly representative sample. Thus, the observed behavior of the sample considered in the study can reliably be extrapolated directly for the district.

3.5 Theoretical Framework of Market Participation

3.5.1 Theories of Trade and Utility Maximization

The study of smallholder farmer's commercialization is based on the theory of trade developed by Recardo (Siziba et al., 2011), and the theory of utility which assumes a non-separable household model as operationalization by Barrett. The trade theory postulates that, as a rational economic unit, the household's motivation to trade in the market is derived from its desire to explore welfare gains and also to satisfy its unlimited wants. This it does by producing goods for which it has comparative advantage to trade in order to buy goods it has no comparative advantage in its production. Also, the household's production process uses purchased inputs (labour and non-labour: seed, fertilizer, chemical etc.) from markets and/or own farm produce from previous farming seasons (Geoffrey 2015). Thus, the household faces an optimization problem based on benefits and costs arising from participating in both input and output markets. However as noted by Siziba et al., (2011) the trade theory fails to identify determinants of commercialization, hence other theoretical models (Boughton et al., 2007 and Barrett 2008) have been developed.

Premised on utility maximization, Barrett's stylized non-separable market participation behaviour model is developed to make-up for the limitation of the trade theory (Abu 2013). The basic consideration of this model is that, households in developing countries are both producers and consumers of crops and that the imperfections of markets make their production and trade decisions non-separable (Ouedraogo 2018). As producers, they make resource allocation decision (labour, land etc.) to different crop production and the quantity of labour to hire in order to maximize farm profit. As consumers, they have to make the decision on the allocation of income

gained from various activities to consumption and the decision on the amount of labour to allocate to off-farm activities in order to maximize their utility (Tayloy et al., 2008).

Utility is hence defined as a function of consumption of a vector of agricultural commodities denoted as Y^c for $c = 1, \dots, C$ and a Hicksian composite of other tradables denoted as X . The farm household gains income from production and sale of some or all of the crop C produced and other incomes earned from off-farm activity W . Every crop is cultivated adapting a certain technology, $f^c(A_c, G)$ that indicate how services flow beginning with the service offered by the assets privately owned by the farmer – land, labour, machinery shown by the vector A and services provided by the public, including services from extension officers also represented by G , for the ultimate achievement of output.

The farm household is faced with market price for each crop, P^{cm} and a vector of crop and a vector of transaction costs per unit depending on public goods and services G available, specific household characteristics that can affect costs reflected in the vector Z as well as Assets of the household A , cash from earnings W and net sales. Households' decision to commercialize is represented by M^{cs} where $M^{cs} = 1$ if the household participates in the market and $M^{cs} = 0$ if its does not commercialize.

Truncating Barrett's model, the decision to commercialize (thus selling in the output market) (M^{cs}) can be presented in a reduced function of exogenous variables (A, G, W, P^{cm}, Z) this includes private assets, costs involved in transaction, income earned from non-farm activities and price of commodity (Siziba et al., 2011). As justified by Boughton et al., (2007), the truncation considers the household as only a net seller hence each choice can be presented as a function of the exogenous variables. This then allows for participation in the market only as a net seller to be a stand-alone model.

The Barrett household model when truncated, shows the relationship that exist between commercialization of farm households and some variables. The specified relationship is as follow:

Commercialization

$$= f \left(\begin{array}{l} \text{private asset (A), public asset (G),} \\ \text{household characteristics (W),} \\ \text{commodity price (P) and transaction cost (Z)} \end{array} \right) \quad (3.1)$$

Previous studies (Abu 2015; Ouedraogo 2018; Geoffrey et al., 2015 and Martey et al., 2012) have included these variables in the estimation of determinants of commercialization. From equation (3.1) the theoretical relationship can be specified as;

Commercialization

$$= f \left(\begin{array}{l} \text{AGE, GEN, EDUC, MARST, HHSIZE, FEXP, MFBO, FRMSIZE, HHINC,} \\ \text{OFINC, OUTPUT, TEL, ACCRE, EXTCON, PRICE, MKTINFO, POS, FOS} \end{array} \right) \quad (3.2)$$

Adding to the Barrett's theoretical model, Abu (2013) creates an empirical dimension of the probability of commercializing and intensity of commercialization as follows:

Commercialization:

$$\begin{aligned} = & \alpha_0 + \alpha_1 \text{ AGE} + \alpha_2 \text{ GEN} + \alpha_3 \text{ EDUC} + \alpha_4 \text{ MARST} + \alpha_5 \text{ HHSIZE} + \alpha_6 \text{ FEXP} + \alpha_7 \text{ MFBO} \\ & + \alpha_8 \text{ FRMSIZE} + \alpha_9 \text{ HHINC} + \alpha_{10} \text{ OFINC} + \alpha_{11} \text{ OUTPUT} + \alpha_{12} \text{ TEL} \\ & + \alpha_{13} \text{ ACCRE} + \alpha_{14} \text{ EXTCON} + \alpha_{15} \text{ PRICE} + \alpha_{16} \text{ MKTINFO} + \alpha_{17} \text{ POS} \\ & + \alpha_{18} \text{ FOS} + \varepsilon \end{aligned} \quad (3.3)$$

Intensity of commercialization: (CCI)

$$\begin{aligned} = & \alpha_0 + \alpha_1 \text{ AGE} + \alpha_2 \text{ GEN} + \alpha_3 \text{ EDUC} + \alpha_4 \text{ MARST} + \alpha_5 \text{ HHSIZE} + \alpha_6 \text{ FEXP} + \alpha_7 \text{ MFBO} \\ & + \alpha_8 \text{ FRMSIZE} + \alpha_9 \text{ HHINC} + \alpha_{10} \text{ OFINC} + \alpha_{11} \text{ OUTPUT} + \alpha_{12} \text{ TEL} \\ & + \alpha_{13} \text{ ACCRE} + \alpha_{14} \text{ EXTCON} + \alpha_{15} \text{ PRICE} + \alpha_{16} \text{ MKTINFO} + \alpha_{17} \text{ POS} \\ & + \alpha_{18} \text{ FOS} + \mu \end{aligned} \quad (3.4)$$

Equations 3.3 and 3.4 relays the specification of the empirical models to be estimated by this study.

3.6 Specification of Empirical Model

Building on the utility maximization theory discussed, empirical models for the achievement of the study objectives are developed. This section discusses the measurement of the key dependent variable i.e., commercialization index. It sheds light on the empirical models used to achieve the study objectives.

3.6.1 Measurement of Crop Specific Commercialization Index

Household Crop Commercialization Index (CCI) is estimated to determine the level of commercialization of smallholder rice farmers. This measures the proportion of the value of agricultural output sold in the market and purchased inputs to the total value of agricultural production (Eqn. 3.5 and Eqn. 3.6). These two indices measure household participation in output and input markets respectively. This study focuses on only commercialization measured by the proportion of the value of only rice output traded in the market to the total value of rice production (Eqn. 3.5).

This index measures the extent to which household rice production is oriented toward the market. The CCI introduced by Govereh et al., (1999) and Strasberg et al., (1999) offers an estimation of an index for each crop grown by a household which is represented by:

$$CCI_{ir} = \left[\frac{\text{Gross value of sale}_{hhiyearj}}{\text{Gross value of all rice production}_{hhiyearj}} \right] * 100 \text{ ----- 3.5}$$

$$CCI_{ik} = \left[\frac{\text{Gross value of inputs}_{hhiyearj}}{\text{Gross value of all rice production}_{hhiyearj}} \right] * 100 \text{ ----- 3.6}$$

where CCI_{ir} is the *ith* household commercialization index for rice; the numerator is the total amount of rice sold by the *ith* household in the *jth* year ($j = 2019$ cultivation season) and the denominator is the value in total of the *ith* household's rice output in the *jth* year ($j = 2019$ cultivation season).

The percentage of the figure realized in the bracket is taken by multiplying it by 100 to convert the

index to a percentage. Since this study focuses on rice crop commercialization, other crops and livestock are excluded from the computation of the index.

This study adapts an output commercialization index categorization used by Furaha et al., (2020) which considered farmers who sold less than 25% of their output as subsistent, while farmers who sold between 25% and 50% as transitional and lastly farmers who sold above 50% of their output as commercial farmers. Abera (2009) also used a similar classification stating that, households that sell from 1% to 25% of their output are low commercial farmers, also households that sell between 26% and 50% are medium commercial farmers and finally households that sell 50% are considered as highly commercialized.

3.6.2 Empirical model for estimating determinants of commercialization

The commercialization process usually starts with the question whether a household sells its output (in this case rice output) and goes a step further to consider the degree of commercialization as measured by the quantity of the rice produce sold in relation to the quantity of rice produced. These two steps are represented by equation 3.3 and 3.4.

The computation of the CCI in equation 3.5 forms the basis for estimating equations 3.3 and 3.4. The later equation implies that only households that market some or all of their rice output are considered while households that did not sell their output in the market are excluded from the sample. Therefore, the CCI is observed for just a portion of the sample population which creates a selection problem for the sample. Thus, the concern usually raised is that all households do not participate in the market. Such distribution in data poses a problem for the standard OLS regression estimations (Wooldridge 2010).

To deal with these problems, earlier studies modeled market participation decisions as a two-step decision making process involving first the binary decision to participate or not to participate in the market and then followed by the intensity of participation conditional on having decided to

participate (Goetz 1992; Mathenge et al., 2010; Mather et al., 2011; Reyes et al., 2012). These studies either used Tobit models, Heckman sample selection models or double hurdle models (Boughton et al., 2007; Alene et al., 2008; Omiti et al., 2009; Mathenge et al., 2010; Mather et al., 2011; Reyes et al., 2012).

The Tobit model proposed first by Tobin (1958) describes the relationship between non-negative dependent variables and a set of independent explanatory variables. The weaknesses of the Tobit model in this kind of analysis is the assumption that a given set of explanatory variables have the same effects on both the probability of market participation and intensity of market participation (Wooldridge 2010). This assumption also means that the partial effect of a given explanatory variable on the binary decision and the continuous decision is of the same sign. The model also assumes that zero traded volumes for non-market participating households are due to rational choice of the households (corner solution), though it may be due to a market entry barrier as noted by Komarek (2010).

However, the Heckman sample selection and double hurdle are two-step models that relax these Tobit assumptions by allowing different factors to determine the discrete probability of participation and the intensity of participation. In these two-step models (Heckman and Double Hurdle), the first step involves estimation of a probit model while the second step can take different functional distributions (lognormal or truncated normal). In the Heckman sample selection models developed by Heckman (1979), a probit analysis is employed first to estimate the probability of participation (selection model) and then computes the inverse mills ratio (IMR) from the estimated probit regression. The computed IMR is used thereafter in the second step with other explanatory variables to explain the variation in the continuous (non-zero) outcome variable. These Heckman sample selection models correct for the fact that non-market participating group is not a random

sub-sample of the population but one that self-selected itself into non-participating group due to both observed and unobserved covariates. In other words, as indicated by Wooldridge (2010), this self-selection bias is viewed as an omitted variable in the selected sample which is corrected by including IMR in the second step estimation.

On the other hand, the two-step double hurdle model nests the Tobit model and therefore allows to test the restrictions implied in the Tobit hypothesis (Wooldridge 2010; Mather et al., 2011). Also, unlike the Heckman sample selection models where households that do not sell output or buy inputs are treated as missing observations in the second step (Goetz 1992), the double hurdle model treats such households as corner solutions (modeled as a Tobit). The rationale for a corner solution model is that non-market participating households are treated as valid and rational economic choices to be explained in the model and not a reflection of missing data (Reyes et al., 2012).

Thus, the Double Hurdle Model allows the possibility to model equations 3.3 and 3.4 simultaneously. The basis for this assumption is that these steps which are separate have to occur for a positive level of commercialization to be attained (Beltran et al., 2011). Smith (2003) assesses that, the dependency that exist between the two equations is not a worthwhile exercise because there is only little statistical information available to support dependency in the double hurdle model, hence equations 3.3 and 3.4 are treated as independent.

3.6.3 Description and measurement of the variables

The description, measurement and priori expectations of the independent variables in the study are presented below. The household rice commercialization index is the dependent variable for achieving the determinants of rice commercialization. Thus, the calculated proportion of the quantity of rice sold in the market to the total quantity of rice output in the production season of

2019). The explanatory variables that determine both the decision to participate in the market and the extent of participation have generally been categorized into; Farmer characteristics, Private Asset variables, Public Assets Variable and Transaction cost variables. The choice and categorization of these aforementioned variables have been derived from literature (Siziba et al., 2011; Strasberg et al., 1999; Govereh et al., 1999; and Randela et al., 2008).

3.6.4 Dependent Variable

In the first stage of the estimation (probit model shown in Eqn 3.3), the dependent variable was a market participation (commercialization) model. It involves a binary variable indicating the decision to participate in the market as a seller or not. On the other hand, for the second stage estimation of the determinants of market participation intensity, the dependent variable (shown in Eqn. 3.4) was a household crop commercialization index (CCI_{it}) which is a ratio ranging from 1% to 100% developed on the basis of Eqn. 3.5.

3.6.5 Independent Variables

Past empirical studies (Goetz 1992; Key et al., 2000; Barrett 2008; Alene et al., 2008 and Omiti et al., 2009), have generally categorized factors that influence household market participation (binary decision and continuous intensity) into four categories: - i) Household demographic characteristics; ii) Household private asset endowments; iii) Public asset/services; and iv) transaction costs.

3.6.5.1 Household Characteristics

The farm household characteristics discussed include the following; Gender, Age, Years of farming experience, Educational Status, Membership of farmer-based Organization, Household Size and Marital Status.

Gender which is usually male or female is a dummy variable. This variable measures the probability and intensity of commercialization between the two sects of gender. Cunningham et al., (2008) found the male gender to be more likely to engage in the output market especially in the early periods of the season due to higher prices offered for farm produce at such times. On the other hand, female farmers due to their skepticism about household food sufficiency turn to be less motivated to sell their farm produce. Hence a positive coefficient for gender is expected.

The age variable captures the number of years of existence of the farmer. It could either have a positive or negative effect on the households' probability to commercialize and its degree of commercialization. Abu (2013) found that, given the high energy levels of younger farmers, they are more dynamic when it comes to adopting innovations that can enhance both their productivity and marketing at a reduced cost. Randela et al., (2008) confirms this as he observed that younger farmers are progressive, more receptive to new ideas and understand the benefits of agricultural commercialization. In sharp contrast, Martey et al., (2012), found that, farmers who are older and more experienced are better able to make sound production decisions and are more likely to have a wider contact network that opens them to several trading opportunities than younger farmers who are relatively less experienced and exposed. These arguments make the expectation for the variable indefinite.

Years of farm experience tells the length of time in years the farmer has been engaged in rice farming. This variable is expected to have a positive relationship with market participation as well

as the extent of participation. This is because the more experienced the farmer, the more the chances that he/she would have to be able to leverage on the experience to increase output. He also stands a chance of having more information on the marketing of rice, and hence is expected to participate more in the market than the less experienced farmers.

The educational status of a farmer tells highest level of formal education attained by the household head and is usually expected to increase a household's understanding of markets and hence improve decisions about the amount of output to sell (Makhura et al., 2001). Enete and Igbkwe, (2009) found that the enlightenment from education gives a farm household an added advantage as it equips them with the ability to easily learn and adopt new production and farm management skills which could otherwise have been difficult to acquire. This has the potential to influence market participation decisions. Counter opinions offered by Martey et al., (2012) and Lapar et al., (2003) argue from the point that, education increases the likelihood of the household head earning off-farm income that is higher than what is realized from the farm. Such income can be a disincentive to the households' motivation to engage in agricultural markets. Considering these opposing views, the expectation for this variable could either be positive or negative.

When a farmer belongs to a farmer-based organization, due to information flow among members, farmers are more likely to be privy to relevant information necessary for production and marketing decisions (Olwande and Mathenge, 2012). In the case where the group engages in collective marketing, this increases farmer's probability to commercialize (Martey et al., 2012). This kind of marketing has an added advantage of transaction cost sharing. According to Randela et al., (2008)

belonging to a farmer-based organization relates positively to farmer's commercialization status. Hence this variable is expected to have a positive coefficient.

A positive effect is expected for the variable of marital status. This is due to the observation that, married couples usually have more responsibilities to meet. This increases their probability and intensity of commercialization through production of more output sufficient to feed the household and marketable surplus. This subsequently increases the intensity of participation.

The household size explains the family labour supply for production and household consumption levels (Alene et al., 2008). A positive sign implies that a larger household provides cheaper labour and produces more output in absolute terms such that the proportion sold remains higher than the proportion consumed. A negative sign on the other hand means that a larger household is labour-inefficient and produces less output but consumes a higher proportion, leaving smaller and decreasing proportions for sale (Omiti et al., 2009). Therefore, the directional effect of household size is not definite.

3.6.5.2 Private Assets Variables

According to Geoffrey et al., (2015) farm size has a positive effect on farmer's market participation and intensity. Olwande and Mathenge, (2012), makes a similar assertion that the size of farm impacts positively on commercialization. This is so because due to the relatively huge farms, farmers are able to generate sufficient output for consumption and marketing. They are also able to seek credit by using their lands as collateral. Finally, huge farm sizes allow farmers enough flexibility to adopt new improved technologies that eventually increases productivity. Hence the coefficient for this variable is expected to be positive.

The income of a household is expected to have a positive relationship with both the probability of a household to commercialize and its degree of commercialization. When a household earns more income, it is able to invest more into its farming activity which can result in increased marketable surplus. Alene et al., (2008) found off-farm income as a contributor to more marketed output since such income can be invested in farm technology and other farm improvements. However, such off-farm income can also influence households to diversify into more off-farm activities especially when earnings are high. The expectation is hence indefinite.

Output realized from the farming activity is expected to have a positive influence on the probability and the intensity of a farm households' commercialization. When output rises, the farmer is able to save enough marketable surplus.

3.6.5.3 Public Assets/Social Capital Variables

Randela et al., (2008), argues that, availability of credit reduces transaction costs in both input and output markets. Also, Sindu (2008) found that, availability of credit and the cost associated with it are crucial in the success of the agricultural industry. Credit facilities when availed to farmers, serves a great recipe for increased agricultural production. This is expected to influence an increase in marketing surplus for households. Thus, the availability of credit variable is expected to be positive.

Contact with extension officers measures how often farmers are visited by extension officers on their farms. These visits offer farmers opportunity to acquire technical advice, get introduced to improved production methods and technology which could lead to increased production and consequently increased commercialization. Extension contact is hence expected to have a positive coefficient.

As indicated by Omiti et al., (2009), output price is an incentive for sellers to supply more in the market. The incentive realized from higher the prices is expected to increase the probability and intensity of a household's commercialization.

3.6.5.4 Transaction Cost Variables

Cost of attaining information is a fixed transaction cost that to a large extent influences market entry decision (Vance and Geoghegan, 2004). Randela et al., (2008) established that, the efficiency of the market is hindered by challenges in information flow causing a rise in transaction costs by raising search, screening and bargaining costs. Thus, when farmers have access to market information, the burden of transaction cost is reduced which encourages commercialization. This variable is therefore expected to be positive.

Sales point explains the various trading avenues available to farmers. Geoffrey et al, (2015) and Abu (2013) found distance to the market to have a negative effect on both a household's probability and intensity of commercialization. Therefore, depending on the point at which a farmer sells his output (whether at farm gate, market, or farmers house), it is expected to have varying effects on probability and intensity of a households' commercialization. Thus, the point-of-sale variable does not have a definite sign.

Table 3. 3: Description, measurements and expected signs of variables

Description	Measurement	Sign Expected	
		Step 1: Decision	Step 2: Intensity
Dependent Variables			
Binary variable indicating the decision to participate in the market or not	Dummy: 1 = farmer participates in market (sold rice); 0 = otherwise		na
Output market participation intensity	Household Commercialization Index	na	
Explanatory Variables			
<i>Household Farmer Characteristics</i>			
Age of the farmer	Number of years	+/-	+/-
Gender of the farmer	Dummy: 1 = if male; 0 = otherwise	+	+
Education level of the farmer	Number of years of schooling	+/-	+/-
Marital status of farmer	Dummy: 1 = if married; 0 = otherwise	+	+
Household size of farmer	Number of people in the household	+/-	+/-
Farmer's experience in groundnut farming	Number of years in farming	+	+
Membership of farmer to an FBO	Dummy: 1 = if member; 0 = otherwise	+	+
<i>Private Assets Variables</i>			
Total amount of land cultivated to rice in the 2019 production season	Acres	+	+
Total annual household income	Ghana Cedi (GH¢)	+	+
Proportion of off-farm income in total household income	Ratio	+/-	+/-
Total output of rice produced in the 2019 production season	Number of 50kg bags	+	+
Farmer's ownership of a mobile phone	Binary: 1 = if yes; 0 = otherwise	+	+
Ownership of Means of transport	Binary: (1=Yes; 0=Otherwise)	+	+
<i>Public Assets/Social Capital Variables</i>			
Access to credit by farmer	Binary: 1 = if farmer received credit; 0 = otherwise		+
Farmer's contact with extension officers	Continuous: (number of days visited)	+	+
Average price at which each 50kg bag sold	Ghana Cedi (GH¢) per 50kg bag	+	+
<i>Transaction Cost Variables</i>			
Farmer's access to market information	Binary: 1 = if yes; 0 = Otherwise	+	+
Distance to Market	Continuous: (kilometers)	-	-
Transport cost to market	Ghana Cedi (GH¢) per trip	+/-	+/-

Source: Author's compilation (2020).

3.7 Empirical model for estimating the effect of commercialization on welfare

The final part of the research deals with estimating the effect of commercialization on the household per capita expenditure and income which are proxies adopted for measuring household welfare. The two-step Heckman treatment effect model is specified to assess the effect of commercialization on household welfare. The first step involves estimation of the binary selection model of commercialization decision based on Eqn 3.3.

The second step of this Heckman treatment effect model involves an OLS regression that estimate the welfare outcome of the household as it commercializes. In this computation, a farmer is considered to commercialize if part of his/her rice output is marketed. Since the objective is to estimate the effect of commercialization on the welfare of rural farming households, the CCI is introduced into the function (Eqn 3.4) as an explanatory variable.

3.7.1 Variable definition and measurement

3.7.2 Dependent variables

In the first-step of the two-step Heckman treatment model, the binary estimation of the determinants of commercialization based on Eqn. 3.3 is estimated using the probit model where the dependent variable is binary i.e., 1 if the household is commercialized and 0 if not commercialized. On the other hand, the second step of the Heckman treatment model is based on the OLS estimation of Eqn. 3.4 where unlike in the first step, the dependent variable in both equations (average annual per capita household expenditure on food and non-food items including own produced and consumed foods) is a continuous variable.

3.7.3 Independent variables

In the first-step probit estimation of the determinants of commercialization, the independent variables were exactly similar to those that were used in the first-step of the double hurdle model.

The summary definition and measurement of independent variables are shown in Table 3.4.

Table 3. 4: Description, measurements and expected signs of variables

Description	Measurement	Sign Expected	
		Step 1: Decision	Step 2: Intensity
Dependent Variables			
Output market participation	Binary: 1 = farmer participates in market (sold rice); 0 = otherwise		na
Household welfare	Continuous (average annual per capita household expenditure on food and non-food items including own produced and consumed foods)		
Explanatory Variables			
<i>Household Farmer Characteristics</i>			
Age of the farmer	Number of years	+/-	+/-
Gender of the farmer	Dummy: 1 = if male; 0 = otherwise	+	+
Education level of the farmer	Number of years of schooling	+/-	+/-
Marital status of farmer	Dummy: 1 = if married; 0 = otherwise	+	+
Household size of farmer	Number of people in the household	+/-	+/-
Farmer's experience in groundnut farming	Number of years in farming	+	+
Membership of farmer to an FBO	Dummy: 1 = if member; 0 = otherwise	+	+
<i>Private Assets Variables</i>			
Total amount of land cultivated to rice in the 2019 production season	Acres	+	+
Total annual household income	Ghana Cedi (GH¢)	+	+
Proportion of off-farm income in total annual household income	Ratio	+/-	+/-
Total output of rice produced in the 2019 production season	Number of 50kg bags	+	+
Farmer's ownership of a mobile phone	Binary: 1 = if yes; 0 = otherwise	+	+
Ownership of Means of transport	Binary: (1=Yes; 0=Otherwise)	+	+
<i>Public Assets/Social Capital Variables</i>			
Access to credit by farmer	Binary: 1 = if farmer received credit; 0 = otherwise		+
Farmer's contact with extension officers	Continuous: (number of days visited)	+	+

Average price at which each 50kg bag sold	Ghana Cedi (GH¢) per 50kg bag	+	+
<i>Transaction Cost Variables</i>			
Farmer's access to market information	Binary: 1 = if yes; 0 = Otherwise	+	+
Distance to Market	Continuous: (kilometers)	-	-
Transport cost to market	Ghana Cedi (GH¢) per trip	+/-	+/-

Source: Author's compilation (2020)

Note: na (not applicable)

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents and discusses the empirical results of the study. The discussion includes general descriptive statistics of all characteristics of respondents presented in Section 4.2, the level of commercialization of rice farmers in the Builsa South District and the determining factors of their commercialization are discussed in Sections 4.6 and 4.9. Also, the chapter presents and discusses the effect of commercialization on the welfare of rice farmers in Section 4.10.

4.2 Demographic Characteristics of Households

The household characteristics discussed here are age, gender, marital status, household size level of education, rice farming experience, dependency ratio and membership of a farmer-based organization (FBO).

4.2.1 Age Distribution of Household Heads

As presented in Table 4.1, ages of the household heads in each category i.e., subsistent, transitional and commercial farmer range from 20 to 71, 20 to 75 and 19 to 75 years, with mean ages also standing at 40, 39, 38 respectively. This means that households in the study area can considerably young and fall within an economic active population. It is observed that averagely commercial farmers are younger than the other categories of farmers. This has favorable implications for agricultural development in the Builsa South District considering the finding of Polson and Spencer (1992) that, households with younger heads are more open to new opportunities when it comes to adoption of innovations. Majority of the household heads fell within the youthful age bracket 20-40, showing a great engagement of youth in agriculture in the district hence presenting prospects for developing agriculture in the district.

4.2.2 Sex of Household Heads

Table 4.1 also presents the result of the sexes of the household heads. It is found that about 67% of subsistent farmers are males and about 33% are females. In the case of transitional and commercial farmers about 82% and 80% of them are males while about 18% and 20% are females respectively. This result is found to coincide closely with the findings of GSS (2015) which reports the country's gender distribution as 65.3% males and 34.7% females. It also confirms what Abatania et al., (2019) found that females become household heads in the unlikely event of the absence of an adult male who is able to handle the affairs of the household. In consistence with this finding, the survey identified that most female household heads are situational heads, who only landed such a position due either to the demise of their spouse or separation in marriage and hence do not have a male within an adult age range in the household.

4.2.3 Marital Status of Household Heads

The marital status of household heads as presented in table 4.1 shows that, about 73% of subsistent farmers are married while 27% are unmarried. Also, 85% of transitional farmers are married with 15% unmarried. Finally, 79% of the commercial farmers are married while 21% are unmarried. It was observed that married households have the advantage of labour which can be instrumental in increasing production and hence marketing surplus. All married couples confirmed this accession mentioning the usefulness of the additional labour contribution from their spouses in the completion of the entire cultivation process.

4.2.4 Size of Households

The mean household sizes of the three categories of farmers do not differ significantly as presented in table 4.1. For subsistent farmers, the mean household size is 8 people, while transitional and commercial farmers have a mean household size of 9 and 10 people respectively. This is found to be relatively large considering the regional average of 6 people reported by GSS (2015). The

advantage of such a large household size is that it allows for sufficient supply of labour from the household for production (Martey et al., 2012), which could be instrumental in increasing production and hence marketing surplus. Indeed, farmers admitted to using household labour since they couldn't afford to hire labour and thus reducing production cost and saving cash for use on other household expenditure. Additionally, Al-Hassan (2008) also found that a large household size, increases the chances of some members earning additional income from non-farm activities for the household. However, this finding is not consistent with what is observed in the study area considering the high unemployment rate in such rural communities in Ghana. Households with high numbers rather stood high chances of facing high dependency ratio. As Makhura et al., (2001) found, large household sizes can reduce the household's marketable surplus due to high dependency ratio which will mean that most of the farm produce will be used to satisfy household consumption needs and hence reducing households' market participation.

4.2.5 Educational Level

Across all categories, the majority of household heads do not have formal education, subsistent farmers had the highest number at 72% while 57% and 53% of transitional and commercial farmers had no formal education. This is followed by those with only basic and secondary education. The least are those who have tertiary level education which is only 2%, 1% and 7% of subsistent, transitional and commercial farmers respectively. This low level of education recorded may have negative effect on agriculture when it comes to technology adoption and understanding market dynamics especially in this era of increasing food quality standards required by emerging commodity markets. Minot et al., (2006) found that education opens employment opportunities from other sectors other than agriculture. Since majority of households' heads lack formal education, it is safe to suggest that most of these people lack the skills set needed to be assumed into formal job opportunities and hence are trapped in agriculture. Given such a situation,

transforming their agricultural activities into a reliable income stream through commercialization will be the best bet for creating a useful livelihood for these people.

4.2.6 Rice Farming Experience

The study found that the average rice farming experience is 9.3 years. The minimum and maximum rice farming experience are 1 and 50 respectively. The average farming experience realized by the study suggests a sufficient period of time for farmers to be abreast with the farming techniques needed to increase productivity and commercialization through the adoption of improved farming technologies.

4.2.7 Membership of a Farmer-Based Organization

The study found that just a minority of the household heads surveyed belonged to FBOs. About 26% of the subsistent farmers belonged to an FBO, while about 35% of transitional and commercial farmers also belonged to an FBO. Farmers generally showed low interest in joining FBOs and for the few who joined hardly attended meetings except those who played leadership roles. Most FBOs identified were relatively dormant because their formation was based on some NGO intervention projects like the Millennium Villages Project (MVP) which was run by the Savannah Accelerated Development Authority (SADA). Farmers who did not belong to a group stated reasons such as: no need of belonging to a group and nonexistence of functional farmer groups. Given the many advantages that comes with belonging to a functioning FBO like increased bargaining power, farmers in this district stand a high likelihood of missing out on such advantages. This low participation in farmer-based organizations in the district has the potential to negatively affect the probability of commercialization and the intensity of commercialization since farmer organizations are a platform for farmers to exchange useful information on market requirements and as a means of collective bargaining that enhance agricultural earnings.

4.3 Private asset endowment

This section presents an overview of the various assets owned by the households surveyed that have a bearing on household farming activities. It is important to note that asset ownership plays a key role in enabling households to commercialize as noted by Bellemare and Barrett, (2006). Therefore, both capital and productive assets like rice farm size, total land holding, means of transport, mobile phone, income from other farm enterprises, off-farm work and remittances which are critical in agricultural commercialization process are discussed.

4.3.1 Ownership of means of transport

The study observed that only 3% of subsistent farmers had their own means of transport. Also 39% of transitional farmers had their own means of transport. Being the highest, most commercial farmers had their own means of transport (i.e., 43% of them had their own source of transport). According to farmers interviewed, owning a source of transport, greatly facilitated the market participation process. The remote nature of the communities made a private means of transport a very useful asset to own as a farmer so as to ensure easy access to markets.

4.3.2 Ownership of mobile phone

Most of the households generally had at least one member of the household owning a mobile phone. This is consistent with the finding of GSS (2015) that every household has at least one mobile phone. However, due to illiteracy, usage of such phones to assess market information and facilitate market participation was almost non-evident. Also, there is no marketing platforms that offer market information via mobile networks in the district. Thus, most of the exchange activities happened in the traditional markets without traders locating buyers via mobile networks. The study found that, 80%, 95%, and 97% of subsistent, transitional, and commercial farmers owned at least one mobile phone.

4.3.3 Landholding size

The study found that the mean land size cultivated by subsistent, transitional and commercial farmers are about 1.6 ha (4 acres), 2 ha (5 acres) and 3.2 ha (8 acres) respectively, with an overall average of 1.9 ha (4.7 acres). Commercialized households had bigger average farm sizes compared to transitional and subsistent farmers. Since land is a primary factor in agricultural production, these results mean that those households with bigger farms have a higher probability of commercialization compared to those with small farms. Higher land size serves as an incentive to produce surplus for market (Martey et al., 2012) and thus can influence market participation positively and vice versa.

4.3.4 Rice farm size

The study also narrowed particularly on the rice farm sizes cultivated by households. It found that the mean rice farm size cultivated by subsistent, transitional and commercial farmers are about 1.2 ha (3 acres), 1.6 ha (4 acres) and 2.8 ha (7 acres) respectively, with an overall average of 1.8 ha (4.6 acres). Comparing the averages of farmers total landholding sizes and rice farm sizes showed that most farmers dedicated a higher amount of their total landholding into rice cultivation. Just as seen in the result for total landholdings of farmers, commercialized households again had relatively bigger rice farm sizes on average compared to transitional and subsistent farmers. This confirms the assertion of the district department of agriculture that rice farming is a major economic activity of farmers in the district.

4.3.6 Income from other farm enterprises income

The study showed that, while the average annual income from other farm enterprises for subsistent farmers is GH¢ 483.00, those of transitional and commercial stands at GH¢ 922.00 and GH¢ 2683 respectively. This gives an aggregated average of GH¢ 1363.00, which is found to be higher when compared with the estimate of GH¢1,217.00 by GSS (2015). Given limited sources of income of

most households in the district, it was revealed that the major household income for the people basically flows from sales of output of rice, and other farm enterprises. The average annual income from other farm enterprises of subsistent farmers could influence their ability to buy improved marketed inputs for an increased productivity and hence marketable surplus. This situation is worsened considering high expenditure on other socioeconomic needs such as education, health and clothing.

4.3.7 Off-farm work

The study showed that, while 36% subsistent farmers engage in off-farm income generating activities, 45% and 38% of transitional and commercial farmers engaged in off-farm jobs. The general low engagement of household heads in off-farm income generating activities is largely due to the limited economic opportunities in most rural areas. Another factor is the high level of illiteracy among most household heads.

4.4 Public and Social asset

Public and social assets are very important in facilitating market access as shown by Shiferaw et al., (2011). The public and social assets discussed in the study are; extension contacts, access to social interventions, access to credit, and access to combine harvester.

4.4.1 Extension contacts

Subsistent farming households receiving agriculture extension services stood at 44% while those without extension contact are the majority (56%). Transitional farming households who also received agriculture extension services of some sort are 64% while those who did not receive extension service made up the remaining 36%. Lastly being the group that had the highest contacts with extension services, 68% of commercial farmers received agricultural extension services. Among a range of services asked, farmers said they only received production services. This raises a need for agricultural extension agents in the district to expand the scope of their services to

include marketing services, credit services and market information services. These proposed services when included will have a positive bearing on farmer's market participation levels in the district. When incurred from the MOFA office in the district, they attributed their restricted number of services to logistical constraints.

4.4.2 Access to social intervention

There is currently a government funded social intervention program across poor rural communities intended to support the livelihoods of the poorest in the country. Some of the households surveyed are beneficiaries of this livelihood empowerment program (LEAP). About 34% of subsistent farmers are beneficiaries of this program and thus receive an amount of money periodically. Also, 29% and 26% of transitional and commercial farmers benefit from this intervention. Farmers admitted that a portion of these funds when received are channeled into financing some of their agricultural activities.

4.4.3 Access to Credit

Access to credit was defined as household's record of obtaining refundable resources both cash and input from either formal and informal sources for the purpose of financing farm activities. Access to credit among the various categories of farmers in the study area is observed to be very low especially among the subsistent farmers. Only 12% of the subsistent farmers had access to credit. About, 17% and 31% of transitional and commercial farmers had access to credit respectively. This confirms the observation by Martey et al., (2012) that access to credit is one of the major constraints faced by households. The most frequent reasons given by farmers for non-acquisition of credit included; risk of crop failure, high interest rate, inadequate collateral, unconversant with loan procedure due to illiteracy. The most frequent source of credit received by the households were from relatives/friends and farmer groups.

4.4.4 Market Price

The average price received by subsistent farmers for an 80kg bag of rice (paddy) is GH¢109. Transitional farmers received an average of GH¢119 per 80kg bag of paddy rice, meanwhile commercial farmers received an average of GH¢147 per 80kg bag of paddy rice. The distribution of prices shows that commercial farmers received higher prices than both transitional and subsistent farmers. It was found that famers generally have three primary sale points. The most used point of sale is the district market center which convenes once in every week or at the farm gate. Just a few farmers sold their produce at their homes in the rear cases where buyers visit the village to make purchases. The point of sale for most of the commercial farmers was at the farm gate.

4.4.5 Access to combine harvester

The study realized that most subsistent farmers could not afford a combine harvester thus only 5% of them were able to employ the services of the combine harvester. It was noticed that some of the communities had absolutely no combine harvesting services. Generally, the combine harvester service is best accessed by farmers who had relatively huge farms. The common form of payment for the service was in kind. Farmers pay with an agreed percentage of their total output. About 54% of commercial farmers had access to combine harvesters. The users of the combine harvesters are those who usually have ready buyers at the farm, selling immediately harvesting is over. For farmers who cannot arrange for the service of the combine, they opt to estimate and sell the unharvested produce on the farm to buyers. These buyers then hire the services of the combine for harvesting.

4.5 Transaction cost

Transaction costs (fixed and proportional) influence the ability of the household to commercialize. As demonstrated by Goetz (1992) and Key et al., (2000), transaction costs could be very important in determining agricultural commercialization. The transaction cost related variables discussed in the study are; access to market information, availability of buyer and distance to market.

4.5.1 Access to market information

The descriptive statistics show that, only 19% of subsistent farmers had access to market information prior to sales of their rice produce. Their source of the information was mainly friends and family members who attended the previous market to sell their rice (paddy) produce. For the majority who did not have access to market information, they only take their produce to the market totally oblivious of the value of the produce. When they arrive at the market, they pick price signals from the various offers being made by buyers and choose the best offer. Some also hand over their produce to middle men/women who then sell the produce on their behalf. Many at times some are forced by circumstance to trade even if the price offered is not good enough, while others postpone selling to the when next market convenes. It was also observed that about 74% and 76% of transitional and commercial farmers had access to market information. Since most of them sold to big traders (termed Tamale women) they made contacts with them and are able to request prevailing market prices to inform their sales. They use this information to sell at the times prices are high explaining why most of the commercial farmers sold at higher prices than the subsistent farmers.

4.5.2 Availability of buyer

The availability of buyers is explained as the presence of ready buyers at farm-gate to engage with farmers to buy their produce immediately after harvesting. Scavenging traders usually visit farms during harvest periods to buy produce outright from farmers so as to take advantage of cheap farm-

gate pricing. Their availability influences sales especially farmers who usually need the cash for pressing household expenditure. Also, this helps farmers who lack storage facilities and post-harvest handling skills to reduce their post-harvest losses. About 31%, 96% and 85% of subsistent, transitional and commercial farmers had available buyers at farm-gate respectively. Though this system helps farmers to sell their produce with ease, some farmers complained about exploitative prices offered by these buyers.

4.5.3 Distance to market

Distance to the market influences transaction cost greatly given the remote nature of some communities in the district. Farmers who have their own means of transport spend more on fuel to transport their produce to the district market at Fumbisi. Farmers without their own means of transport usually face higher transaction cost due to transport fares. The only means of transport available to farmers in the district for the transportation of their produce to the market are tricycles. On the average subsistent, transitional and commercial farmers travel a distance of 12km, 14km, and 11km respectively to reach the main district market where most of the trade of food commodities take place.

Table 4. 1: Descriptive statistics

Variable Label	Subsistent farmers		Transition farmers		Commercial farmers	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
<i>Demographic characteristic</i>						
Age of household head	40.252	12.148	39.072	10.808	38.101	9.692
Sex of household head	0.673	0.471	0.826	0.382	0.803	0.399
Marital status	0.729	0.447	0.855	0.355	0.788	0.409
Household size	8.150	3.417	8.783	4.018	9.524	4.812
No formal education	0.720	0.451	0.565	0.499	0.524	0.501
Basic education	0.215	0.413	0.348	0.480	0.322	0.468
Secondary education	0.047	0.212	0.072	0.261	0.082	0.275
Tertiary education	0.019	0.136	0.014	0.120	0.072	0.259
Rice farming experience	10.112	10.348	9.928	9.780	8.389	6.984
Membership of FBO	0.262	0.442	0.348	0.480	0.351	0.478
Dependency ratio						
<i>Private asset endowment</i>						
Ownership of means of transport	0.028	0.166	0.391	0.492	0.433	0.497
Ownership of mobile phone	0.798	0.404	0.952	0.215	0.966	0.18
Rice farm size	3.318	2.759	4.188	1.809	7.221	5.724
Land size	3.974	2.796	4.876	2.685	7.875	5.732
Rice yield	648.178	621.138	1155.797	849.677	2709.69	2113.193
Income from other farm enterprises	483.187	1238.541	922.036	1397.335	2682.981	5419.113
Off-farm work	0.355	0.481	0.449	0.501	0.375	0.485
Access to Remittances						
<i>Public and Social asset</i>						
Extension contact	0.439	0.499	0.638	0.484	0.678	0.468
Access to social intervention	0.336	0.475	0.290	0.457	0.255	0.437
Access to Credit	0.121	0.328	0.116	0.323	0.308	0.463
Price of 80kg bag of rice	108.813	22.175	119.435	42.572	147.380	52.966
Access to combine	0.047	0.212	0.261	0.442	0.538	0.500
<i>Transaction cost</i>						
Access to market information	0.187	0.392	0.739	0.442	0.755	0.431
Availability of buyer	0.308	0.464	0.957	0.205	0.851	0.357
Distance to market	12.168	4.779	13.514	5.105	11.317	4.815

Source: Author's computations

4.6 Level of Commercialization of Households

Upon computation of the output commercialization indexes of the households surveyed, the status of households' level of commercialization as indicated in the table 4.2, only 28% of the respondents were subsistent, 18% were still in transition (likely to commercialize) while 54% were commercial farmers. This means, on average, about 28% of the households surveyed, sold just 6% of their rice output, while about 18% of the households surveyed also sold 41% of their rice out.

Table 4. 2: Status of Households' output commercialization

Rice commercialization	Mean	Std. Dev.	Freq.	Categorization
Subsistent farmers	5.633024	8.956031	107	Sold up to 25%
Transition farmers	41.31993	7.559965	69	Sold 26-50%
Commercial farmers	76.70527	13.36196	208	Sold >50%
Pooled sample	50.54298	32.85358	384	

Source: Computed from Household Survey Data, 2020.

Lastly about 54% of the households surveyed sold 76% of their rice output. The pooled level of commercialization of smallholder rice farming households from the data gathered indicate an average marketed ratio of 51%. This implies that, on average, 51% of the total rice produced by smallholder farmers in the study area was sold. The results thus show a moderate commercialization index for rice farming households in the district.

Given that the average National and Upper East Regional marketed surplus ratio for all crops as estimated by IFPRI, (2011) was 33% and 15% respectively, then the commercialization of rice production is relatively higher in the study area. The finding of this study comes close with Martey et al (2012) who estimated a commercialization index for maize in the Effutu municipality to be at 53%. Abu, (2013) estimate of the commercialization index for maize and groundnut in the Upper

West Region was 24% and 53% respectively, with an aggregated index of 38% for both crops. Similar studies conducted in other countries for different crops also show different results. For instance, Tozooneyi (2017) estimated a commercialization index of 88.55% for tomato farmers in Goromonzi district, Zimbabwe. In all these findings, while some are similar, others vary especially in the case of the tomato farmers in Zimbabwe. Due to the perishable nature of tomatoes, the study realized that farmers are usually forced to sell regardless of price to reduce spoilage losses.

4.7 Households by Degree Commercialization

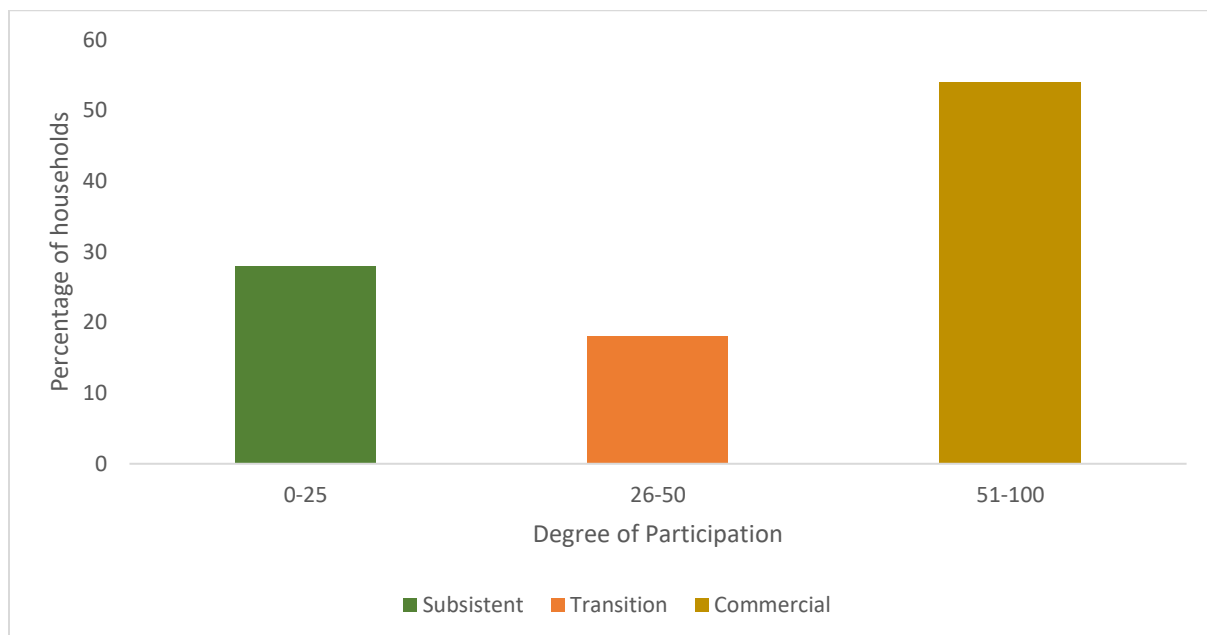
From the results, subsistent farmers thus, farmers who sell less than 25% of their rice output are 107 in number, making about 28% of the sample size. Their combined average index is about 6% meaning subsistent farmers sold only 6% of their entire rice output. Out of these 107 farmers 48 did not sell any of their produce at all, thus their entire rice output is for household consumption only. These farmers stated that they did not only lack marketed surplus, but also did not harvest enough output to feed the family all year round and thus will even have to rely on the market to suffice consumption needs. On the flip side though, others who did not sell at all stated that, they are not in a haste to sell since they have no urgent need for cash and are only waiting to sell at a time the prices are good or perhaps when they fall in need of money. This finding follows in line with what Guta (2017) said that, smallholder farmers mostly sell their produce in the market when household cash needs arise.

Also, transitional farmers (farmers who sold between 25 and 50% of their entire rice output from the 2019 production season) are 69 in total and make about 18% of the sample size. Their estimated output commercialization index is 41%, implying that on average, a transitional farmer in the study area sells about 41% of his rice output. Going by Rashid et al, (2020) who termed farmers in this category as those preparing to commercialize, this gives a good narrative that, these farmers even

though are few, will soon be joining the commercial farmers who are already the majority in the study area.

Commercial farmers (i.e., farmers who sold above 50% of the entire rice output) were the majority numbering 208. They form 54% of the sample size which is more than half of the entire number surveyed. On average these farmers scored an output commercialization index of about 77%, meaning that 54% of farmers surveyed sold about 77% of their rice output to the market. This has implications on the supply side of rice in the study area. Thus, when farmers' rice output rises, in the district, it will push up rice supply since more than half of the farmers in the district sell up to 77% of their rice output. This tells that rice a more of a cash crop than a food crop in the district. During the study, farmers who sold all their rice produce were 84. Such purely commercial farmers mostly sold at farm gate when buyers come to the fields during the harvest season to buy from farmers.

Figure 4. 1: Proportion of Output Sold and the Percentage of Households



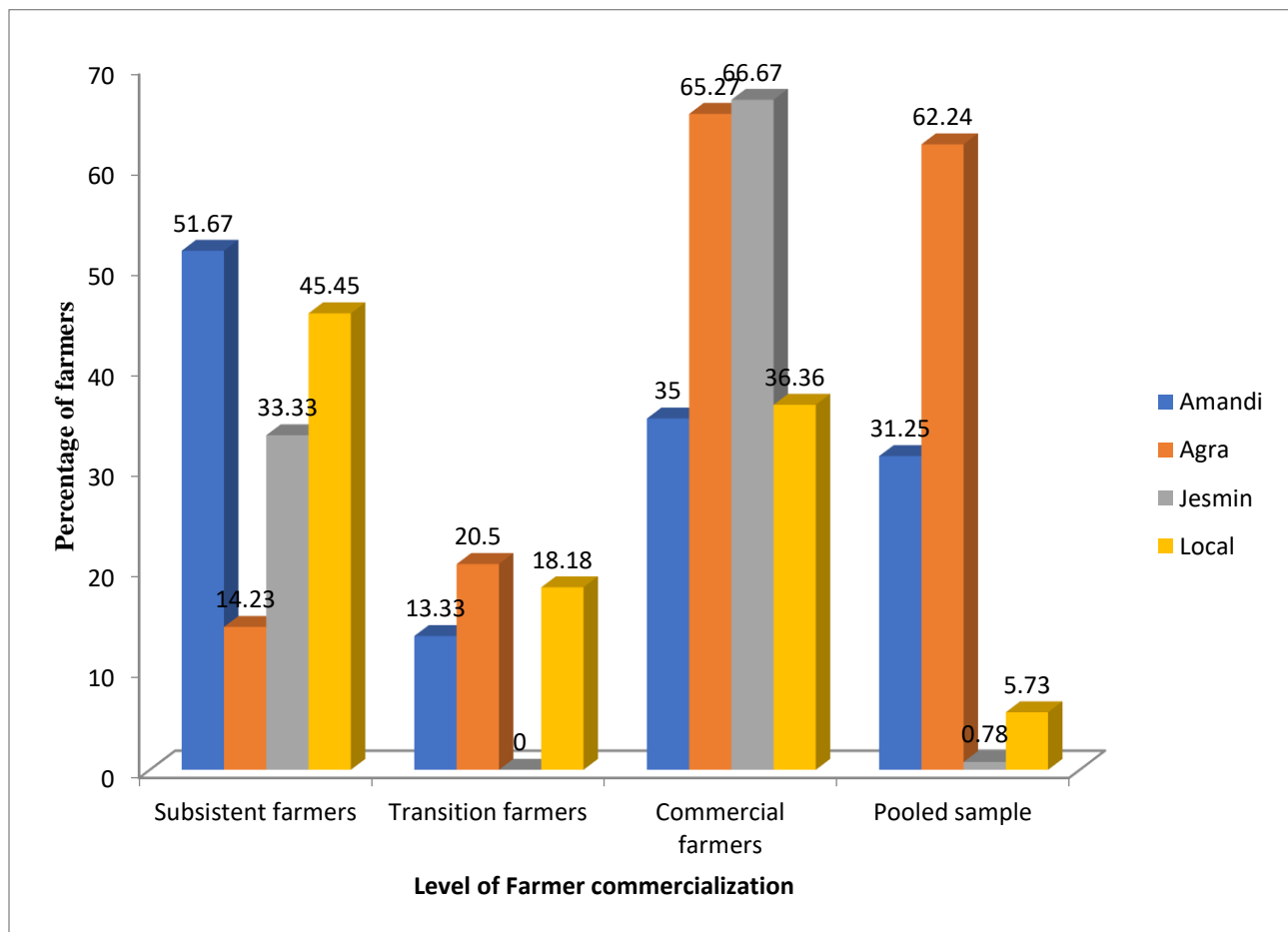
Source: Household Survey Data, 2020.

Due to lack of storage facilities farmers in their quest to reduce post-harvest losses hasten to sell to these buyers sometimes at exploitative prices. Also, farmers who do not have enough cash to pay for the services of combine harvesters use a percentage of their produce to offset the cost and then sell the remaining output to buyers. Although some farmers feel exploited, they still think it's their best option given their vulnerable circumstances.

4.8 Characterization of Rice Variety Adoption by Farmers' Commercialization Status

Figure 4.2 presents in summary the level of rice variety adaption based on the various categories of farmer's commercialization status.

Figure 4. 2: Rice Variety Adaption by Farmers



Source: Household Survey Data, 2020.

As shown in figure 4.2, a greater percentage of the amandi rice variety is cultivated by subsistent farmers (51.67%), 45.45% of local rise varieties are also cultivated by subsistent farmers in the study area. The names of these local rice varieties were only given in farmer's local dialect. The department of agriculture in the district did not also have the scientific names of these local varieties. Subsistent farmers also cultivated 33.3% jasmine rice (Khao Dawk Mali 105). This rice variety which originates from Thailand is widely promoted for subsistence rainfed lowland rice system (Apichart 2018). Lastly subsistent farmers cultivate 14.23% of the Agra rice variety. Most of the farmers in this category said their high choice for the local and amandi was based on the taste and preference of household.

On the part of transitional farmers, the study found that, they cultivated 20% of Agra, 18% of local rice, 13.33% of amandi but did not cultivate the jasmine variety.

Commercial farmers mostly produced the Jasmine (66%) and Agra (65%) due to its high demand by their target buyers and its good market value. These two varieties are currently being promoted by the district department of agriculture as the best suited crops for the climate in the district. Some farmers said to get the best market value of the Agra rice, the timing of harvesting must be appropriate and thus harvesting it was best done with the combine harvester. The limited access to the combine harvester was the reason given by some farmers for their low adaption of the Agra variety despite MOFA's recommendation of the variety. The pooled results show that the district produces more Agra than the rest of the varieties. This is partly due the promotion of the variety by MOFA and also its high market value.

With the recent commencement of the establishment of a rice processing factory in the district as part of the one district one factory policy by Government, the said factory will be expected to feed on the rice supplied by the farmers in the district. Given the percentage of farmer's output supplied

to the market, it is expected that this factory will have sufficient rice supply from the local market to feed the factory.

4.9 Determinants of Commercialization and its' Intensity among Smallholder Rice Farming Households

A double hurdle model (DHM) is estimated for the determinants of smallholder rice farmer's level of commercialization, measured by rice crop commercialization index. Following Lin and Schmidt (1984), before estimation, it is important first to test whether the DHM is preferred over the Tobit specification using the log likelihood ratio (LR) statistic. In this study, the LR test statistic was -1430.0338 and it was significant at 1% (Table 4.3). Therefore, this test statistic showed that the DHM was strongly preferred to Tobit model.

The results for the determinants of commercialization (estimated with the Probit model, stage one) are presented in Table 4.3. The Wald chi-square value of 110.13 is statistically significant at 1% indicating that the explanatory variables in the model explain the probability of participating in the market.

The decision to participate in the market is significantly determined by marital status of the household head, access to remittances, access to market information, availability of buyers, and size of rice farm. The significant variables determining the decision to commercialize are distributed over the categorizes of variables (characteristics of the household, private assets, public assets and transaction cost variables).

The coefficient of the marital status is statistically significant at 5% and negatively associated with farmer's probability to commercialize (sell their rice output). This means married household heads are less likely to commercialize than their unmarried counterparts. It is highly likely that married

people will be more concerned about meeting household consumption needs, thus reducing their marketable surplus.

The coefficient of access to remittances is negatively related to the probability of commercialization of smallholder rice farmers at a significance level of 5%. This means that, farmers who have access to remittances are less likely to commercialize than those without remittances. This contradicts the prior expectation of the study. The reason for such a relationship could be that, farmers who have access to remittances, have less need for cash since they receive it from other sources. This will thus be a disincentive for such farmers to sell their output and hence reduce their probability of selling. On the other hand, farmers who do not have access to remittances are highly likely to have more need for cash. This raises a need to sell their output to raise enough cash for the upkeep of the household.

Access to market information positively influences farmer's probability to commercial and is statistically significant at 1%. This means that, smallholder rice farmers who have access to market information are more likely to commercialize than those without access to market information. This finding is consistent with the initial expectation and the observation of Abu (2013) and Siziba et al., (2011) who further suggested that access to information reduces risk of perception. A plausible explanation of this finding is that, farmers who have access to market information are easily motivated to sell especially during periods when markets offer more favorable prices go higher than those without are such information.

Availability of buyers positively related to farmer's probability of commercializing at a significant level of 1%. This implies that, households who have available buyers are more likely to commercialize than those without available buyers. This finding is inclined with the prior expectation of this study. Availability of buyers lessens farmers risk of market failure, reduces

transaction cost and post-harvest handling responsibilities like drying and storage. These reliefs are themselves an incentive for farmers to sell their produce immediately after harvest.

The coefficient of rice farm size is having a positive effect on the probability of a smallholder rice farmer commercializing and statistically significant at 5%. This means that smallholder rice farmers with larger rice farm sizes are more likely to commercialize (sell their rice output in the market). This finding is consistent with Barret (2008) who observed that, the probability become a crop seller increases when land size increases. Abu (2013) made a similar observation in the Upper West region of Ghana. In a similar opinion, Ouedraogo (2018) in the case of Burkina Faso and Olwande et al., (2015) in the case of Kenya found a significant and positive relationship of farm size and its' probability of market participation. Other studies with similar findings include Siziba et al., (2011) and Makhura et al., (2001). In fact, Kaminski (2011) argued that growth in agricultural production in Sub-Saharan Africa is driven more by increase in farm size than improvement in productivity. These findings imply that; larger farm size provides a better opportunity for surplus production other than productivity. However, smallholder farmers who are mostly poor are challenged in producing enough marketing surplus because of their limited access to larger farm sizes. In the study area it was found that the rice valleys are increasingly being taken over by more resourced farmers thus reducing low resourced smallholder access to farm lands within the rice valleys.

Results for the determinants of the extent or degree of commercialization are presented in Table 4.3. The degree of commercialization of smallholder rice farmers is significantly determined by five variables in the regression. These determining factors include, sex of household head, size of rice farm, rice farming experience, ownership of means of transport and educational level of household head.

The coefficient of sex of household head is negative and it is statistically significant at 5%. This means that female headed households are more likely to sell more of their rice output than their male counterparts. Thus, female farmers sell 48% more rice output than male farmers. This finding is independent of the first-tier probability of commercialization. The negative finding is not in sync with the prior expectation as well as the finding of Ouedraogo (2018) and Cunningham et al., (2008) who observed that, men more likely to sell higher volumes of their output, while women prefer to store more output for household sufficiency. Also, Mathenge et al., (2010) found a similar result in Kenya. They observed that, female-headed households have a greater likelihood of participation in maize, beans, other cereals and pulses markets than male-headed households. It however confirms Abu's 2013 finding which also observed a similar negative effect of gender on market participation of maize and groundnut farmers. The likely reason for this negative finding could be tied to the observation that, female household heads were mostly widows and did not have an adult male within the household. The implication of such a situation would be that, female headed households would have to sell more rice output in order to finance other household expenditure. The study also showed that female headed households given the need to raise money through sales of rice output were more motivated to increase their marketing surplus. This suggests how productive women can be and thus raises a good argument for increasing women's access to productive assets to propel the agenda to increase general agricultural productivity in rural Ghana.

The coefficient of size of rice farm relates positively to the degree of commercialization of smallholder rice farmers at a significance level of 1%. This interprets as, farmers with larger rice farms are more likely to sell higher quantities of rice than those with smaller rice farm sizes. Thus, households with large farm sizes sell 37% more output than households with smaller rice farm sizes. This follows suit with the prior expectations of the study. Martey (2014), Mathenge et al.,

(2010) and Geoffrey et al., (2015), found that, farm size to be positively and significantly related to commercialization decision and intensity, explaining that, households with bigger farm sizes have a higher probability of producing more food beyond their subsistence consumption levels thus selling the surplus. According to IFPRI work by Chapoto et al., (2013) and Jayne and Muyanga (2012), most of the agricultural production increases in Africa has been as a result of area expansion and not productivity growth. Empirical work in south Asia by Sharma et al., (2012) also found out that one of the major constraints faced by smallholder farmers in responding to market driven commercialization opportunities in the region included small and fragmentation of land holdings. With about the same level of soil fertility, farmers with large farm sizes are expected to have harvest more quantities of rice output translating into higher marketing surplus. This will mean that such farmers who harvest more will enough to satisfy home consumption needs, while reserving still a good quantity to sell in the market. On the other hand, those will smaller farm sizes will only harvest just enough for home consumption and just little to non-offered to the market. However, contrary to these findings, (Tozooneyi 2017) found a negative relationship between farm size and extent of commercialization of tomatoes in Zimbabwe. Also, Randela, et al., (2008), asserts that, gains in land productivity and markets sales are not large enough to offset the costs associated with the increase in production, suggesting that the degree of crop commercialization is more likely to be influenced by land allocation decisions than just landholding.

The coefficient of rice farming experience is negatively correlated with the degree of commercialization of rice farmers. Thus, farmers with more experience sell 27% less of their rice output than their less experienced counterparts. This contradicts the prior expectation, the findings of Abu (2013) who observed that households that have more farming experience in groundnut

farming sell more of their groundnut output than those with less experience and Martey et al, (2012) who also argues that, more experienced heads of households are better able to take sound production decisions and have more contacts with trading partners. Additionally, it is assumed that, more experienced household heads have acquired extra understanding of markets how the market operates and therefore improve decisions about the quantity of output sold Makhura et al., (2001). However, considering the high ages of experienced farmers in the study, such aged farmers may be more concerned with keeping the home food secure. Their advanced ages also reduce their risk-taking ability and thus reduces their interest in participating in markets which is characterized by high risk of market failures. On the other hand, less, experienced farmers are the younger farmers who are able to take more production and market risk. In this circumstance, it is very likely to have such a negative relationship between experience and degree of commercialization. This tells a positive outlook revealing the readiness of younger farmers in the district to engage in rice commercial farming which is currently being advocated for.

The coefficient of ownership of means of transport has a positive relation with the degree of commercialization and significant at 5%. This implies that, smallholder rice farmers who own a means of transport are more likely to sell higher quantities of their rice output than those who do not have their own source of transport. Thus, such a household that owns a source of transport sells 45% more output than a household without its own means of transport. This falls in line with the prior expectation of the study. Also, Geoffrey (2015) found that, ownership of variables that reduce transaction costs e.g., means of transport, mobile phone was significantly higher among commercialized households compared to noncommercialized ones. He indicated that that a household that owned any of these assets was likely to be more intensively commercialized than a similar household without these means, indicating that, households with these means of transport

could be using them to transport their crops produce to the market thus reducing per unit transportation cost. Additionally, Mathenge et al., (2010) found convincingly that, ownership of means of transport has a positive and significant influence on the decision to participate in the maize market and a positive and significant influence on the amount sold for maize. Considering the poor transport systems in most rural areas, conveying farmers output to the local market place is usually a big challenge for rural farmers. This challenge possesses some sort of market entry restriction as it limits their ability to conveniently access the market. Finding means of transport to convey farmers output alone comes with charges and stress enough to discourage farmers from participating meaningfully in the market. For farmers who have access to their own source of transport, this asset serves as a big source of relief it may exclude them from some of the market entry restriction faced by others. Thus, due to their advantage of accessing the markets more conveniently than farmers without their own source of transport, these farmers are able to sell higher volumes of their output.

Coefficient of average price of rice output is positively related to the degree of commercialization of smallholder rice farmers and is significant at 1%. This means that farmers who receive higher prices for their produce are more likely to sell more of their rice output than those who receive relatively lower prices. Thus, households had higher prices for their rice output sold 12% more output than those who had relatively lower prices. This finding aligns with the prior expectation of the study and reflects how prices can trigger supply in the district. This result confirms the findings of Abu 2013 who observed that higher prices increased the extent of sale of groundnut and maize in the upper west region. In the same vein, Martey et al., (2012) asserts that, this finding assumes a basic economic theory that output price is an incentive for farm households to increase supply enough to maximize utility through the profitable gains from the market. Olwande and

Mathenge, (2012) also agrees that, output price is an incentive for sellers to supply more farm output to the market. However contrary to these findings, Mathenge et al., (2010) observed that, prices for maize and beans have a negative and significant influence on volume of sell.

In conclusion, the objective was an attempt to evaluate the determinants of the both the probability and degree of commercialization of smallholder rice farmers in the Builsa South District. The study found the variables discussed above as very significant in the determination of both the probability and degree of commercialization of smallholder rice farmers in the study. Hence finds these factors key in informing policy direction in the study area.

Table 4. 3: Factors influencing decisions and the degree of commercialization

Variable label	Coef.	Std. Err.	P>z	Marginal Effects
Tier 2: Commercialization intensity				
Sex of household head	-5.148**	2.878	0.074	-0.488
Size of rice farm	0.863***	0.266	0.001	0.373
Access to market information	-2.128	3.411	0.533	-0.311
Membership of FBO	-1.660	2.638	0.529	-0.528
Rice farming experience	-0.382**	0.161	0.018	-0.265
Off-farm income activities	-3.662	2.591	0.158	-0.072
Access to remittances	1.359	2.759	0.622	0.874
Own means of transport to market	6.309**	2.534	0.013	0.457
Income from other crops	1.337	0.557	0.016	0.382
Household size	0.212	0.268	0.429	0.009
Distance to market	0.047	0.273	0.864	0.235
Education of household head	-0.406	1.458	0.781	-0.080
Price of rice output	0.137***	0.024	0.000	0.117
_cons	36.921	6.508	0.000	
Tier 1: Commercialization decision				
Sex of household head	0.373	0.315	0.236	0.071
Marital status of household head	-0.510**	0.302	0.091	-0.128
Membership of FBO	-0.297	0.319	0.353	-0.038
Rice farming experience	0.008	0.019	0.664	0.001
Off-farm income activities	0.193	0.314	0.540	0.142
Access to remittances	-0.952**	0.380	0.012	-0.008
Access to market information	0.962***	0.310	0.002	0.100
Own means of transport to market	0.366	0.521	0.482	0.152
Access to extension service	0.591	0.340	0.082	0.011
Availability of buyers	2.839***	0.409	0.000	0.129
Household size	-0.042	0.039	0.285	-0.009
Rice farm size	0.168**	0.085	0.046	0.054
Income from other farm enterprises	0.081	0.049	0.101	0.031
Distance to market	0.048	0.030	0.116	0.004
Education level	0.271	0.198	0.171	0.026
Price of rice output	0.002	0.005	0.648	0.003
_cons	-2.154	0.678	0.001	

Tobit restriction LR test 103.320

Significance level: *** at 1%, ** at 5%, * at 10%

Cragg hurdle regression

Number of obs = 384 Wald chi2(13) = 110.13 Prob > chi2 = 0.0000 Log pseudolikelihood = -1430.0338 Pseudo R2 = 0.1130

Source: Author's computations

4.10 Effect of commercialization on household welfare

The Heckman's two-step approach has been used to determinants of commercialization and its subsequent effect on household welfare. In the first stage, dependent variable was modeled as a binary variable, equal to 1 if a quantity of the farmers' rice output is sold and zero otherwise. The OLS model (second stage) is used to estimate the effect of commercialization on household's welfare. In the second stage which is the main focus of this objective, the model estimates the factors that affect household's welfare, proxied as both household annual income and expenditure. Since the double hurdle model was used earlier to estimate the determinants of commercialization, the focus of this section will be on the second stage of this model which estimates directly the variables determining household welfare. In this second stage, two welfare indicators are used separately as dependent variables, while the household commercialization index is introduced as one of the explanatory variables so as to estimate its effect on each of the welfare indicators used. The result of the effect of the commercialization index on the first indicator which is household annual income is shown in table 4.4, while the result of the effect on the second indicator which is the households' annual expenditure is also presented in table 8.

Annual income of the household is used as an indicator for welfare following its usage by earlier authors like Abdullah et al., (2019). The household income is used as a measure of welfare because of the role it plays wellbeing of every household. It is expected that, when a household has a high annual income, it is able to afford its most basic needs required for their wellbeing and vice versa. The study estimates the determinants of a household income (dependent variable), and introduces the household's extent of commercialization (commercialization index) as one of the explanatory variables to estimate the effect it poses. Results as presented in table 4.4 found the following variables as significant determinants household income; Household dependency ratio, Literacy of household members, Distance to market and rice commercialization index.

The coefficient of household dependency ratio is negative and significant at 5% means that households having high dependency ratio are more likely to have low annual income (welfare) because the number of people not earning income outweighs those earning. This leads to high consumption and expenditure; thus, the rice output will be consumed by household members, remaining almost no surplus for the market which could have been sold to raise more income for the household. This finding conforms with Abdullah et al., (2019) and Tufa et al., (2014).

The coefficient of literacy of household members is positively related to the annual income of the household and is significant at 5%. This implies a household with more literate members is, more likely to higher annual income than households with fewer literate members. This aligns with the prior expectation of the study. In the rural setting, where illiteracy is high the few who are literate are more open to employment opportunities outside farming. Thus, literate people are more likely to have other sources of income beside the farming activities. In the study, households with more literate people have higher annual income because those people are able to function in other income earning activities that require literate persons.

The coefficient of distance to market has a negative relationship to annual household income at a significance level 5%. This means that, the closer the household is to the market, the higher the likelihood of a lower annual income. This is found to be contrary to prior expectations, however the possible explanation to this finding is that, due to proximity to the market, a households' likelihood to participate in the market as a buyer increase. Thus, the household's expenditure increases as they increasingly engage in impulse buying, thus reducing their income. On the other hand, a household who stays far from the market have reduced market visits due to the distance and thus reducing expenditure and thus increasing income.

The coefficient of rice commercialization index is positively linked to annual household income and is significant at 1%. This means that, as a household degree of rice commercialization increases, the greater the likelihood of the household having high income. This conforms with the prior expectation of the study, and plays an important part in arriving at the core research objective which is to determine how rice commercialization influences household welfare which in this section is uses annual household income as a proxy.

Table 4. 4: Heckman treatment effect model results for household income

Variable Label	Coef.	Std. Err.	P>z
Stage 2: Effect on Household Income (log)			
Sex of household head	-0.018	0.099	0.852
Household size	0.006	0.011	0.592
Household dependency ratio	-0.008**	0.004	0.044
Age of household head	-0.002	0.003	0.512
Educational level of household head	-0.051	0.060	0.397
Marital status of household head	0.143	0.103	0.164
Membership of FBO	-0.127	0.094	0.179
Literacy of household members	0.051**	0.020	0.010
Off farm income activities	0.082	0.086	0.344
Access to remittances	0.026	0.099	0.796
Extension contact	-0.060	0.107	0.572
Distance to market	-0.026**	0.009	0.005
Household landholding size	-0.001	0.015	0.936
Rice Commercialization Index	1.838***	0.285	0.000
_cons	7.403	0.254	0.000
Stage 1: Rice Commercialization			
Sex of household head	0.307	0.193	0.112
Marital status of household head	-0.552**	0.211	0.009
Membership of FBO	-0.020	0.195	0.919
Experience in rice farming	0.010	0.009	0.271
Off farm income activities	0.152	0.213	0.475
Access to remittances	-0.693**	0.238	0.004
Access to market information	0.343	0.283	0.225
Ownership of means of transport	0.439	0.314	0.162
Extension contact	0.315	0.192	0.100
Availability of buyers	1.395	0.461	0.002
Household size	0.012**	0.026	0.632
Rice farm size	0.105**	0.037	0.004
Income from other farm enterprises	0.080**	0.030	0.007
Distance to market	0.063**	0.020	0.002
Education level	0.449**	0.150	0.003
Price of rice output	0.011	0.004	0.016
_cons	-2.972	0.683	0.000
/athrho	-1.627	0.705	0.021
/lnsigma	-0.224	0.054	0.000
rho	-0.926	0.101	
sigma	0.799	0.043	
lambda	-0.740	0.114	

Significance level: *** at 1%; ** at 5%; * at 10%.

Number of obs = 384 Wald chi2(14) = 164.65 Prob > chi2 = 0.0000 Wald test of indep. eqns. (rho = 0): chi2(1) = 5.33 Prob > chi2 = 0.0210

Source: Author's compilation.

Following its usage by Geoffrey (2015), the household's annual expenditure is also used in this section as an indicator for household welfare. Expenditure is used as a measure of welfare because of the proposition that, the composition of every rational household's expenditure is pre-empted by the satisfaction of its basic needs. Thus, the standard of living of the household is considered to be high when its consumption goes high and hence signaling a positive welfare standing. The study tries to determine the factors that influence household expenditure (dependent variable), by introducing the household's extent of commercialization (commercialization index) as one of the explanatory variables to estimate its effect. Results as presented in table 4.5 found the following variables as significant determinants of household expenditure; Off farm income activities, Literacy of household members, Size of landholding of the household and Rice commercialization index of the household.

Off farm income activities has a coefficient that is positively related to household expenditure and is significant at 5%. This implies that a household with more of its members engaged in off farm income activities has a higher likelihood of increasing its expenditure than those with fewer members engaged in off farm income activities. This result confirms the prior expectations of the study and the finding of Ouegraogo (2018). He highlighted the importance of non-farm income in the livelihoods of rural households and how its promotion can help alleviate poverty. Several studies have emphasized the role of engaging in non-farm income activities for farm households in developing countries (Tsiboe et al., 2016 and Savadogo et al., 1998). The point being advanced here is that, improving farm households' access to food and modern technologies through increasing their liquidity, engagement in off-farm income generating activities may have positive effect on household welfare. In the study area, households with more of its members earning from their engagement in non-farm income activities, complemented their farm income and were better

place to afford all expenditure required for the wellbeing. They were also able to invest well in their farming activities to attain high yields.

Literacy of household members is positively related to the annual household expenditure and is significant at 5%. This implies that, when a household has more literate members, it has a higher likelihood of having an increased annual expenditure than households with fewer literate members. This is in line with the prior expectation of the study and that of the findings of Geoffrey et al., (2015). He argued that, the positive and significant effect of literacy on household annual per capita expenditure could be related to the possibility that literate household members are able to accurately process market information. This accurate processing of market information enables commercialized households to access niche markets as compared to those who are less educated (Jaleta et al., 2009). The likely explanation to this result is that, due to the high illiteracy in most the rural areas in Ghana, households with literate members are more likely to be employed in other sectors of the rural economy since they are more opened to employment opportunities outside farming. Since literate members are more likely to have other sources of income beside the farming activities, this increases the household's entire income. With the advantage of multiple streams of income, the household is able to increase its expenditure covering both basic and non-basic needs of household members for their wellbeing.

The coefficient of household landholding size is positively related to the household's annual expenditure at a significance level of 1%. This implies that, households with larger landholding sizes are more likely to have high annual household expenditures than those with smaller landholdings. This is in line with the prior expectation of the study. Households with large landholdings have more land to engage in several arable activities.

The coefficient of rice commercialization index has a positive relationship with household annual expenditure and is significant at 5%. The implication being that, households that sell more of their rice output (i.e., high commercialization index) are more likely to have a high annual household expenditure. This confirms the prior expectations of the study as well as the finding of Awotide et al., (2016) and Abdullah et al., (2019), who observed that, extent of household market participation was positively related to household expenditure, adding that welfare of households depended on their market participation.

Table 4. 5: Heckman treatment effect model results of household expenditure

Variable Label	Coef.	Std. Err.	P>z
Stage 2: Effect on Household Expenditure (log)			
Off farm income activities	0.167**	0.065	0.010
Literacy of household members	0.048**	0.019	0.010
Marital status of household head	0.055	0.079	0.490
Sex of household head	0.047	0.072	0.517
Age of household head	0.000	0.003	0.875
Household size	0.009	0.010	0.408
Household dependency ratio	0.000	0.003	0.941
Household landholding size	0.030***	0.009	0.001
Educational level of household head	-0.011	0.042	0.787
Distance to market	0.003	0.006	0.668
Access to Credit	0.109	0.084	0.195
Membership of FBO	0.000	0.068	0.997
Rice commercialization index	0.321**	0.144	0.026
_cons	7.643	0.191	0.000
Stage 1: Rice Commercialization			
Sex of household head	-0.211	0.174	0.224
Marital status of household head	-0.352**	0.183	0.054
Membership of FBO	-0.118	0.166	0.477
Rice farming experience	-0.003	0.009	0.770
Off farm income activities	-0.396**	0.164	0.016
Access to remittances	-0.026	0.176	0.884
Access to market information	0.296	0.193	0.126
Ownership of means of transport	0.403**	0.199	0.043
Extension contact	0.007	0.184	0.969
Availability buyers	0.324	0.219	0.138
Size of household	0.022	0.019	0.239
Size of Rice farm	0.151***	0.043	0.000
Income from other farm enterprises	0.093***	0.032	0.004
Distance to market	0.011	0.016	0.502
Educ	0.080	0.109	0.463
Price	0.007***	0.002	0.001
_cons	-2.027	0.411	0.000
/athrho	-0.168	0.166	0.311
/lnsigma	-0.516	0.043	0.000
rho	-0.167	0.161	
sigma	0.597	0.025	
lambda	-0.100	0.097	

Significance level: *** at 1%; ** at 5%; * at 10%. Number of obs = 384 Wald chi2(13) = 88.05 Prob > chi2 = 0.0000 Wald test of indep. eqns. (rho = 0): chi2(1) = 1.03 Prob > chi2 = 0

Source: Author's computations (2020).

In conclusion, degree of rice commercialization (i.e., rice commercialization index) was found to be significantly and positively related to both of the welfare indicators used in the study. Other authors who used both or one of the welfare indicators realized similar results confirming the finding of this study. Abdullah et al., (2019) found in Malakand Pakistan that, household welfare which was proxied with household expenditure depends on the extent of a household's rice market participation. In a similar study, Awotide et al., 2016, in Nigeria found that, an increase in a farmer's welfare was conditional on both the probability and intensity of a farmer's participation in rice output markets. Additionally, the result of this study, confirms results of various studies that show the high potential of food crops in securing welfare gains among smallholder households in many African countries (Olwande et al., 2015). Ouedraogo (2018) also found that commercialization increases welfare gains of households but however argues that, this is only conditional on the household's crop yield. Further intimating that commercialization can only bring about welfare gains if the household increases its crop yield but on the other hand increases household's risk of food shortage in the event of low crop yield. In a similar finding, Dzanku (2015) observed a positive effect of agricultural commercialization of high value food crops on households' welfare conditional on productivity of farmers. Contrary to these findings, (Carletto et al., 2016) found no strong evidence of a positive relationship between commercialization and welfare among smallholder farmers.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of the major findings of the study and draws conclusions on these findings. It presents also the policy recommendations arising from the conclusions of the study, limitations of the study and suggestions for future studies.

5.2 Major Findings of the Study

The major findings presented have been reached based on the analysis carried out in the study.

- On average about 50% of paddy rice output produced by smallholder farmers within a production year in the Builsa South District are sold in the market. This shows a relatively moderate rice commercialization index in the study area.
- About 28%, 18% and 54% of smallholder rice farming households surveyed are categorized as subsistent, transitional and commercial given that they sell on average 5.6%, 41.3% and 76.7% of their entire rice output (paddy) to the market respectively.
- The decision to participate in rice output market as sellers (commercialize) is significantly determined by access to market information, availability of buyers and size of rice farm in a positive way and negatively determine by marital status of household head and access to remittances.
- The intensity of rice output market participation as sellers (degree of commercialization) is significantly determined in a positive way by size of rice farm, ownership of means of transport and price of rice output and also determined in a negative way by sex of household head and rice farming experience.
- Used as an indicator for household welfare, annual household income is significantly determined by literacy of household members and degree of household rice

commercialization (rice commercialization index) in a positive direction. It is also significantly determined in a negative direction by household dependency ratio and distance to market.

- Also used as a welfare indicator, annual household expenditure is significantly and positively determined by off-farm income activities, literacy of household members, size of household landholding, and degree of rice commercialization (rice commercialization index).

5.2.1 Summary of the Study

The study sought to estimate the level of commercialization among smallholder farmers in the Builsa South District, uncover the major determining factors influencing their decisions to commercialize and extent of their commercialization. In furtherance, the study ultimately sought to understand the effect farmers level of commercialization has on their households' welfare. A random sample of 384 households were engaged in a survey using a semi-structured questionnaire. The objectives were arrived through the use of the Household Crop Commercialization Index, Double Hurdle Model and Heckman Treatment Effect model respectively. After all computations, the study realized a household rice commercialization index of 50.54% which signifies a moderately commercialized rice farming population. Ownership of means of transport, price of rice output and size of land under rice cultivation significantly influenced farmers level of commercialization. Suggesting that, interventions either internal or external that are able to coerce these factors are more likely going to increase farmers' levels of commercialization. Also, both household income and household expenditure when used as proxies for welfare showed that farmers' level of commercialization had a positive and significant effect on the household's welfare.

5.3 Conclusions of the Study

Based on the major findings realized by the study, the following conclusions have been drawn;

- Rice production in the Builsa South District is moderately commercialized by smallholder rice farmers. Rice can therefore be considered a cash crop in the district.
- The study confirms that household demographics and asset endowments, public asset characteristics and transaction cost factors significantly determine both probability and degree of rice commercialization of smallholder farmers in the district.
- The study confirms that degree of rice commercialization positively influences both household annual income and expenditure and hence the welfare of smallholder rice farming households in the district.

5.4 Policy Recommendations

Based on the conclusions of the study, the following recommendations are raised;

- The survey found a moderate level of rice commercialization among farmers in the district. At about 50% level of commercialization, the study recommends that farmers form a trade union that will facilitate their trade, protect their common interest and link them to more profitable and organized markets.
- Deducing from the findings of this study, about 72% of farmers in the study area sell between 41.3% to 76.7% of their produce, thus considering such volumes of rice available in the market, the study recommends that, through a private-public partnership, farmer groups and government should establish a rice processing factory to take advantage of the availability of rice stock for processing.

- As widely argued, productivity enhancement without complementation with the ability to sell profitably through increased access to wider markets would not yield maximum benefits to smallholder farmers. Therefore, MoFA should extend its current portfolio of services provided by their extension officers to include marketing services. Extension officers should be well resourced and motivated to gather and disseminate relevant market information, and to also organize trainings for the purpose of empowering farmers with marketing skills and the know-how for meeting quality standards to be better placed to take advantage of emerging markets and thus not restricting their sales to only their local markets.
- The central message of this study is that commercialization of rice farming represents a promising pathway to improving welfare of smallholder farmers. Therefore, reducing cost of transaction through access to transaction enhancement assets like means of transport and storage facilities will be relevant to induce significantly farmers shift to commercial farming. Also as revealed by the study, higher price offers by market players serves a great deal in influencing commercialization. Hence there should be promotion of public investments in rice value chain development with the intension of integrating smallholder farmers so as to widen their sales networks for more profitable exchange.
- Farmer groups should advocate for fair share of the land to their members from local authorities spearheading the land tenure system at the rice valleys in the district. Also, FBOs should acquire for themselves a common means of transport for transporting their goods to the market.

5.5 Limitations of the Study

The key limitation of the study is based on the underlying theory by Barrett (2008). The theory assumes that, estimating the level of farmers' commercialization should include both input side and output side market participation. This study does not follow this two-sided approach to estimating the commercialization level of farmers. However, empirically either side of a farmer's market participation can be made to stand alone and hence capable enough to make scientifically accepted analysis. Again, the study did not include interaction analyses of variables to determine their possible effects. Additionally, the study was conducted in just one district which makes the findings limited to a particular area. These limitations are technical but does not pose serious analytical consequences.

5.6 Suggestions for Future Research

It is suggested that future research should examine both input side and output side market participation of farmers in the estimation of farmers' commercialization level. Further studies could if available use panel data to examine input and output side market participation in estimating commercialization. Finally, the inclusion of other crop enterprises that farmers have comparative advantage in cultivating them would give a more comprehensive agricultural commercialization status than a crop specific commercialization calculated in this study.

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APPENDIX 1.0

**DEPARTMENT OF AGRICULTURAL ECONOMICS AND AGRIBUSINESS COLLEGE
OF AGRICULTURE AND CONSUMER SCIENCES UNIVERSITY OF GHANA,
LEGON**



UNIVERSITY OF GHANA



UNIVERSITY OF GHANA

QUESTIONNAIRE FOR HOUSEHOLD SURVEY

This questionnaire is to solicit information for a study on the **Effects of Commercialization on Welfare of Smallholder Rice Farmers in the Builsa South District of Ghana**, leading to the award of an **MPhil Agribusiness**. All information provided will be treated as confidential and will be used solely for the purpose of the study.

Interviewer _____ Date of interview ____/____/2020

Zone _____ Operational Area _____

Community/Code _____ /..... Questionnaire Number _____

Rice cultivation: Yes [] No []

Other crops cultivated: Maize [] Sorghum [] Millet [] Groundnut [] Cowpea [] Soybean []

HOUSEHOLD DEMOGRAPHIC/SOCIO-ECONOMIC CHARACTERISTICS

Responses to be provided by household head/primary decision maker

General information

1. Name of respondent.....
2. Sex of respondent: [] 1=Female 0=Male
3. Age of respondent in years.....
4. Highest level of formal education of respondent: [] 0=None 1=Basic (Primary/JHS/Middle) 2=SHS 3=Tertiary (Training college/Polytechnic/University)
5. Marital status of respondent: [] 0=Single 1=Married 2=Divorced/Separated 3=Widowed
6. Were you a member of any farmers' organization in the 2019 crop year? 01 Yes [] 02 No [] (**If no move to Q 9**)
7. What is the name of the FBO _____
8. How often did your association meet to discuss issues related to rice production and marketing?
01
Weekly [] 02 Fortnightly [] 03 Monthly [] 04 Quarterly [] 05 Annually []

9. Why were you not a member _____

Household composition

10. How many people are you in your household? Total [] male [] female []
11. Number of persons with ages below 15 years. Total [] male [] female []
12. Number of ages between 15 and 65 years. Total [] male [] female []
13. Number of ages above 65 years. Total [] male [] female []

14. Number of people who are literate or attended school.Total [] male [] female []

Income generation

15. What is your major occupation [] 1=Agriculture 2=PettyTrading 3=Craftsmanship
4=Salaried work (formal sector) 5=other

16. If [1] How many years of experience do you have in farming (years).....

17. What is the total size of land available for all your farming activities

18. (Excluding rice farms) How many other farms did you cultivate in the 2019 season?.....

Indicate in the table below

Crops Produced	Maize	Millet	Sorghum	Groundnut	Cowpea	Soybean	Other(specify)
Size of land (acres)							
Quantity Harvested							
Unit							
Period of Harvested (month)							
Quantity Consumed							
Unit							
Quantity Sold							
Unit							
Price per unit							
Total Income							

19.Did you or other members of your household engage in any off-farm income generating activities? [] 1=Yes 2=No.

20. If yes mention them

Activity	Number of people	Average monthly income

21. Did your household receive remittance in the 2019 season? 1 Yes [] 2 No []

22. If yes, indicate the total amount you received (GHC)

23. Did your household enjoy any social intervention in the 2019 season? 1 Yes [] 2 No []

24. If yes how much? (GHC) _____

Rice Production Information (2019)

25. How many years have you been engaged in Rice cultivation?years
26. What is the total land size dedicated to rice cultivation?acres
27. What is your main intention for rice cultivation? If it's for sale, do you have a sales plan?

--

Rice Cultivation Table (2019)

Plot No.	Size	Seed				Ploughing		Planting		Fertilizer		
		Variety	Qty	Unit	Cost	Method	Cost	Labour	Cost	Qty	Unit	Cost

Weed/insect control					Harvest				Other cost	Yield	
Chemical			Labour		Method	Cost	Labour	Cost		Qty	unit
Qty	Unit	Cost	Number	Cost							

Rice Marketing Information

28. Did you sell rice from your 2019 season harvest? 1 Yes [] 2 No [] (If no move to Q40)
29. If yes, provide information on table below.

No	Place of sale	Buyer	Quantity	Unit	Period (month)	Price (GHC)	Total	Transport cost (if produce was transported to point of sale.	
								Means used	Cost

(Options for place of sale: a. Farm gate b. Community market b. Fumbisi Market c. Home c. other market d. other specify)

(Options for Buyer: a. Traders/market women, b. Established enterprises (e.g. state or private cooperatives), c. Individuals d. Others (Specify))

30. For produce not sold immediately after harvest, where did you store produce prior to sale? _____

31. What is the distance from your farm to place of storage (kilometres) _____

32. What is the distance from place of storage to each market? (kilometres)? (both community and Fumbisi Market) _____

33. What do you travel on to community market centre 01 Road [] 02 Footpath [] 03 Other [] (specify) _____

34. If road, what is the nature of the road? 01 Tarred [] 02 Untarred []

35. If untarred, is it good or bad? 01 Good [] 02 Bad []

36. What do you travel on to Fumbisimarketcentre 01 Road [] 02 Footpath [] 03 Other [] (specify)

37. If road, what is the nature of the road? 01 Tarred [] 02 Untarred []

38. If untarred, is it good or bad? 01 Good [] 02 Bad []

39. What quantity (in bags/bowls) of the amount harvested that was:

Was self-consumed?	Used as seed	Was given as gift?	Was lost due to post harvest losses?

40. If you did not sell at all (**in reference to Q28**), why did you not sell? 1 Output not enough [] 2 price not good for me [] 3 could not access market [] 4 Purposely for eating [] 5 other [] (specify) _____

Assets owned

41. Did your household own any of the following assets in the 2019 season? (Multiple response possible)

Asset	Tick	Condition
Transport		

Bicycle		Good [] Bad []
Donkey Cart		Good [] Bad []
Motor bike/Motor King		Good [] Bad []
Vehicle (Specify)		Good [] Bad []
Communication		
Mobile Phone		Good [] Bad []
Radio		Good [] Bad []
Other (specify)		Good [] Bad []

42. (If farmer had asset of transport) Did you use any of your means to transport rice to point of sale? 1 Yes [] No []

43. If yes, which one (s)? _____

44. If no, why? _____

45. Did you have access to market information for the sale of rice in the 2019 season? 1 Yes [] 2 No []

46. If yes, what kind of information? 1 Price [] 2 Other [] (specify) _____

47. Who provided the information? (Multiply response possible) 1 Friends [] 2 Relatives [] 3 Market women [] 4 Extension agents [] 5 Radio [] 6 Television [] 7 Other [] (specify) _____

48. Did you use any of this information to sell your rice? 1 Yes [] 2 No []

49. If you had a phone or radio, did you use any of them to access market information on rice? Yes [] No []

50. If no, why didn't you use them to access information? _____

PUBLIC ASSETS CHARACTERISTICS

Access to credit

51. Did you request for credit in the 2019 season? 1 Yes [] 2 No [] (If no move to Q56)

52. What was the form of the credit? 1 Agricultural inputs [] 2 Cash [] 3 Both [] 4 Other (specify) _____

53. If agricultural inputs, did you receive the inputs? 1 Yes [] 2 No []

54. If you received inputs, please indicate here the type of inputs

55. If you received cash please, indicate the source and amount below:

Source (Multiple responses possible)	Tick	Amount requested (GH¢)	Amount received (GH¢)	Amount devoted to rice cultivation
Neighbour/Relatives/ Friends				
NGO				
Rural bank				
Commercial banks (specify)				
Others (specify)				
Total				

56. If no, provide reason (s) why you did not request for the cash credit. Select from these options: 1 Do not need [] 2 Involves paying bribe [] 3 Inadequate collateral [] 4 Do not want to pay interest [] 5 Cumbersome/expensive procedure [] 6 Lenders too far away [] 7 Interest rate too high [] 8 Others [] (specify) _____

57. Did you have contact with any extension officer in the 2019 season? 1 Yes [] 2 No [] (if no, state why?..... and move to Q60)

58. If yes, how many working visits did you have with the extension officer (s) during the 2019 production period? _____

59. Which type of services did you receive from the extension officer (s)? Production service [] Credit service [] Processing of agricultural produce [] Trading [] Other [] (specify)

60. Did you have access to market for traded inputs for your rice farm? 1 Yes [] 2 No []

61. If yes, did you purchase inputs? 1 Yes [] 2 No []

62. If yes, how did you finance your purchases? 1 Household income [] 2 Credit [] 3 Gift 4 Other [] (specify) _____

63. What was the distance to the input market if not within the community (kilometres)?

64. Specify the inputs you got access to 1 Fertilizer [] 2 Seed [] 3 Pesticides [] 4 Weedicides [] 05 Other (specify) _____

65. Did you use tractor service for the cultivation of your rice in 2019 season? Yes [] No []

66. If yes, how accessible was it? 1 Easily accessible 2 Moderately accessible 3 Difficultly accessible

67. If no, why? 1 Couldn't afford 2 Couldn't make contact 3 Other (Specicy).....

68. Did you have access to a combine harvester for harvesting your rice in the 2019 season? Yes [] No []

69. If yes, how accessible was it? 1 Easily accessible 2 Moderately accessible 3 Difficultly accessible

70. If no, why? 1 Couldn't afford 2 Couldn't make contact 3 Other (Specicy).....

Household Expenditure

Food

No	Over the past (MONTH), did you or others in your household consume any []? INCLUDE FOOD BOTH EATEN COMMUNALLY IN THE HOUSEHOLD AND THAT EATEN SEPARATELY BY INDIVIDUAL HOUSEHOLD MEMBERS.	YES:1 NO:2 > NEXT ITEM	How much in total did your household consume in the past MONTH?		How much came from purchases?		How much did you spend?	How much came from own production?		How much came from gifts and other sources	
			Quantity	Unit	Quantity	Unit	GHC	Quantity	Unit	Quantity	Unit
1	Cereals, Grains and Cereal Products Maize Grain/Flour; Green Maize; Rice; Millet; Sorghum; Bread; Other Cereal)										
2	Roots, Tubers, and Plantains (Cassava Tuber/Flour; Sweet Potato; Other Tuber/Plantain)										
3	Nuts and Pulses (Bean; Groundnut; Ground Bean; Cow Pea; Other Nut/Pulse)										
4	Vegetables (Onion; Cabbage; Wild Green Leaves; Tomato; Cucumber; Other Vegetables/Leaves)										
5	Meat, Fish and Animal Products Egg; Dried/Fresh/Smoked Fish, Beef; Goat Meat; Pork; Poultry; Other Meat)										
6	Fruits										

	(Mango; Banana; Citrus; Pineapple; Papaya; Guava; Avocado; Apple; Other Fruit)										
7	Milk/Milk Products Fresh/Powdered/Soured Milk; Yogurt; Cheese; Other Milk Product - Excluding Margarine/Butter or Small Amounts of Milk for Tea/Coffee)										
8	Fats/Oil (Cooking Oil; Butter; Margarine; Other Fat/Oil)										
9	Sugar/Sugar Products/Honey (Sugar; Sugar Cane; Honey; Jam; Jelly; Sweets/Candy/Chocolate; Other Sugar Product)										
10	Spices/Condiments (Tea; Coffee/Cocoa/Milop; Salt; Spices; Yeast/Baking Powder; Tomato/Hot Sauce; Fish Powder/Sauce; Other Condiment - Including Small Amounts of Milk for Tea/Coffee)										

Education

How much was spent on education in the last 12 months by the household: IF NOTHING WAS SPENT, RECORD ZERO.										
Number of members in school	Tuition, including extra tuition fee	Expenditures on after school programs & tutoring	School books & stationery	School uniform clothing	Boarding Fees	Contribution for school building or maintenance	Transport	Parent/Teacher Association & other related fees	Other	Total

Health

How much was spent on health in the last 12 months by the household: IF NOTHING WAS SPENT, RECORD ZERO. (include estimated value of any in-kind payments)						
Total cost of hospital bills.	Total cost of the service from the traditional healer	Cost of transport to the medical facility.	Cost on food during stay(s) at the medical facility?	Cost on medical products for all illnesses and injuries, including for medicine, tests,	How much in total did you spend for non-prescription medicines - Panadol, cough syrup, etc.	Total

Other non-food consumption

How much was spent on the following non-food items in the last 12 months by the household: IF NOTHING WAS SPENT, RECORD ZERO. (include estimated value of any in-kind payments)									
Alcoholic beverages, tobacco and narcotics	Clothing and Footwear		Housing, water, electricity, gas and other fuels including Materials for the maintenance and repair of the dwelling			Furnishings, household equipment and routine household maintenance			
	Clothing	Foot ware	Maintenance and repair of the dwelling	Water supply and miscellaneous services relating to the dwelling	Electricity, gas and other fuels	Furniture and furnishings, carpets and other floor coverings	Household appliances	Tools and equipment for house	Goods and services for routine household maintenance
Insurance	Communication		Transport		Recreation and culture		Miscellaneous goods and services		
			Private	Public			Personal care	Personal effects	Others

CODES FOR UNIT:

KILOGRAMME . . .1	BALE.....4	CUP. 7	SATCHET/TUBE. .10	BASIN.13	MILLILITRE.....16
50 KG. BAG.....2	BASKET5	TIN. 8	HEAP.....11	LITRE.....14	OTHER (SPECIFY). 17
80 KG. BAG.....3	BUNCH.6	GRAM 9	PIECE.....12	TEASPOON.. .15	

APENDIX 2.0
PLAGIARISM REPORT SUMMARY

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by NATHANIEL ADAJAGSA

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